FSM INNOVATION

Case Studies on the
Business, Policy and Technology
of Faecal Sludge Management

EDITED BY ISABEL BLACKETT AND PETER HAWKINS

SECOND EDITION

FSM Innovation: Case Studies on the Business, Policy and Technology of Faecal Sludge Management

Edited by Isabel Blackett and Peter Hawkins

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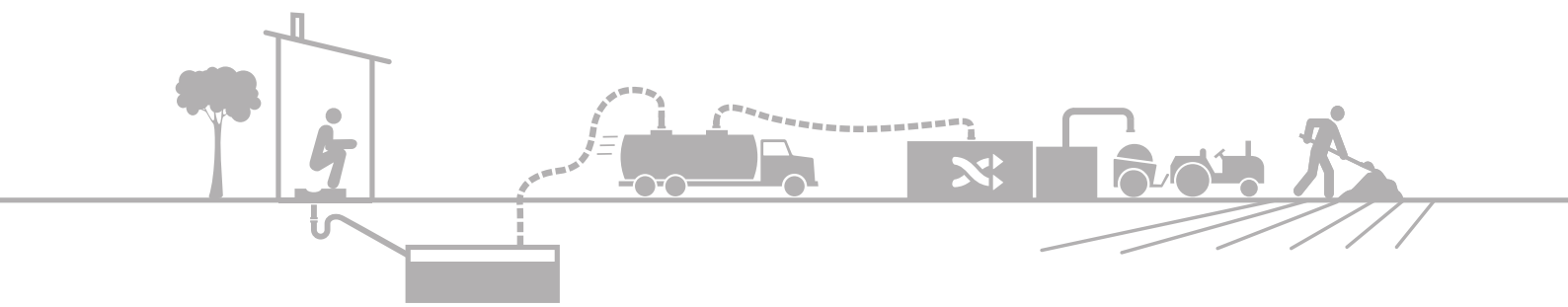
FSM
INNOVATION



Developing FSM: Leadership and Service Providers

Worldwide, 2.7 billion people rely on onsite sanitation and more than 4.5 billion people do not have access to safely managed sanitation services. Yet, in many places there is still no management system in place to deal with the faecal sludge (e.g. septage and pit latrine sludge) from such systems. This results in the faecal waste often being dumped directly into the immediate residential surrounding areas, neighbourhood or downstream environment, with significant health and environmental implications. Creating faecal sludge management (FSM) public services and infrastructure that work for everyone, to keep faecal sludge out of the environment and protect public health, is a new major challenge for achieving universal sanitation access as acknowledged by the Sustainable Development Goals adopted by the United Nations at its General Assembly of September 25, 2015.

To address this challenge, a global platform for FSM discussion and learning was created in 2011 by leading global sector organizations. The aim was to share experiences, brainstorm potential solutions and formulate evidence-based policy recommendations that promote appropriate practices. At the same time, the hope was to identify and disseminate lessons learned on how to make FSM an integral part of urban sanitation service delivery – in cities and towns both with and without sewerage systems.

The International FSM conferences have played a key part of this global platform and have successfully brought together increasingly large numbers of professionals working in the sector. This has included utilities, service providers, cities, governments, academics, scientists, consultants, donors and industries, to support the global initiative of disseminating sustainable solutions for FSM. The FSM conferences have grown considerably in size and most recently, FSM4 was held in Chennai, India in 2017 and attracted over 1000 participants. Previous conferences were held in Hanoi (2015) and in Durban (2011 and 2012). FSM5 will be held in Africa in the third week of February 2019.

To further on-going learning and dissemination about better FSM solutions, I am pleased to introduce a second edition of Faecal Sludge Management case studies on behalf of the FSM conference committee. The publication will be available in hardcopy, on USB and on the SuSanA forum website (www.susana.org) for download.

The first edition was developed for FSM4 and focused mostly on city experiences. This second edition presents more in-depth information in each case study and shares some aggregate lessons and recommendations. In this edition, the case studies are structured to be used as a reference guide. I encourage readers to jump to the sections that are most relevant for what they want to learn. The opening chapter provides a critical analysis of the experiences of developing FSM programmes at scale from more than 20 cities. It summarized the lessons learned and important 'do's and don'ts' for policymakers, managers, experts, donors or service providers who are in the process of developing or funding improved FSM services.

The examples in the second edition are from:

- *Africa*: Mozambique (Maputo), Kenya (national), Senegal (Dakar), South Africa (eThekwini), Uganda (Kampala), Zambia (Lusaka)
- *Asia*: Bangladesh (Dhaka, Faridpur and Shakhipur), India (Warangal), Indonesia (Balikpapan, Bekasi, Malang and Tabanan), Malaysia (national, Penang Island and Kota Bharu), and Philippines (Dumaguete and Manila).

The eleven case studies in the document are city based while some combine several cities into a country case study. We have introduced new examples that focus on the role of political leadership, role clarity and national policy and regulation which are all critical to FSM success. In fact, the analysis of the case studies in this new edition supports the Gates Foundation advocacy messages and policy recommendationthat all governments should create a clear accountability framework and designate one ministry to oversee sanitation – including both sewered and non-sewered solutions (inclusive of FSM). Responsibilities for the ministry overseeing sanitation should include national strategic sanitation planning, policy development,

coordination across various government agencies, capacity building, support for service providers, and resource mobilization.

These case studies are a compilation of the strong evidence that FSM businesses can be profitable and financially viable, while also highlighting the latest innovations in the field. Success at scale is driven by utility service models that promote the strong participation and recognition of the role of the local private sector in pit latrine and septic tank emptying and in designing and operating treatment plants that have the potential to recover resources for revenue generation activities. The cases studies make a strong case for FSM as a utility service where:

- local or national governments play keys role in: practical policy development and as a regulator; and assist finance infrastructure,
- private service providers operate and maintain the infrastructure (public and household latrines or septic tanks); operate and invest in equipment (trucks) or resource recovery facilities; and
- households pay for services and invest in their containment systems (latrines, septic tanks or other toilet technologies).

The examples presented in this edition discuss the viability of FSM public-private partnership (PPP) models and strategies to scale-up success in cities or at country level.

It is my hope that this publication will encourage and support everyone starting out or already developing FSM policies and services to develop or fine tune intervention models. I hope it will also inspire all project leaders to capture their own learning to share at future FSM conferences and other peer-to-peer learning platforms.

Finally, on behalf of the FSM Conference Committee, I would like to thank all the authors and co-authors who (some for a second time) have kindly spent valuable time in summarizing their many years of experience and learning in these short case studies. Also to the editors Isabel Blackett and Peter Hawkins who have written the analysis chapter, coordinated the production and provided support to the authors.

I am grateful to all members of the FSM Conference committee and the Chair of the Program Committee (Dr Stefan Reuter, CEO of BORDA), for helping to identify the case studies and for the support provided to the authors. I am particularly thankful to the committee members for their ongoing active advocacy work to build a better world and reduce inequalities in our communities by improving access to sustainable and affordable sanitation services.

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August 2017

Implementing FSM Services: Emerging Examples of Success

Peter Hawkins and Isabel Blackett

INTRODUCTION

With the growing acceptance that city-wide inclusive sanitation is essential in this rapidly urbanizing world, there has been a major growth of interest in faecal sludge management (FSM). The variety and continuously changing characteristics of neighbourhoods in any given city create the need for a range of sanitation services, both sewered and non-sewered, working side by side. Non-sewered sanitation is a rapid and flexible means of providing cost-effective sanitation in a wide variety of urban settings, including both poor and better-off communities, and has an essential role to play in delivering city-wide, inclusive sanitation. FSM services are a major component of non-sewered sanitation, and are essential to deal with the ever-increasing quantities of faecal sludge generated by the range of sanitation options from well-built septic tanks and improved latrines to simple self-built sanitation facilities, where there is no longer any space to cover and relocate pits when they are full.

The 2017 JMP report estimates that worldwide 43% of the faecal waste generated by urban dwellers is safely managed, by sewerage systems, on-site sanitation and faecal sludge management.[1] Non-sewered sanitation is reported to be the principal form of improved sanitation in the urban areas of Central Asia and Southern Asia, Oceania and sub-Saharan Africa, but only 13% of this is estimated to be safely managed.[2] This is due in large part to the lack of FSM systems to deal with the septage and pit latrine sludge from on-site sanitation facilities. Faecal waste is often dumped directly into the immediate residential, neighbourhood or downstream environment, with significant public health and environmental implications. The establishment of publicly available FSM services and infrastructure to keep faecal sludge out of the environment and protect public health, is a major new challenge for achieving universal sanitation access, and is incorporated in the Sustainable Development Goals adopted by the United Nations General Assembly on September 25, 2015.

Conventional approaches to urban sanitation, often reflected in policies and legislation, are strongly focused on sewerage (sewers and wastewater treatment plants), and non-sewered sanitation has generally been left to individual households and

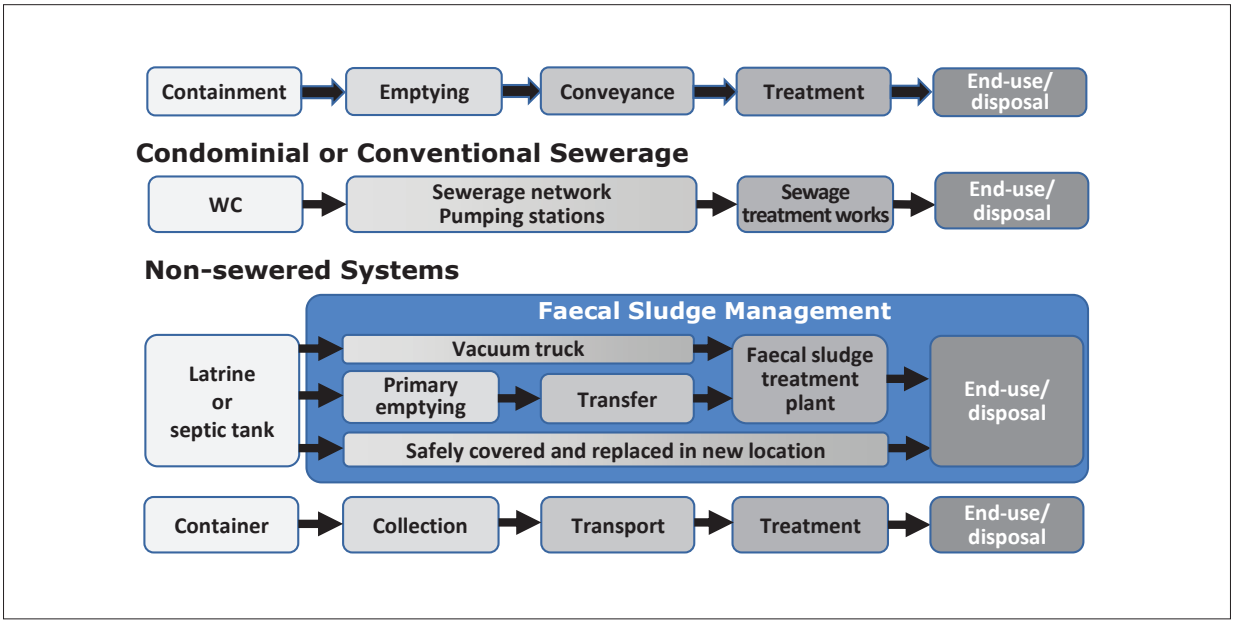

Figure 1: Urban sanitation service chains

unregulated service providers. This is now changing, and over recent years a growing number of cities have been developing more systematic FSM services, as reflected in the case studies in this document. FSM comprises the emptying, collection and treatment of faecal sludge from pit latrines and septic tanks, and is a major part of the city-wide system of sanitation, which may include all or some of the elements set out in Figure 1. This chapter sets out an initial analysis of the evidence, and draws out learning about common factors promoting or hindering improvements in FSM services, and how and why these vary between local contexts. The aim is to assist practitioners (national and city planners, project managers, technical staff, utilities, consultants, etc.) in making informed decisions for their own situation, and to highlight pitfalls to avoid.

The lessons and analysis are divided into three broad areas:

- **The institutional and policy environment** – the critical elements required to legitimise and support the use of non-sewered sanitation, including FSM;
- **Business models and service delivery** – how to manage the sustainable delivery of FSM services; and
- **Technical aspects** – which require resolution to enable effective FSM service delivery.

This overview chapter is based on the seventeen FSM case studies published for the FSM4 bi-annual conference held in Chennai, India in February 2017. It includes additional and updated cases, published in this second edition; supplementary information provided by the Bill & Melinda Gates Foundation (BMGF); the authors' own experience (mainly from Botswana, Ethiopia, Ghana, Indonesia, Lesotho, Mozambique, South Africa and Tanzania) and documents on FSM published by the World Bank in recent years. Some of the case studies are for a single city, while others cover a number of cities in the same country, hence some refer to cities and others to countries.

POLICY AND INSTITUTIONAL ENVIRONMENT

Sanitation services provide both private (household) and public benefits, and are therefore (at least in part) a public responsibility. FSM has failed in the past because it has been left almost entirely to the uncoordinated and unregulated actions of individual customers and informal service providers, due to weak, unclear or non-existent institutional mandates for FSM. However, the case studies show that meaningful change can occur at scale with appropriate advocacy, political support and partnerships. This must be solidified and supported by appropriate legislative, policy and planning instruments, based on an appreciation of the technical issues. In particular, attention must be given to structuring the relationship between the responsible public authorities and the private sector, which in many cases provides most of the services.

POLICY AND INSTITUTIONAL DO'S AND DON'TS

Essential

- Recognize and include FSM as an integral component of national sanitation policy
- Leadership and strong ownership by local government, as part of urban management
- Sustained advocacy
- Involve a diverse set of stakeholders, including different levels of government, city officials, utilities, private operators, CSOs, etc. in developing policies and regulations
- Strong national level commitment and accountability for city-wide inclusive sanitation
- Clear institutional mandates, roles and responsibilities for FSM with associated budgets
- Ensure adequate staffing levels, continuity and training
- Adopt a gradual and incremental approach
- Develop and put in place regulations, standards and guidelines
- License and monitor FSM operators

Seriously Consider

- Adapt planning to a mix of sanitation types
- Lease the treatment/processing plant
- Use practical experience as a basis for developing or refining policy

Avoid

- Expecting major changes overnight – or even in the first few years
- Expecting that policy alone will drive effective and sustainable action
- Setting regulations unilaterally
- Adopting overly ambitious standards
- Assuming that the private sector will want to be involved without incentives

Ensure Leadership and Commitment

The case studies identified high profile leadership at the city level by the Mayor and other high-ranking officials as a key factor in ensuring the adoption of appropriate institutional responsibilities, regulations and budgets for FSM. Political support at both national and local government levels was explicitly identified as an important enabling factor in the at-scale examples from Malaysia, Philippines and South Africa. The emerging examples from Bangladesh, India, Indonesia, Mozambique, South Africa, and Uganda also identified the role for both national and local political support. In Warangal, Balikpapan, Maputo and Kampala, advocacy was an important factor in achieving this support.

Local commitment is also critical where infrastructure is constructed by an external actor, e.g. central government or a donor agency. Without strong local ownership and an agreement on management arrangements and recurrent financing, as happened with sludge treatment facilities in Indonesia in the 1990s, such facilities may be abandoned or fall into disrepair.

Clarify Roles and Responsibilities

The case studies from eThekwini, Malaysia, Dumaguete, Indonesia, Kenya and Kampala show that clear institutional mandates and well-defined responsibilities are essential if sanitation (and within that, FSM) is to be effectively managed, and the same is implicit in many of the others. Given that sanitation is an urban management issue, it is not surprising to find that progress is being made where local government has well-defined responsibilities with respect to sanitation and a commitment to improving FSM, often articulated initially by statements from the Mayor or other high-profile officials. Responsibilities may be shared with a water and sanitation utility (as in Balikpapan, Dumaguete, Kenya and Lusaka) but ultimately still fall under municipal supervision and, in principle, are fully integrated into urban management.

While overall authority will almost always lie with local government, effective FSM requires the development of structured partnerships and coordination between the stakeholders, and a corresponding understanding of formal and informal community and political structures – the political economy. This was an explicit consideration in Indonesia, Maputo and Lusaka. As in any such undertaking, priority should be given to building on existing structures rather than starting completely new ones. Experience in Balikpapan, Bekasi, Lusaka, Kenya and Maputo shows that careful consideration should be given to developing adequate staffing levels, staff continuity and training, to ensure the sustainability of the improved sanitation regime.

Apply Realistic Time Frames

It is apparent that to ensure full local ownership of sanitation services, time is needed for decision-making and the internal processes which are essential to negotiate, align and embed responsibilities for sanitation with other aspects of governance, and to develop and formulate the associated regulations. The need to allow time for developing institutional roles and to work with all stakeholders was identified in Bangladesh, Kenya, Indonesia, Mozambique and Uganda, and the experience shows that this may often take 5 years or more. This means that development partners wishing to support the process need to ensure continuity beyond typical 3–5 year project horizons.

Tackle the FSM Policy Agenda

Progress depends on continuous political support from the highest level of the local government, so a sustained advocacy effort is required at multiple levels, both to convince politicians who typically see little political advantage to be gained from improved sanitation, and to address the inevitable turnover of national and local government officials. In Warangal, the need for advocacy to be evidence-based was noted, and instruments such as shit flow diagrams (as in eThekwini, Lusaka, Maputo, Indonesia and Sakhipur), clean city indices or environmental reports can all be effective ways of presenting the evidence. In Indonesia, almost 25 percent of all cities will develop shit flow diagrams in 2017. Epidemics of cholera or other faecally transmitted diseases can be particularly persuasive (and were significant in eThekwini, Lusaka and Maputo) as they bring sanitation onto the visible public agenda. Concerns about the effects of poor sanitation on the attractiveness of the city for tourism and investment (for example, in Dumaguete) can also be powerful drivers of change.

Politicians are usually pragmatists, and experience in Bangladesh, Kenya and elsewhere shows that tried and tested concepts, backed by practical evidence that a given type of intervention will work, can help in giving them the confidence to enact effective policies. Thus, the case studies from Warangal, Kenya and eThekwini all recommend that policy should be based on evidence, piloting and local practice. Conversely, experience from Malaysia, Zimbabwe and Rwanda shows that a lack of progress, or even chaos, can be caused by well-meaning, but poorly formulated or impractical policy based on a theoretically ideal scenario rather than practical experience. This has implications for the work of NGOs and development agencies, which often target the development of national policies. Their contribution can be invaluable when they work together to support local and national authorities, and base policy on project trials,

local experience and insights. However, importing international or developed country standards and guidelines in an unmodified form and without a suitably phased introduction or trial period can have negative effects by setting unattainable and costly goals, leading to 'high standards for the few', or discouragement and neglect instead of incremental improvement. As mentioned above, effective support requires a willingness to enter into medium to long-term partnerships with a strong commitment to inclusive dialogue.

Policy support from national government for the systematic inclusion of non-sewered sanitation is highly desirable, and was a key driver in India, Malaysia and Philippines. However, the evidence from Bangladesh, Indonesia, Mozambique, South Africa, and Uganda shows that progressive city authorities can make good progress, prior to the development relevant of national policy. National policy on non-sewered sanitation can therefore be developed in parallel with effective action at city level. This may even be advantageous, as it allows for the generation of evidence and experience to support sound policy formulation.

Develop Regulations, Standards and Guidelines

Nearly all the case studies identify that regulations, standards and guidelines which recognize and codify FSM are essential to underpin the delivery of improved services. In extreme cases, on-site sanitation in urban areas may be illegal (for example in Zimbabwe and Rwanda), although it may still account for most of the sanitation in a city. Elsewhere, the ambiguity resulting from a lack of regulation can discourage potential service providers, and force residents to obtain the services they need from the informal sector. Explicit legislation and standards for FSM are essential if unhygienic manual emptying is to be phased out and replaced by safe, regulated services. However, the legislation must be practical and acceptable to stakeholders if it is to function effectively, which means that customers and service providers must be involved in its development, as demonstrated in Dakar, Dumaguete, Durban, Kampala, Malaysia, Manila and Warangal. Service providers are often supportive of this, despite the regulatory burden it imposes on them, because it creates a legal space within which they can operate and expand their businesses, and confers improved status on them – as seen in Bangladesh with the formalization of the Khutibari Cleaners Co-operative, in Dakar with the tanker operators' association, and in Maputo and Lusaka with the small-scale non-mechanized emptying teams.

A second area of regulatory intervention is the need to ensure the quality of on-site sanitation facilities, so that they are emptiable. Some positive results have been obtained in Indonesia, Kenya, Malaysia, Philippines and Kampala, although they are often constrained by the practicalities of enforcement, especially in illegal or unplanned settlements, or in challenging environments (high water table, flood plains, rocky land etc.) In such situations, the regulated solutions may not be suitable.

Include FSM as a Recognized and Necessary Component of Sanitation

Legal provision for FSM must implicitly or explicitly recognize that sanitation services can and should be provided by a mix of the available options, according

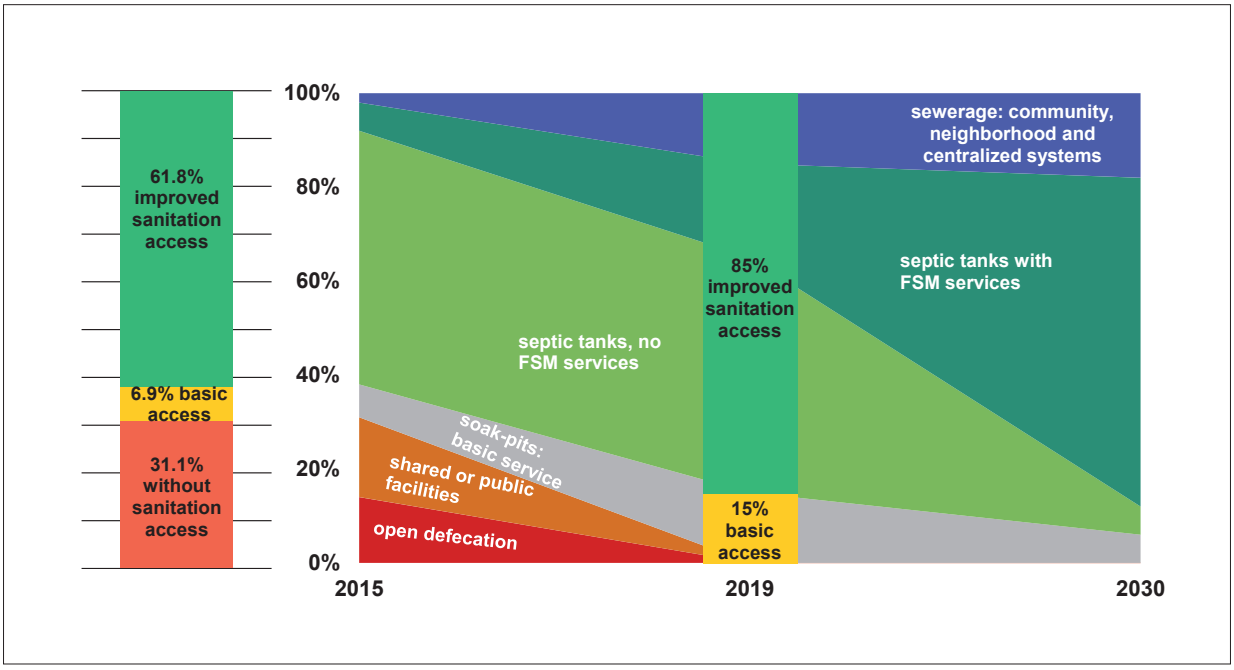

Figure 2: A changing technology mix to achieve national targets in Indonesia

to what is appropriate in each area at any given time. This can have profound implications for urban planning systems based on the common assumption that all improved sanitation is by means of sewerage. Employing a mix of sanitation options opens the way for a more incremental approach, a focus on services and how to deliver them, rather than infrastructure, and the acceptance that sanitation modalities will change over time in any given location. Integral to such an approach is a trajectory for improving sanitation, that explicitly considers how the mix of options will change over time, rather than focusing exclusively on the gradual introduction of sewerage while neglecting all other options. This will almost certainly require modifications to planning guidelines and procedures, with perhaps the most notable example being Indonesia.

Develop Local Public-private Partnerships

In most cases, the private sector will provide the bulk of faecal sludge collection and transport services, and may also undertake treatment and production of materials for sale. Based on the case studies, it is clear that much remains to be learned about sustainable and appropriate partnership arrangements with the local authorities, which will, in any case, vary widely from place to place. However, evidence of arrangements that work at scale, is outlined in the case studies for Philippines, Dakar and Malaysia, and is emerging from Warangal, Kenya, Indonesia and Kampala. Approaches that have been effective in different places range from a regulated market of emptiers, to more formal service level agreements and/or zoning, to subcontracting under a utility. The private sector may already be active in the sector and eager to become more formally involved, as seen in Maputo, Balikpapan, eThekwini and Malaysia. In other cases, they may not want to be involved initially, as observed in Sakhipur, Faridpur, Norton, Kenya and elsewhere. However, this initial reluctance can be overcome by advocacy, building up new business models and ensuring that convenient sludge disposal facilities are available. The development of partnership arrangements should in any case include a wide-ranging and inclusive dialogue with existing service providers, which must include manual emptiers where they exist, such as happened in Faridpur, Lusaka and Maputo.

Whatever arrangements are decided upon, licensing, reporting, monitoring and data management systems will be required. As operators also need management information for their own purposes, there may be scope for including an obligation in licensing agreements to share certain data with the local authorities.

Faecal sludge collection and transport is highly suited to the private sector, but treatment and the sale of end products can also work well in the private sector, as demonstrated in Sakhipur and Kigali. Collection and processing may or may not be combined under the same operator, but the available examples tend to the combined approach, with the treatment plant under a lease agreement (i.e. the treatment plant belongs to the utility or local government) as in Dakar and Kigali.

BUSINESS MODELS AND SERVICE DELIVERY

The demands of urban life mean that an accessible toilet is a basic need for all residents, and that all toilets must be connected to a sanitation service chain that ensures the separation of people from faecal material, all the way to its final treatment and disposal or reuse. The service chain may be sewered or non-sewered. Non-sewered sanitation is based on using an on-site excreta containment facility (a pit latrine or septic tank) and is the more widely used option in many countries, including those in the case studies. Where housing density is such that the faecal waste generated cannot be retained or infiltrated on site, the containment facility will need to be periodically emptied and/or continuously discharge faecal sludge to the environment.

Emptying of fecal sludge can be managed safely and hygienically, however, in many cases emptying is carried out manually with burial or open dumping nearby, or by vacuum tankers, which may or may not discharge the sludge at a designated site. Vacuum tankers typically focus on higher-income areas, where water based toilet systems with septic tanks predominate and road access is adequate. As the case studies on Kampala, Kigali and Maputo observe, manual emptying is more usual in densely settled, unplanned areas, where pit latrines are common and access to them is often difficult. As noted in the same studies, the heavier, drier sludges from pit latrines are often difficult or impossible to remove using vacuum tankers – and even when they might be possible to remove, the cost or the potential damage to a poorly-constructed pit latrine discourages the use of vacuum tankers.

Improved FSM is always developed in the context of, and often in competition with existing services, however insanitary they may be. In effect, the improved service needs to replace existing, usually cheaper, but lower-quality services. A tried and tested approach to that is to focus on the four P's of marketing – Product, Price, Place, Promotion – and this is reflected in the successful examples from many of the case studies.

SERVICE DELIVERY DO'S AND DON'TS

Essential

- Develop services across the full FSM value chain, not only infrastructure
- Build the technical capacity and business skills of service providers
- Implement a sustained campaign of community engagement and FSM marketing

Seriously Consider

- Encourage and support the private sector to become service providers
- Use public funds to develop FSM services
- Cross-subsidies from water, sewerage or septic tank emptying services in better-off areas
- Establish a call centre for FSM services
- Combine FSM with other related services
- Systematic enforcement of relevant public health regulations
- Establish partnerships for undertaking applied action research
- Research and development on the reuse of treated faecal wastes
- Show improved value to customers before attempting cost recovery

Avoid

- Using old tankers or other equipment beyond its economic life
- Abandoning the FSM awareness raising and marketing campaign

Product

An improved FSM service must be perceived by customers as offering something that is superior to existing options. This means adopting a service-oriented approach – improved infrastructure and technology are part of it, but they are only effective in the context of a service package appreciated by customers. These improvements typically include easy access to service providers, a quicker response time, less disruption, the ability to access hard-to-reach pits, and cleaner operating practices. In general, the private sector – with its flexibility, ability to innovate and the commercial incentive to improve efficiency – is better at delivering this than the public sector. Even where there is a dynamic public utility, for example in Dumaguete in the Philippines or eThekwini in South Africa, the private sector has still proven to be an effective partner in providing faecal sludge collection and transport services.

The case studies indicate that faecal sludge collection and transportation can be a viable business, but that if it is to compete effectively with long-standing unregulated services, a subsidy or cross-subsidy of some kind may be necessary (see also the discussion below on price) to reach the poorest customers. This is reported from countries as diverse as Bangladesh and South Africa, India and Kenya. Therefore, it may not always be possible to depend entirely on the private sector to make the necessary up-front investments to an adequate standard. However, leasing arrangements (as in Dhaka, Bangladesh and Dumaguete) or the judicious use of seed capital (as in Maputo in Mozambique) to buy basic equipment have resulted in viable businesses able subsequently to expand from their own resources. At-scale technical capacity building and business skills development of local companies are also consistently necessary components of FSM services development, as explained in the case studies from Dakar, Dhaka, Faridpur, Kampala, Maputo, Norton and Warangal.

Linked to this, and given the current limited knowledge base on FSM, partnerships with NGOs, research institutes and universities for applied research in developing, testing and piloting improved techniques have proven useful – as well demonstrated in the case studies from Bangladesh, India, Madagascar, South Africa, Uganda and Zimbabwe.

A number of studies (the BMGF study of 30 cities, Maputo, Kampala) suggest that the typical one-truck or one-team emptying operation is less viable than a larger one. This is perhaps not surprising given the wide range of containers and contents to be emptied, thus requiring a range or combination of equipment. Operators in Dakar also reported that a larger size (or at least a joint venture) is essential to gain large and lucrative commercial contracts – which could in principle cross-subsidize emptying in low-income residential areas. In the case of simplified mechanical and improved manual operations in Maputo and Lusaka, initial attempts to work with handcarts failed due to the distances involved, and the shift to motorized transport demands several emptying teams working simultaneously to justify the costs this incurs.

Most FSM services operate in response to customer requests, which is adequate in many situations, and in particular where households use dry or wet pit latrines rather than septic tanks. Regular or scheduled emptying is an alternative system that has been

tried in various places, including Indonesia, Malaysia and Philippines. It delivers better performance for septic tanks, simplifies payment by customers, as they pay monthly through the water bill, and provides a predictable income stream to the service provider. However, it has proven to be challenging to implement in practice. It also requires a high degree of organization and communication with customers, easy access to the septic tanks and a comprehensive database of onsite facilities. A door-to-door system worked quite well initially in Dumaguete, but the rate of emptying dropped dramatically when the system changed and owners had to make their own arrangements with approved emptiers. Malaysia had similar problems getting households to accept service, but is reintroducing scheduled emptying with improved customer awareness creation and more stringent enforcement. The lesson seems to be that even where people have paid regularly for desludging, they do not necessarily take up the services to which they are entitled. It also shows that on-demand emptying tends to operate at a much lower frequency than the ideal 3–5 years, and is usually triggered by septic tank failure rather than maintaining optimum performance.

Price

As transport is usually the largest cost element in FSM, traditional services that remove faecal sludge from the immediate vicinity of the customer but frequently fail to take it to an effective treatment facility (if one exists), are generally cheaper for the operator, and sometimes also for the customer. In comparison, the cost of hygienic collection, transport and treatment will usually be greater. This is to be expected, as an improved service including sludge treatment has a public good component in the form of improved public health, a cleaner more attractive environment, reduced pollution of water resources etc. In Mozambique, although customers preferred the improved service because it was more hygienic, 40 percent of them reverted to manual emptying because it was more affordable. It is therefore crucial to offer improved FSM services with a price and payment regime that is easily affordable to customers.

An affordable price means getting the technology and operational procedures right, and this is discussed below in the section on technical issues. The other part is the establishment of viable financial arrangements to ensure a sustainable service at a price that customers are willing to pay.

As already mentioned, FSM has a substantial public good component, so it is important to ensure that specific and focused funding arrangements are in place, which could reasonably include a component of public funds. Where sewerage is used to provide a sanitation service, public funding usually covers at least part (if not all) of the investment costs, and is rarely questioned. This can be used as an argument to support public financial support for FSM services, usually at a much lower cost per capita. It is the low-income segments of the market that are particularly important to capture, since it is these customers who depend the most on manual emptiers and are least able to pay for the public benefits delivered by improved FSM.

Various forms of cross subsidy have been developed and applied in a number of different ways: on an area basis, as in Dhaka; from septic tank emptying to pit latrines (Norton); and from institutional to residential services (Malaysia, although eventually somewhat reduced due to protests from commercial customers). In eThekwini, emptying services for urine diversion toilets (every two years) and ventilated improved pit latrines (every five years) are funded by cross-subsidies from water and sewerage service charges in more affluent areas. Should households require emptying in between scheduled services, they can request this but must pay a fee. Payment through the water bill may also help low-income customers to spread payments in small regular instalments, instead of dealing with a major expense every few years. Under such a system or by applying an explicitly pro-poor tariff (Dumaguete), capital cost recovery may even be achievable – if the capital costs have been kept low, as demonstrated in Dumaguete. The sale of safe processed faecal sludge products such as solid fuel or fertilizer can partially cover treatment costs, and this is already the case in Dakar, Faridpur and Kigali. However, in many places, such as Dhaka, Antananarivo, Malaysia, Philippines, and eThekwini, research and development is still in progress and a significant return has not yet been achieved. Such solutions require careful adaptation to local conditions, such as the range of sludge composition encountered, the seasonal availability of sludge, the balance of supply and demand for potential products in local markets, and transportation costs to the point of use.

It is important that the financial models cater explicitly for adequate maintenance and replacement of all equipment. Thus, in Kenya the business model for the decentralised sludge treatment facilities takes into account affordability for customers, while covering the capital investment, operation and maintenance costs. This also includes ensuring that tankers operate at optimum cost-effectiveness, which means avoiding the false economy of keeping old equipment running when it should have been replaced. A guarantee fund has

been successfully used to mobilize bank loans for this purpose in Dakar.

Place

Septic tank and pit emptying is a seasonal business, with peaks in the wet season in many, if not most countries. It therefore makes sense for operators to provide other related services that keep them in business throughout the year, or add value to their FSM business. Thus, in Maputo, FSM services are being provided by some of the micro-enterprises already undertaking primary solid waste collection (using different equipment), while in Kampala one of the FSM operators also sells and installs Sato pans to improve pit latrines.

In Balikpapan, Bekasi, Dakar, Kampala, Santa Cruz (Bolivia), and Warangal, a call centre or 'hotline' number has been (or is being) established to help customers make contact with a service provider, and in some cases to make the market more efficient by providing a platform for operators to bid for jobs. These can also provide a financial win-win by reducing the costs of job acquisition for operators and the cost of service for customers. In some cases, they have been used in conjunction with a database of on-site facilities, to assist in longer term planning for operators and the responsible authorities.

Promotion

In nearly all cases, a programme of long term community engagement, awareness raising and marketing was identified as essential to promote and maintain demand for improved FSM services. Examples include Dhaka, Faridpur, Warangal, Indonesia, Kenya, Dumaguete, Maputo, eThekwini, and Kampala. In the absence of such activities, demand was weak, and where they were abandoned after some time, the take-up of services decreased greatly, for instance in Dumaguete and Malaysia.

There is some evidence (for example in Dumaguete, Maputo and Balikpapan) that customers do appreciate the indirect benefits to public health and the environment as well as the direct benefits of improved FSM, and are prepared to pay at least something for them, if not the full extra cost. If this is promoted, it also helps to raise the status of FSM service providers, which may attract them into the market. This improved status allows them to operate during the day instead of at night (which is common amongst traditional manual emptiers), and their new-found visibility may become a marketing tool in itself, as reported by operators in Lusaka and Maputo. The status and attractiveness of the services to both providers and customers is further improved by the use of clean uniforms, personal protective equipment and more "formal" pit emptying equipment (pumps, covered plastic drums etc. as opposed to the simple tools and scoops used by traditional emptiers).

The availability of improved FSM services allows for more effective application of public health regulations on emptying, since customers now have the option of using a more hygienic service. The same regulations can also be used to discourage traditional emptiers – as, for example, in Kampala or Lusaka. Related regulations can be used to persuade users to upgrade their on-site facilities, making them more hygienic and also easier to empty.

TECHNICAL ASPECTS

Due to the previous focus on sewered sanitation there has been a widespread neglect of non-sewered sanitation by city managers and the engineering profession. However, that is now changing, and the case studies demonstrate how FSM technology is under development, testing and piloting. While, this is still work in progress, there is now sufficient experience to serve as a basis for developing the often very location-specific solutions needed, in collaboration with private sector service providers, engineering companies and academic institutions.

Looking beyond FSM services themselves, the on-site containment facilities often constitute a major obstacle to service provision, because the well-established principles of septic tank and pit latrine design are often flouted, misapplied or simply not understood under a weak or non-existent regulatory regime. This is especially the case in unplanned and illegal settlements, where policy and building regulations hardly apply. Furthermore, in challenging environments such as areas of high ground water, flood plains or rocky land, most established sanitation options are likely to be unsuitable.

There is thus a need both for ongoing research and development of FSM technology and for the development of approaches to the large-scale upgrading of on-site facilities. Below is a set of remaining challenges and constraints which would benefit from further study and additional case studies to illustrate good practice to mitigate these concerns.

Improving Containment

One of the major constraints to efficient FSM, noted in many case studies, is the type and poor quality of on-site containment structures. This 'containment' aspect of FSM is being addressed in eThekwini, Indonesia, Kenya, Madagascar, Warangal and Uganda. In South Africa and India, subsidies are available from national Government, and in Indonesia a performance-

TECHNICAL DO'S AND DON'TS

Essential

- Ensure dumping facilities are open from early morning to evening
- Develop adequate faecal sludge treatment capacity
- Use and upgrade or improve existing infrastructure
- Incremental approach starting with robust low-cost, low-tech solutions

Seriously Consider

- Pilot at-scale latrine upgrading
- Applied research on pit emptying
- Assessing the feasibility of fixed and/or mobile faecal sludge transfer stations
- Co-location and partial co-treatment of FS at sewage treatment facilities
- Build dedicated faecal sludge treatment facilities, where none currently exist
- Vehicle tracking devices and other digital applications to increase efficiency

Avoid

- Overloading sewage treatment facilities with faecal sludge

and output-based program for upgrading onsite sanitation was launched in 2015. In India and in Kenya masons are being trained to build improved standard septic tanks.

The containment challenges which are being, or need to be, addressed include:

- **Direct discharge of septic (or conservancy) tank effluent** and pit latrine overflows to storm drains, rivers, and canals. These need to be directed to soak pits, planted (evapotranspiration) beds or to off-site treatment in decentralised or centralised sewage treatment. Direct discharge is especially common in Asia, where wet systems are used, but also occurs widely in Africa.
- **Lack of a removable cover** to access a pit or tank for emptying:
  - In the case of pit latrines, this may mean that emptiers need to break the slab or the side wall of the pit, or work through the drop-hole within the confined space of the superstructure,
  - In the case of indoor water-seal toilets, the seepage pit or septic tank may be situated under the house and only accessible by breaking the floor, at considerable inconvenience and expense to the house owner. This is especially common in East Asia, where houses are often extended over the back yard where the septic tank was originally placed;
- **Poorly constructed latrine pits** unable to be emptied mechanically, for fear of collapse.

Although the problems are widely recognized, and many pilots are underway, work is still in progress on how to achieve effective interventions at scale, particularly in reaching the poorest residents, who bear the major burden of these problems. A number of cities have started to collect and manage data on existing on-site facilities (see above under 'place'), but have been able to make only a limited impression on the millions of existing on-site sanitation structures. While many responsible authorities recognise the need to apply resources to this area, the sheer scale of the problem demands that this be a partnership with users and the private sector, involving both incentives and sanctions.

Making Emptying More Efficient

Thick sludge from pit latrines with a low water content can be difficult to empty, especially when there is also solid waste in the pit – as commonly found in Rwanda, Mozambique, Ethiopia, Uganda and Zambia. In such situations, there is often little alternative to scooping it out with a range of buckets and hand tools. In the long run, the solution lies partly in improving the containment structures and reducing the solid waste content (by improving solid waste management and/or introducing a water seal, requiring small amounts of water). However, for the existing millions of pit latrines, quicker and more hygienic methods of pit emptying, coupled with more efficient sludge fluidisation, could make a huge and more immediate impact.

The development and production at scale of effective, low-maintenance and low-cost equipment could transform this blockage in the sanitation chain. This could be realised through applied research and pilots, in partnership with the private sector, and with the full collaboration of the respective local authorities. Experience already gained on this subject, and new knowledge as it emerges, should be shared internationally as widely as possible.

Improved equipment that enables the removal of faecal sludge to a treatment facility instead of local burial or open dumping will also increase the amount

available for processing and reuse. For instance, in Kigali the private operator of a facility processing faecal sludge into solid fuel has branched out into pit emptying in order to increase the volume of sludge available for processing.

Reducing Transport Time and Cost

As cities grow and become ever more congested, there is a corresponding need to limit tanker travel times, and hence cost. One solution proposed is the use of sludge transfer stations or decentralized faecal sludge treatment facilities, but experience to date is limited and poorly documented. There have been several cases where it was tried, but failed for various reasons: in Accra, due to unclear responsibility for managing them; in Freetown, due to community mistrust of those assigned to manage them; and in Maputo, due to lack of community acceptance for a faecal waste facility near their homes. This limited experience does not, however, rule out such solutions, but does make clear the need for effective planning, strong management and systematic engagement with the communities concerned. Experience in Maputo and Kampala also suggests that mobile transfer stations may have a role to play.

The dumping of faecal sludge into sewers to reduce tanker travel times and congestion has also been tried, with mixed results. Sludge with high faecal solids and/or solid waste content, typically from pit latrines, is likely to block and damage the sewerage system, and its disposal into sewers should be strongly discouraged. However, the discharge into sewers of septic tank sludges with a high water content may be feasible in some instances, and is allowed in Bandung, Indonesia, and Dhaka, for example. Faecal sludges are highly variable, so caution needs to be applied to avoid the dumping of sludge with an excessive solids content or industrial sludges that could be toxic to the treatment system. Even where neither of these conditions apply, care would need to be taken to avoid overloading wastewater treatment facilities.

Significant cost savings and a reduction in open and illegal dumping could also be made by longer opening hours at existing faecal sludge disposal sites. This makes better use of the investment in infrastructure, allows the tankers a longer working day and enables them to travel in the evening and at night when there is less traffic congestion.

The use of the cheap vehicle tracking devices now available and being used in Warangal, Kampala, Balikpapan and other cities, can contribute to improved fleet management and better control of illegal dumping.

A related issue is limited road access to on-site sanitation facilities, necessitating the use of small, portable equipment for emptying combined with a separate means of transport to reach disposal sites, and several case studies (including eThekwini, Indonesia, Kenya, Kigali, Lusaka and Maputo) report the use of specially developed machinery. This is often best developed locally, both to ensure that it can be maintained, and to enable its progressive adaptation to specific local conditions.

Specific Options for Faecal Sludge Treatment

Where dedicated faecal sludge treatment plants exist, they are frequently in bad condition or completely unserviceable, and are often poorly located as well. If they are in a suitable location (within 30 minutes' travel time from the premises they serve), they should be rehabilitated and put under sustainable management arrangements, possibly involving the private sector. Indonesia is promoting the use of an incremental approach to developing sludge treatment plants, aiming to expand them in a modular way as the customer base grows.

The conversion of faecal sludge into saleable products such as organic fertilizer or solid fuel may provide extra revenue opportunities for a private operator if they can be well matched to the local market.

Where there are no dedicated faecal sludge treatment facilities, the use of operational sewage treatment plants with spare capacity may be considered for the treatment of septage with a high water content, but loadings should be carefully controlled to avoid damage to the treatment process by excessive solids or nutrients. Alternatively, and ideally, if land is available, a solids-liquids separation facility for faecal sludge should be installed, with the liquid fraction co-treated with sewage and the solid fraction undergoing further treatment in new facilities, such as drying beds. If no space is available for solids-liquids separation at sewage treatment plants, then dedicated stand-alone faecal sludge treatment facilities must be considered, as in Sakhipur, Faridpur, Kampala and Lusaka.

CONCLUSION

The following eleven case studies provide practical examples and deeper insight into the material presented above. They present a growing and solid base of experience to build on, and some common lessons are emerging, although issues remain to be resolved.

It is notable that many of the lessons learned in the emerging case studies are similar to the ones reported

by examples that have already gone to scale. This strongly suggests that emerging practice is on the right track. It may also imply that there is an element of 'reinventing the wheel' going on – although each city is different and is likely to require different solutions and the learning of lessons in its own specific context. Five lessons that come out clearly from both the well-established and emerging programmes are that:

- **Well formulated and practical policy, rules and regulation** are essential – but always need to be supported by complementary factors such as those below;
- **Local leadership and clearly mandated and resourced institutions** are essential to manage services, even where actual services are delivered by the private sector;
- **Partnership between stakeholders** will contribute to developing services at scale, building community confidence and achieving sustainability;
- **A sustained program of community engagement, marketing and awareness raising** is as essential to FSM as sludge treatment – but is frequently under-valued, under-budgeted and sometimes abandoned after an initial period;
- **Capacity-building for FSM service providers** will be required so as to ensure that they can effectively meet all segments of demand and achieve long-term viability. This may include training in both technical matters and business management, and the facilitation of capital formation through grants, equipment leasing, loan guarantees and other financial instruments.

Improving FSM alone is only one component of improving sanitation. Complementary and well-coordinated programs will be required in the closely related areas of improving:

- solid waste management;
- surface drainage, and grey water management in residential zones;
- the quality of on-site sanitation facilities, especially in densely occupied areas and challenging environments;
- the reliability, quantity and quality of water supplies, and
- reducing – and eventually eliminating – urban open defecation.

Ultimately, FSM – and urban sanitation in general – is only one component of the basic services that are essential to make cities liveable. It is vital to give it the attention it deserves which it has often lacked in the past, but it is unlikely to be delivered effectively without taking other equally essential services into account. Sanitation affects, and is affected by, many other aspects of urban activity. Due to its cross-cutting nature, sanitation must be considered at the level of governance and political management as well as in terms of a technical service. The growing base of experience summarized here and in the following case studies has an important role to play in persuading and guiding city managers towards clean, healthy liveable cities.

The following case studies can be read as one document or used individually as reference material about specific approaches to FSM in different country and city contexts. The following table provides short descriptions and page numbers to help navigate the case study content.

PAGE	COUNTRY/CITY, TITLE	SELECTED FOCUS OF CASE STUDY
16	**Bangladesh** Tackling the Second-Generation Sanitation Challenge at Scale: Business Solutions for Inclusive Faecal Sludge Management in Bangladesh	National policy and institutional framework Whole sanitation chain Treatment and reuse of sludge Working with the private sector
33	**India** Towards a Model Sanitation City: Operationalizing FSM Regulations in Warangal	Evidence based advocacy FSM regulations Licencing desludging operators Use of information technology Capacity development and training

47	**Indonesia** Moving Towards Improved Urban Septage Management at Scale in Indonesia	National sanitation program and plans Advocacy, leadership and planning processes City sanitation surveys and census Scheduled and non-scheduled emptying Use of information technology
59	**Kenya** Scaling up Faecal Sludge Management in Kenya's Urban Areas	FSM services in small and medium towns Decentralised sludge treatment Improved on-site sanitation Working with public and private sector services Capacity development
70	**Malaysia** Sanitation and Sewerage Management: The Malaysian Experience	Utility managed services National policy and management Decentralized services Scheduled and non-scheduled emptying Lessons learned over 40+ years
84	**Maputo, Mozambique** Emerging Lessons on FSM from Maputo, Mozambique	Evidence based advocacy Working with the Municipal Council on byelaws FSM by small scale solid waste entrepreneurs Usefulness of seed funding and technical assistance Impact of TV advertising
95	**Philippines** City-Wide Fecal Sludge Management Programs in the Philippines	National law and regulation FSM city-wide services Working with the private sector Scheduled and non-scheduled emptying
109	**Dakar, Senegal** Dakar: Organising the Faecal Sludge Market	Market interventions FSM call centre and information technology Guarantee fund for FSM equipment purchase Management of treatment plants by private sector
119	**Ethekwini, South Africa** Sustainable FSM Services through Integrated Use of Resources and Innovative Technologies: A Case Study of the eThekwini Municipality (Durban) South Africa	Utility based services Evidence based policy Technical innovation and testing Services for all including the most vulnerable Working with partnerships
132	**Kampala, Uganda** Leveraging FSM to Close the Urban Sanitation Loop in Kampala	City authority managed FSM services Stakeholder collaboration Working with the informal private sector FSM call centre and information technology City wide mapping and mobilization for scaling-up
145	**Lusaka, Zambia** Approaches to Faecal Sludge Management in Peri-Urban Areas: A Case Study in the City of Lusaka	Trialling different business models Working with informal service providers Developing sludge treatment Financial sustainability challenges

NOTES

[1] JMP 2017

[2] ibid

Tackling the Second-Generation Sanitation Challenge at Scale: Business Solutions for Inclusive Faecal Sludge Management in Bangladesh

Noémie de La Brosse, Rosie Renouf, Suman Kanti Nath

EXECUTIVE SUMMARY

Globally, Bangladesh stands out as a country that has made remarkable progress in eliminating the scourge of open defecation. However, this success has created a 'second-generation' sanitation challenge of how to deal safely with the faecal sludge collected from pit latrines and septic tanks. As on-site sanitation solutions develop, the question of sustainable and inclusive faecal sludge management (FSM) business models is now at the heart of the challenge in Bangladesh.

This case study looks at faecal sludge management from a small enterprise development, treatment, reuse and financial viability perspective, applying a holistic and multi-stakeholder focus. Based on three solutions for FSM service provision in Dhaka, Faridpur and Sakhipur, the examples demonstrate building the capacity of the public and private sector partners in operating safe FSM, to improve public health and provide business and labour opportunities. The examples illustrate good practices along the faecal sludge value and service chain, as well as smart subsidies to engage stakeholders from start-up to scale-up in a viable way to serve poor households in urban Bangladesh.

The key lessons from and drivers for successfully engaging the private sector and structuring FSM as a viable service and business include:

- Public sector ownership of the FSM system is strategic, and agencies should carefully consider the complexity of the political economy factors urban sanitation in changing contexts.
- Successfully engaging the private sector depends on viable business incentives that can be jointly designed for enterprises to crowd-in. Ultimately, an FSM service model should also be structured around the level of business competition and the potential among local businesses to engage in human waste management.
- Mechanical FSM services can serve the poor and are viable in urban Bangladesh. Providing that institutional support and appropriate differential pricing strategies are established by the private and/or public actors with business development support, lower income consumers can be served without jeopardising a company's bottom line.
- Finally, FSM as a viable service relies entirely on awareness raising and the capacity to generate sufficient and sustained demand from a varied customer base. For a public private partnership (PPP) to be able to offer a strong framework in which multi-stakeholders can operate, an in-depth analysis of customers' demand, their willingness and ability to pay is essential in order to ultimately design models and tariff structures that enable the poor to access this service.

CONTEXT

Following an increase in the urban population from the mid-1960s to the mid-1990s, Bangladesh's cities face enormous challenges providing infrastructure and services to their citizens. The urban population growth rate is 3.5 percent per annum and Bangladesh is now one of the most densely populated countries in the world, with one third of its population living on less than ten percent of Bangladesh's total land mass. Thirty-four percent of Bangladesh's population of 161 million lived in urban areas in 2015 and this is projected to increase to more than 50 percent by 2050 (Figure 1).

The economy is resilient, enjoying consistent growth: gross domestic product (GDP) has increased by an annual average of 6.2 percent for more than a decade (Water and Sanitation Program, 2016). Despite this positive economic picture, national poverty rates

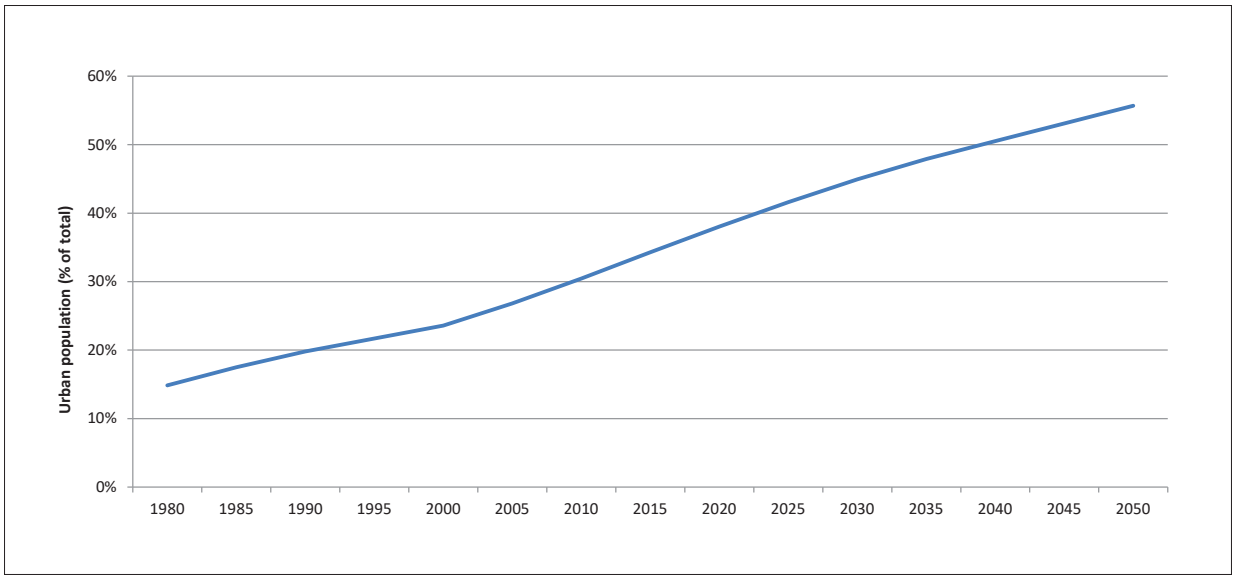

Figure 1: Urban population of Bangladesh, 1980–2050 (United Nations, 2014)

remain high and 21 percent of the urban population in Bangladesh still lived in poverty in 2010 (Riaz & Rahman, 2016). In Dhaka, nearly one third of Dhaka's 16 million-strong population lived in slums in 2014 (Ahmed, 2014). This proportion is lower in Faridpur, a secondary town, where 10,600 residents out of a total population of 130,000 live in slums.

Bangladesh has made considerable progress towards achieving the Millennium Development Goals (MDG) on water and sanitation, reaching and even exceeding the South Asia MDG target of providing access to improved sanitation for 61 percent of its population. Bangladesh's near-eradication of open defecation is particularly remarkable, reducing from 34 percent in 1990 to one percent in 2015. This was achieved through concerted campaigns and community-led total sanitation interventions led by the government, as well as increased use of on-site sanitation systems (OSS) such as septic tanks and various types of pit latrine (now used by around 94 percent of Bangladeshis). However, access to improved sanitation facilities that separates users from faecal waste is lower, at around 60 percent. The country's only sewerage network is in Dhaka and serves around 20–30 percent of households and institutions. Significant national growth in sewer access in the near- or medium-term future is unlikely, although the World Bank's Dhaka Sanitation Improvement Project may improve access to sewers in Dhaka over the next decade or so.

Figure 2: Street in Dhaka

The successful reduction of open defecation and increased reliance on OSS means that Bangladesh is now has a 'second generation' or 'post-ODF' challenge. The faecal sludge collected in sanitation facilities needs to be managed and treated to protect public health and the environment, but the FSM value chain beyond household containment is still underdeveloped. This poses a public health risk that will undermine the strong progress made in increasing toilet and latrine coverage. For example, 99 and 90 percent of human waste returns to the environment untreated in Dhaka and Faridpur respectively, and in Sakhipur, it is 79 percent.

This situation is likely to deteriorate as the country continues to urbanise, so sustainable solutions that respond to the complexities of urban sanitation in Bangladesh are desperately needed. Nationally, the

Ministry of Local Government, Rural Development and Cooperatives is responsible for drinking water and sanitation at the statutory level. The Department of Public Health Engineering (DPHE) takes functional responsibility everywhere except Dhaka and Chittagong according to the World Bank sanitation project in 2015. Beyond the national level, there is little clarity regarding the assignment of roles between service providers, city corporations and municipalities until very recently as discussed below.

FSM SERVICES IN BANGLADESH

Brief historical FSM context

As a result of the factors detailed above, there is a gap in the FSM value chain that is being filled by unsafe practices. Toilets overflow or are manually emptied and untreated sludge is transported and discharged into nearby drains and water bodies, exposing residents to human waste and the problems traditionally associated with open defecation. In many areas, most septic tanks and pits are also connected directly to the storm drainage system, which is linked to open water bodies within or outside cities. This is exacerbated by frequent flooding.

There is a disparity in access to improved toilets and safe FSM services by income level and geographical area. Households and institutions in Dhaka connected to the sewerage network are mostly in mid- to high-income areas. Households in low-income and informal settlements use several types of pit latrine and septic tank and are less likely to be connected to the storm drain network, let alone the sewerage network. They rely on desludging services, which usually means collection and transport by carts and vans. It is estimated that 20 percent of residents in low-income areas are occasionally forced to practice open defecation due to the lack of containment infrastructure or the inability to access emptying services. In other towns, open defecation rates varied between 1 percent (Sakhipur) and 6 percent (Faridpur) before interventions.

THERE IS A GAP IN THE FSM VALUE CHAIN THAT IS BEING FILLED BY UNSAFE PRACTICES

Historically, unregulated informal manual emptiers have provided households with the immediate desludging services they need, which also has negative impacts on the environment, public health and safety.

In Faridpur, manual emptying of a tank or pit costs between USD 15.00 and USD 50.00 (De La Brosse, Stevens, and Islam, 2017). In lower-income areas of Dhaka, the typical cost is between USD 50.00 and USD 500 (the latter for larger tanks serving many households) (Renouf, 2017). In the town of Sakhipur, the fee for faecal sludge collection and transportation is USD 6.50 per trip within the municipality; while clients outside the municipality pay more for the extra fuel (Kanti Nath., Al-Muyeed, and Ranjan Sanyal, 2017). Mechanised systems to empty pit latrines with direct storage in concrete rings or latrines connected to septic tanks by pipe are not used in Sakhipur. It is common practice to seal a full pit, then dig a new one to replace it. When a pit or tank needs to be reused, manual emptiers are employed to evacuate it and transport the waste to the disposal points. Ultimately, the price of FSM services often depends on the volume of sludge, type of emptying (manual or mechanical), distance to a disposal site, ease-of-access, condition of the containment facility and the sludge, and the socio-economic status of the customer.

The absence of treatment facilities in most towns and cities also leaves a gap in the sanitation chain. In Faridpur, the sludge treatment plant started is currently operating at 40 percent capacity. In Bangladesh, the significant amount of solid waste and faecal sludge generated offers the possibility of combined composting. Co-composting is also a core part of the FSM business model developed by the Municipality of Faridpur with support from Practical Action and the Bill & Melinda Gates Foundation (BMGF).

Overview of institutional mandates and responsibilities

According to the regulatory guidance, the Water Supply and Sewage Authorities (WASA) take the lead on water, sewerage and storm water drainage in cities where such bodies exist. This is relevant to Dhaka, as well as Chittagong, Rajshahi and Khulna. In other urban areas, the water supply and sewerage department of the city corporation or the municipality are responsible for solid, liquid and industrial waste management, according to the 2009 Local Government Act. Schedule II of the Act also states that the municipality should provide or identify sites for dumping waste and develop guidelines for residents. In practice, however, this guidance is never applied.

Local governments (and municipalities) have received little guidance on establishing new systems. Nor is there a strategy for significant investment in improving the quality of onsite sanitation facilities and FSM, although they share the responsibility of funding and

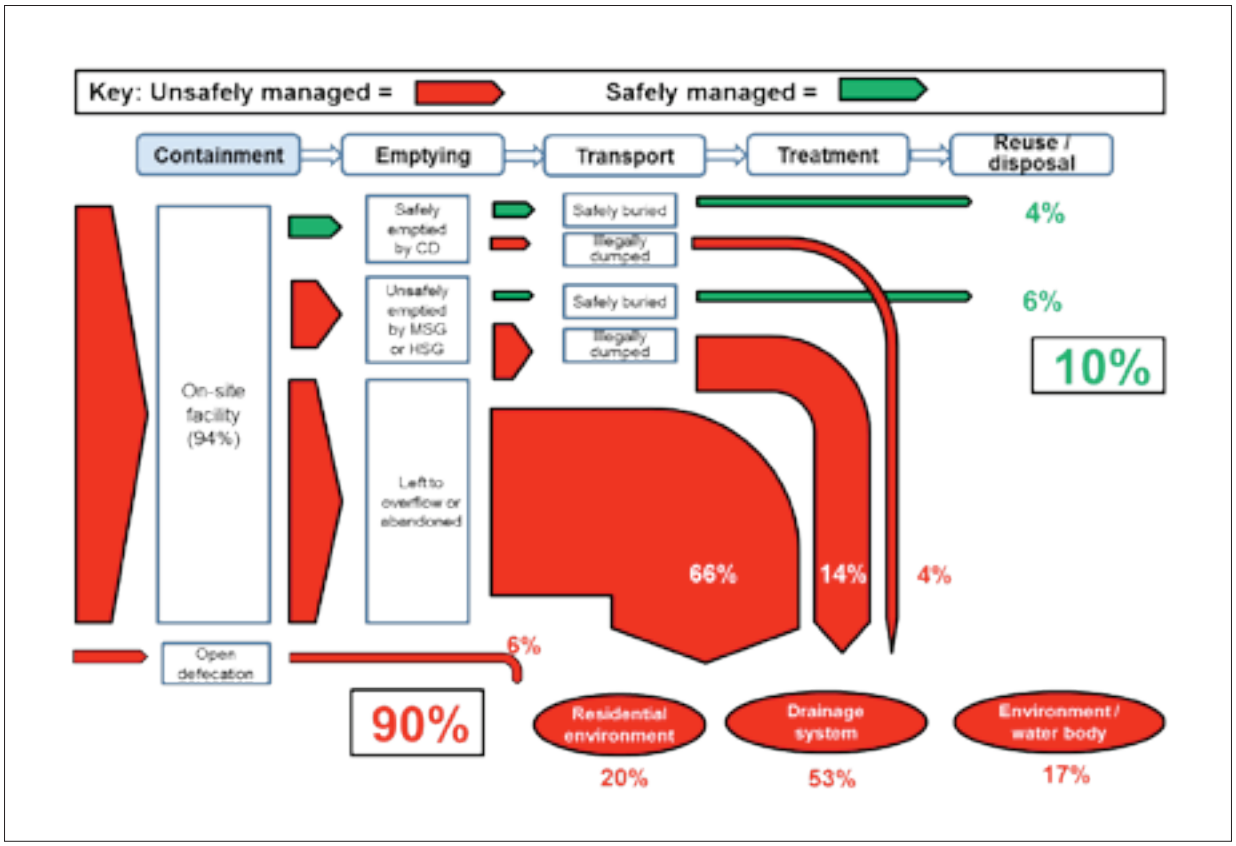

Figure 3: Faecal waste flow diagram Faridpur

implementing the infrastructure. In practice, the decentralised governance system has made it difficult for local governments to provide adequate sanitation because a detailed breakdown of responsibilities has not been available until recently, existing policies are often not enforced, and local governments do not have the budget to realise the policies they are mandated to provide. Key gaps in sanitation policy instruments are a significant challenge faced by the sector, and have led to:

- Continuation of unsafe and unhygienic manual emptying practices
- Lack of well-known and affordable sludge transportation options
- Few options and opportunities for sludge disposal or productive use of faecal sludge
- Lack of appropriate sludge treatment plants to ensure an effective sanitation value chain
- Few examples of successful sludge treatment models at scale
- Little interest from the private sector due to an absence of profitable business models

FSM IN NATIONAL AND CITY URBAN SANITATION POLICY

Legal Framework and Policies

Despite the insistence that municipalities manage waste of all types, faecal sludge is not specifically referenced in the regulatory guidance, although it is alluded to under the term 'refusal' in the Local Government Act. Municipalities have not developed approaches, technologies, or treatment options for faecal sludge management. The National Water Supply and Sanitation Strategy, which is focused on large cities, also pays scant attention to FSM.

Other legislation also ostensibly covers various aspects of sanitation, although these leave many gaps in policy and in practice. For example, the Paurashava (Municipality) Act 2009 provides for the development of a Master Plan for each Paurashava which should effectively incorporate FSM, although most municipalities are yet to enact this due to its complexity. In addition, no building code currently specifies septic tank provision.

THE DECENTRALISED GOVERNANCE SYSTEM HAS MADE IT DIFFICULT FOR LOCAL GOVERNMENTS TO PROVIDE ADEQUATE SANITATION

The Paurashava Act defines 'garbage' as including rubbish, offal, 'night-soil' (faeces), animal carcasses, sewerage deposits, residue from latrines, dirt, waste

and any other polluted materials. Faeces is therefore recognised in the document, though the activities required for its management are not adequately addressed. Elsewhere in the Act, 'sewerage' means drainage, polluted water, rain water carried by drains and any type of polluted and dirty materials carried by canals. Faecal sludge is therefore not linked to sewerage. Similarly, 'drain' is defined as a rain or storm water drain, as well as the water tables, chutes and side drains that carry rainwater from streets, bridges or causeways.

The Institutional and Regulatory Framework
In September 2014, the Policy Support Unit (PSU) of the Ministry of Local Government, Rural Development and Cooperatives started to design an institutional and regulatory framework (IRF) for faecal sludge management in Bangladesh. Developed through extensive consultation, the IRF assigns roles and responsibilities throughout the FSM service chain to institutions based on existing laws, policies and strategies, thus avoiding overlap and taking into account infrastructure, socio-economic conditions and environmental concerns. The IRF was finalised in December 2015, approved in the National Forum meeting in April 2016 and approved by the ministry a year later in 2017.

The national government acknowledged that an appropriate institutional arrangement was a prerequisite for effective FSM. Since the entire FSM service chain is interlinked, it is important that the roles and responsibilities of institutions are clearly defined, integrated and are coordinated based on local conditions, skills, strengths and institutional commitment to an effective, safe and sustainable FSM system. The IRF identifies several institutions and stakeholders to play roles in the overall planning, development, implementation, practice, and monitoring and evaluation of FSM. Within national government, the following ministries are responsible for securing funding, providing technical support through respective line agencies (BMGF and LGED), ensuring enforcement of laws, policies, strategies and guidelines, initiating inclusive planning and execution of FSM, and monitoring through the National Forum for Water Supply and Sanitation (NFWSS), the Ministry of Local Government, Rural Development and Cooperatives, and several other ministries, including Environment and Forestry, Health and Family Planning, Agriculture, Housing and Works and Water Resources.

As the lead ministry, the Ministry of Local Government, Rural Development and Cooperatives, is in charge of:

- leading the planning, development, guidance and monitoring the overall system of FSM in Bangladesh,
- securing funding from central government and development partners, and
- disbursing funds among implementing agencies e.g., city corporations, WASA, municipalities or other urban local bodies as appropriate.

THE INSTITUTIONAL AND REGULATORY FRAMEWORK (IRF) ASSIGNS ROLES AND RESPONSIBILITIES THROUGH THE FSM SERVICE CHAIN

The Ministry will also update policies and strategies, facilitate enactment of laws/bylaws, and prepare guiding principles for FSM as required in consultation with the National Sanitation Taskforce and/or the National Forum for Water Supply and Sanitation. An important responsibility will also be to provide overall coordination among stakeholders/institutions and performance monitoring. Local government institutions and line agencies (Dhaka North City Corporation, Dhaka South City Corporation, other city corporations, Paurashavas and Union Parishads) are in charge of implementing the FSM system. They are supported by WASA, RAJUK (Capital Development Authority of the Government of Bangladesh), DPHE and LGED. The institutional and regulatory framework provides guidance on:

- The responsibilities of stakeholders for each step of the service chain, their roles and obligations, and the mechanisms responsible for the monitoring and enforcement of each activity;
- Proper design and construction of sanitation and disposal facilities, social sustainability (i.e. social discrimination, rights, and safety for desludging service providers), environmental sustainability (i.e. stopping illegal connections to and disposal into water sources with 'environmental police' ensuring compliance), and economic sustainability (i.e. sustainable FSM business models, including cross-subsidies for more pro-poor service-level agreements, and 'safe sludge transfer' incentives, gradually developing a database of all sanitation facilities and their emptying frequency);
- Involving the private sector in FSM services;
- Setting up relevant units in local government bodies (CCs, Paurashavas, and Union Parishads) for the effective delivery of FSM services;

- Collaboration/coordination with departments such as Environment and Agriculture Extension for environmental compliance, quality assurance and marketing of end products;
- Capacity building, training, and research including filling knowledge gaps, technical assistance, training, and quality assurance of processes and products (e.g. compost);
- Awareness-raising campaigns, promoting private-sector participation, and demonstrating FSM business models;
- Technical and funding support from the government for capital infrastructure and other assistance (e.g. securing land for treatment facility construction);
- Guidance on FSM business models, whereby treatment-plant operators pay the collection and transportation operators a discharge incentive to dump the sludge safely. This financial incentive rewards socially desirable behaviours, and encourages re-use and resource recovery.

EXAMPLES OF FSM INTERVENTIONS IN BANGLADESH

Most links in the FSM value chain will require significant support if they are to develop to the level needed to protect public health and ensure improved service provision. Given the complexity of the urban sanitation sector and the scale of the challenge surrounding FSM service provision in Bangladesh, any solution must be multifaceted and holistic, reacting to situations on the ground and taking advantage of the opportunities that arise.

The three city interventions developed by Practical Action, WaterAid Bangladesh and WSUP therefore take different approaches to various sections of the

IN BANGLADESH, ANY SOLUTION MUST BE MULTIFACETED AND HOLISTIC

FSM value chain in their respective cities, from collection to treatment (Figure 4), but all seek to develop solutions that will strengthen the national sanitation sector as a whole.

Between them, these projects undertake a range of activities, including: i) supporting the public sector and existing institutions that are responsible for urban sanitation, ii) developing business models and engaging with the private sector, and iii) improving treatment technologies and processes. As demonstrated in Figure 4 and Table 1, although the projects differ in terms of activities and area of focus, all support multiple local stakeholders to build their FSM capacity.

Overview of three urban FSM projects

In Dhaka in 2015, WSUP designed a PPP to be delivered through a lease contract between DWASA and a cleaning services business that wanted to move into FSM (Gulshan Clean and Care). Under this agreement, DWASA provided the company with two 2,000 litre vacuum tankers to use under the 'SWEEP' brand, developed by WSUP for use by sanitation SMEs in Bangladesh. Until recently, SWEEP targeted mid- to higher-income residences and commercial institutions, with lower income clients making up 15 percent of the customers. A new clause in the lease contract agreed by DWASA, the SME and WSUP mandates that the proportion of low-income

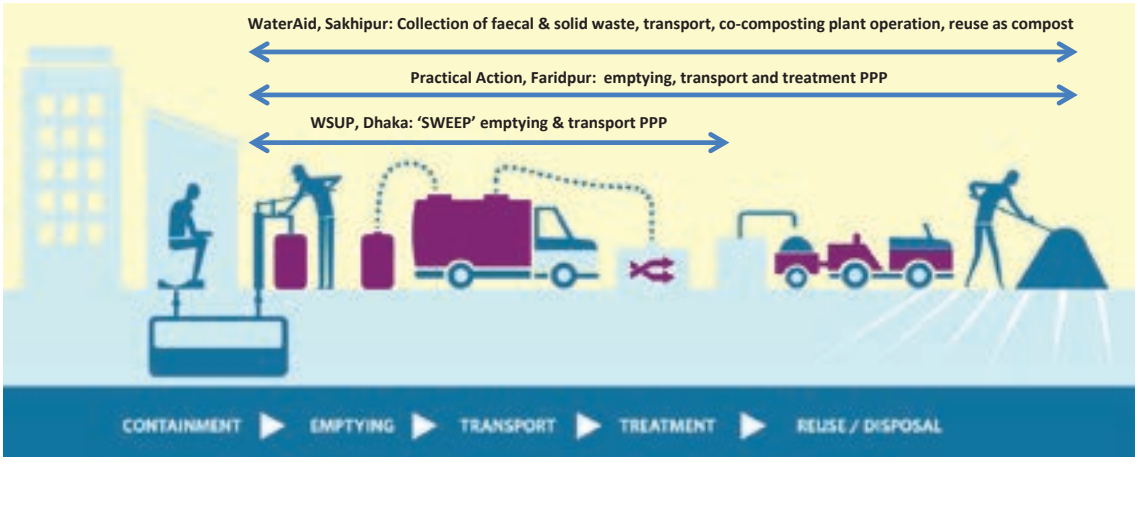

Figure 4: Links of the FSM value chain addressed by Practical Action, WSUP and WaterAid projects

	Dhaka	Faridpur	Sakhipur
Public sector	**Dhaka Water Supply and Sewerage Authority (DWASA)** Infrequent vehicle maintenance (e.g. major repairs) Mass marketing and demand generation Regulatory activity Replacing fleet Disposal/treatment of sludge	**Faridpur Municipality** Monitoring progress Appointing treatment plant operator Subsidising treatment plant Demand generation and awareness raising campaigns	**Sakhipur Municipality** Leasing land for co-composting plant Mechanical desludging (Vacutug) and manual desludging services for a fee (59 percent of the faecal sludge of the town is currently safely disposed and 38 percent is treated safely through the co-compost plant) Selling compost to farmers Promoting compost to farmers through Dept. of Agricultural Extension.
Private sector	**Gulshan Clean and Care (SME)** Paying lease fee and security deposit to DWASA Regular vehicle maintenance Providing desludging services to clients in exchange for market/fixed payment Transporting sludge to DWASA disposal points	**Khutibari Cleaners Cooperative and Bandhob Polli Cleaners Cooperative (sweeper group cooperatives)** Paying lease fee to municipality for machinery Providing desludging services to clients for a fee **Treatment plant operator (Society Development Committee-SDC)** Paying incentive to desludging service providers for sludge delivery Treatment of sludge for reuse (co-compost)	N/A
Other	**UNICEF** **WSUP** Technical and business management training Developing marketing and promotional strategy	**Practical Action Bangladesh** Supporting the municipality with demand generation activities Providing technical backstopping to all stakeholders	**WaterAid Bangladesh** Technical and financial support **Bangladesh Association of Social Advancement (BASA)** Implementing partner

Table 1: Major stakeholders and their roles in the FSM interventions in Dhaka, Faridpur and Sakhipur

Figure 5: SWEEP team with branded vacuum tanker in Dhaka

customers will rise to 30 percent. The SME will achieve this by increasing its advertising and brand promotion in targeted areas, and connecting with community leaders and residents who could act as sales agents.

Although Dhaka lacks adequate treatment capacity for its sewered and non-sewered populations, DWASA provides eight official disposal points for SWEEP. However, there are no facilities to ensure that sludge is treated and safe. WSUP is currently in discussion with the Dhaka City Corporation and DWASA about tackling the city's treatment deficit under the World Bank-funded Dhaka Sanitation Improvement Project. After a two-year pilot that ended in in March 2017, SWEEP had reached over 120,000 people in Dhaka and emptied nearly 4,800m^3 of sludge.

In Faridpur, Practical Action developed a PPP wherein two groups of informal pit emptiers (also known as the sweeper community) have been formalised into cooperatives that provide mechanical desludging services (collection, transport and disposal) for a fee. The municipality monitors progress through quarterly

THE CO-COMPOSTING PLANT IS EXPECTED TO INCREASE THE VOLUME OF TREATED SLUDGE FROM 21 PERCENT TO 58 PERCENT OVER THE NEXT TWO YEARS

targets to ensure quality control and safe disposal of the sludge at a new treatment plant. A multi-stakeholder steering committee oversees the service level agreements and incentives through a set of key performance indicators that ensure the system's responsiveness. A performance-based contract (including an equipment lease) was signed by between the municipality and the Khutibari Cleaners Cooperative, in December 2015. Bandhob Polli Cleaners, a second cooperative, has recently also entered the PPP.

The treatment plant pilot began in August 2016 and the municipality has recently appointed a treatment plant operator (TPO). The project was originally piloted in two wards of the city with a combined population of 26,000; the service is now available city-wide. In the first four months of operation, the Khutibari Cleaners Cooperative completed 149 trips to the treatment plant and earned USD 3,087 in emptying fees. From the start in August 2016 until June 2017, the cooperative emptied a total of 194 latrines and made 583 trips with the Vacutug (2m3 each). The collection, transport and disposal of 1,166 cubic meters to the treatment plant by the cooperative earned USD 9,577 in revenue. The model is expected to expand once the second cooperative receives its own vacuum tanker and adopts this business model.

In Sakhipur, aiming to address the twin problems of solid waste management and faecal sludge management, WaterAid Bangladesh and its implementing partner BASA helped Sakhipur Municipality develop a co-composting plant that will provide scientific and practical knowledge about co-composting as well as management and safety training. Construction began in 2015 and the plant became operational in January 2016. The intervention combined a co-composting plant alongside mechanical faecal sludge removal and transportation, and household solid waste collection and transportation.

The co-composting plant consists of unplanted drying beds, wastewater treatment through a constructed wetland, and aerobic decomposition of dried faecal sludge and organic solid waste. Customers are charged USD 6.50 per trip using the municipality's Vacutug, currently in operation four days a week and collecting around 16,000-20,000 litres of sludge weekly. In the last 16 months, the Vacutug made 1150 trips to collect faecal waste. The solid waste for the plant is collected from households for a monthly fee of USD 0.40 and sold by the municipality to farmers for USD 0.20 per kg. Shit flow diagrams developed to quantify the pre- and post-condition of FSM in Sakhipur demonstrate that the co-composting plant is expected to increase the volume of treated sludge from 21 percent to 58 percent over the next two years (Figure 10). Currently, the plant handles 1,200 tons of faecal sludge and 125 tons of solid waste annually and produces approximately 24 metric tonnes of

Figure 6: Desludging by Khutibari Cleaners Cooperative

Figure 7: Signing the performance based contract in Faridpur

Figure 8: Emptying fee being paid in Faridpur

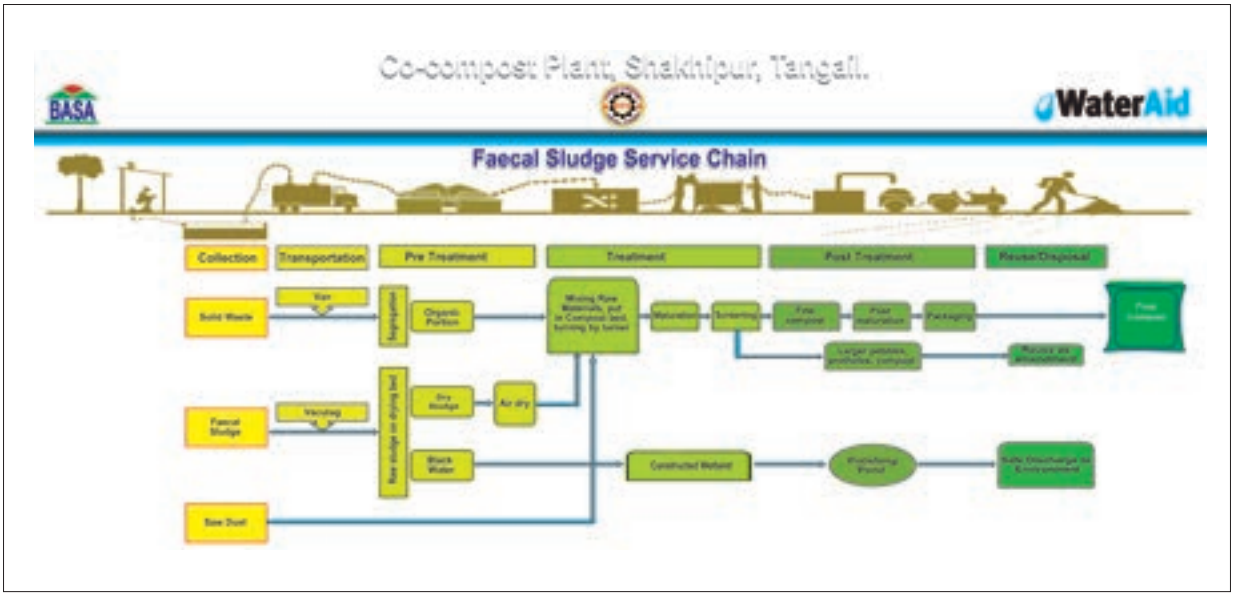

Figure 9: The sanitation service chain in Sakhipur

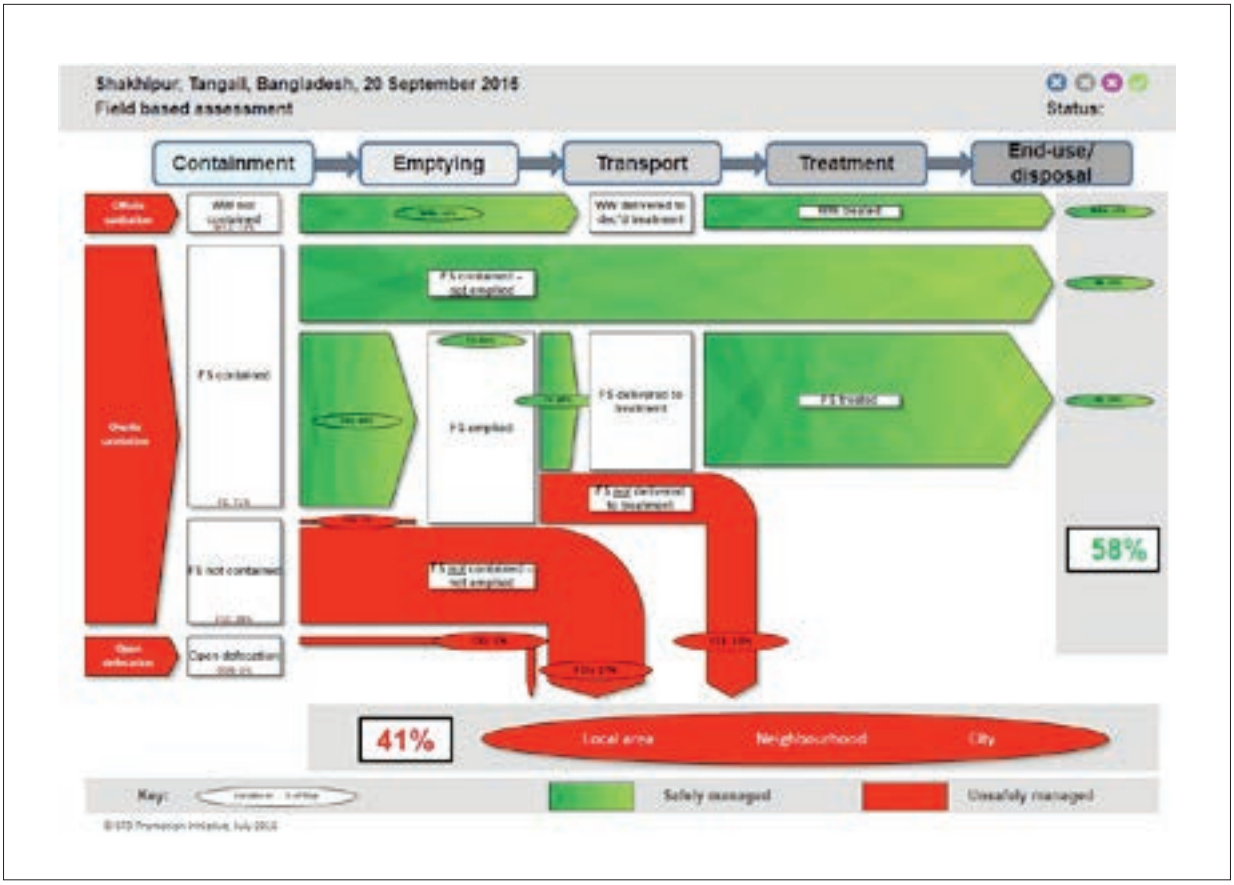

Figure 10: Target shit flow diagram for Sakhipur

compost per year. Laboratory tests demonstrate that the compost has a carbon to nitrogen ratio in the range of 16–20 and the average moisture content is around 16 percent (Kanti Nath, Al-Muyeed, Ranjan Sanyal, 2017).

The three projects offer cost-efficient ways of meeting the needs of diverse groups – not just removing and treating faecal sludge in a hygienic manner, but also providing reusable end products for farmers and business models for SMEs that can be adopted and then adapted according to the needs of customers and cities. The projects are not just providing a needed service, but developing tools and models that stakeholders operating in each municipality/city corporation can use to extend service provision city-wide.

Figure 11: Drying bed in Sakhipur

Figure 12: Sludge turner in Sakhipur

FINANCIAL ASPECTS AND INCLUSIVE BUSINESS MODELS

Public-private partnerships are often the best way to create a competitive environment for mechanical desludging operators to enter the market. Under the contract signed in Dhaka, the 'SWEEP'-branded SME provides desludging services and disposal under a lease agreement with DWASA for use of their vehicles, and DWASA provides eight official disposal points and mass marketing. The total profit generated by SWEEP by October 2016 was BDT 700,000 (USD 8,700) as shown in Figure 13.

In Faridpur, the informal desludging groups formed two cooperatives in partnership with the Municipality. The partnerships include an equipment lease agreement and formalises the service level agreement, and an arrangement with the treatment plant operator. This model replaces an inefficient system of service provision where the municipality and the informal desludging groups were competing with each other.

Desludging fees and compost sales can generate revenue. In Faridpur, revenues from the sale of compost made from dried sludge are expected to be low in the first year of operation (USD 1,600) due to challenges marketing and certifying human waste as a fertiliser (cultural acceptance of these products can be low). However, sales of compost as an extra source of revenue have a potential to alleviate the pressure on the FSM business model and could even become a key driver for financial sustainability. See Figure 14.

In Sakhipur, the municipality has revenue streams of an estimated USD 7,000 collected annually from the fees for faecal sludge and solid waste collection services by the Vacutug operators, and an additional USD 6,000 per year from sales of compost, purchased by farmers from the plant operators. An estimated USD 20,000 is spent annually on labour for faecal sludge and solid waste collectors, plant operators, fuel, part replacement, maintenance and other

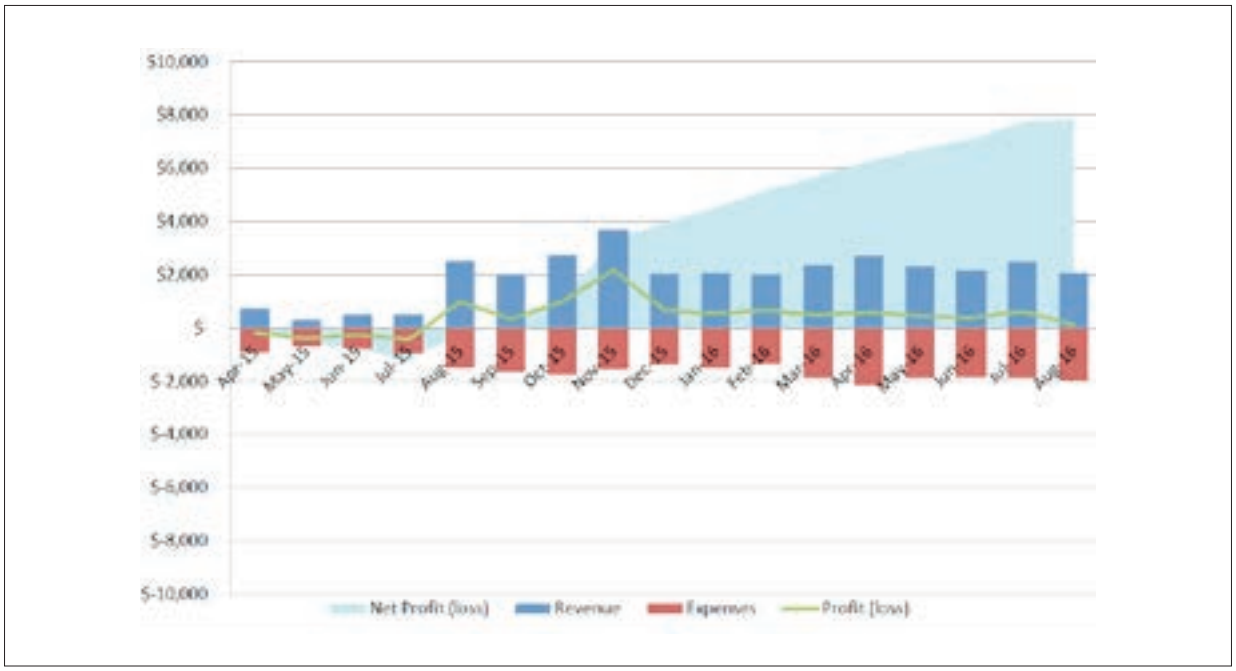

Figure 13: Overview of SWEEP's financial performance, April 2015–August 2016

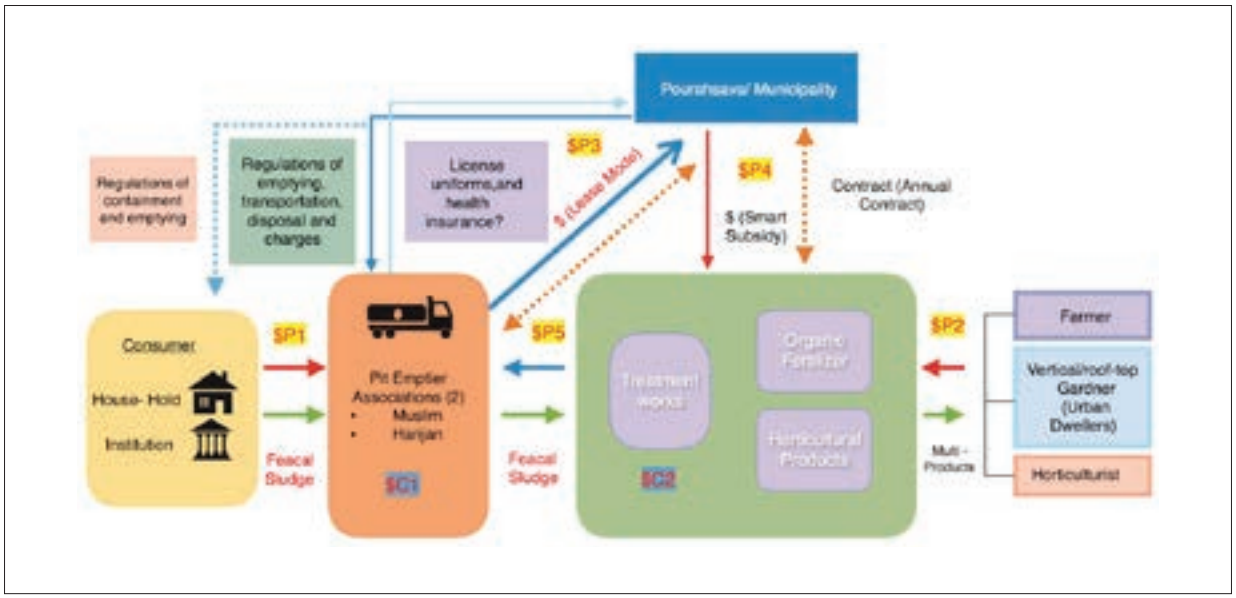

Figure 14: Institutional arrangement and performance based contracts Faridpur

expenses. WaterAid plans to gradually handover the FSM business model, which is yet to reach break-even, to the municipality. In this municipality-led approach, the authorities are the duty bearer, and are responsible for the operation, supervision, regulation, demand management and monitoring of the services. They play a major role in identifying the challenges in the implementation, and the opportunities for business expansion. For example, demand for collection and transport is high during the rainy season, and results in overflowing and flooding of on-site sanitation systems. This also has an impact on composting, as the volume of dry sludge reduces – invaluable information for future planning. The Municipality also has a role to ensure the quality of compost and finally establish interlinks between the components of sanitation service chain.

The uncertainty surrounding innovative FSM business models can be balanced by a smart cross-subsidy system. Revenue earned from emptying services (expected to be USD 4,100 in the first year in Faridpur) subsidises the low revenue expected from compost sales for the treatment plant operator (expected to be USD 1,600). The low revenue from compost sales for the TPO can be compensated by a subsidy from the municipality, covered by revenue from the leasing contract. This cross-subsidy will be in place once the FSM system is operational to help cover the plant's operating costs, estimated at USD 15,000 per year until 2018.

In the start-up phase, a set of smart subsidies and financial and non-financial incentives is often required to cover the shortfall in the budgets of the new businesses. For example, in Dhaka, the business operating under the 'SWEEP' brand reached an agreement with DWASA on the equipment lease fee, which was invaluable in the start-up stages. Desludging service providers in Faridpur were given a six-month exemption on payments for leasing mechanical and transportation equipment from the municipality. Municipalities can then carefully reduce subsidies to private sector stakeholders over time (without subjecting FSM start-ups to undue financial pressure), thus incentivising businesses to maximize their revenue from sales to cover costs without having to rely so heavily on external financial support.

IN THE START-UP PHASE, A SET OF SMART SUBSIDIES AND FINANCIAL AND NON-FINANCIAL INCENTIVES IS OFTEN REQUIRED

A "safe transfer incentive" is a core part of the business model as it supports desludging service businesses to safely dispose of sludge whilst ensuring rapid profitability. The Faridpur treatment business is projected to become more profitable and have a net cash flow of more than USD 50,000 from its third year of operation. This model is transforming informal emptiers into formal businesses, improving their health and livelihoods, and serving as a pilot model for other municipalities facing the challenge of catalysing a competitive FSM business environment.

Targeting mid- to higher-income residences and commercial institutions can help businesses become profitable early in their start-up phase. In Dhaka, SWEEP's initial targeting of higher income customers

and customers with larger tanks, who are often willing to pay more for desludging services, meant that the SME could fully cover its operational costs and become profitable five months after its launch in April 2015. A price analysis undertaken by WSUP demonstrated that the size of the customer's septic tank indicates profitability, which helped determine pricing (Walcott, 2016a). This information will also be important for scaling up and establishing SWEEP branded vacuum tankers elsewhere.

These customers account for 60 percent of SWEEP's revenue despite being only 15 percent of its customer base. As of October 2016, SWEEP had made a total profit of nearly USD 8,890. The SWEEP experience suggests a combination of institutional and household customers can be highly beneficial to a FSM service in the start-up phase. An initial focus on higher-income customers allows the business to introduce differential pricing for customers with lower incomes; the tariff in Dhaka, for example, is typically USD 6.00–USD 7.50 per cubic metre for low-income customers and USD 10.00–USD 15.00 per cubic metre for middle/high-income and institutional customers (the pricing structure is not fixed, given the widespread practice of negotiation over price for services rendered). Despite this potential barrier, the vast majority of jobs performed by SWEEP technicians generate a profit, with jobs that made a loss mostly confined to the start-up period in 2015. While serving higher income customers and institutions can help a business reach profitability at an early stage, a mix of clients (including those with lower incomes) benefits the business as it ensures plenty of customers. In addition, SWEEP serves lower income customers because they are incentivised to do so by local authorities; a clause in the lease contract stipulates that SWEEP must serve a minimum percentage of customers from low-income areas.

A COMBINATION OF INSTITUTIONAL AND HOUSEHOLD CUSTOMERS CAN BE HIGHLY BENEFICIAL TO A FSM SERVICE IN THE START-UP PHASE

The three different financial and business models presented here show that a pilot period is indispensable for assessing the customer base, the end market for desludging services and establishing compost as a potential source of revenue. Identifying the incentives for SMEs to enter the FSM market is crucial for service delivery beyond piloting. Existing competition can encourage local businesses to offer FSM services to the widest customer base and ensure successful uptake. International agencies that facilitate the creation of these partnerships and identify an existing market and key local skills (in business planning, for example) can make a significant difference in establishing sustainable businesses (beyond a more traditional focus on health and safety training, and provision of improved equipment).

IDENTIFYING THE INCENTIVES FOR SMES TO ENTER THE FSM MARKET IS CRUCIAL FOR SERVICE DELIVERY BEYOND PILOTING

CAPACITY DEVELOPMENT

The IRF targets specific institutions to provide research support and fill knowledge gaps, technical assistance, training, and quality assurance of process and products (e.g. compost). These institutions include ministries and relevant line agencies, the International Training Network Centre of Bangladesh University of Engineering and Technology (ITN-BUET), universities, national research organisations (e.g. icddr,b , international research/training organisations (e.g. IWMI), DPHE, LGED, development partners, international/local non-governmental organisations (I/NGOs), and the private sector. The Ministry of Local Government, Rural Development and Cooperatives will set up units for FSM in Paurashavas, while national research and training organisations collaborate with their international counterparts, I/NGOs and the private sector to provide capacity building, training and research, supported by national ministries. The LGD of the Ministry will coordinate, develop guidelines for capacity building, research and training initiatives on FSM, and facilitate sharing and dissemination of knowledge amongst Paurashavas.

In Faridpur, building business planning skills for local businesses was a priority, as well as business modelling tools and skills for facilitators of change in the FSM value chain. A participatory workshop attended by organisations including Faridpur Municipality and ITN-BUET used costing tools developed by UK universities to design a business model, which adapted incentives for private service providers and public stakeholders.

In Sakhipur, sharing information about co-composting, marketing, training, and occupational safety messages and best practice with plant operators and other sewerage and waste collection

process stakeholders is key to upscaling the plant and replicating the model elsewhere. WaterAid Bangladesh continues to organise faecal sludge and septage management training for government and NGO officials, engineers, urban planners, academics, and private entrepreneurs. The main objective is to share knowledge on international FSM initiatives so FSM is prioritised across different departments and national bodies. In Sakhipur as well as Faridpur, technical sludge treatment skills were required and the co-composting projects enhanced stakeholders' capacity during the start-up phase.

THE MUNICIPALITY ORGANISED MASS CAMPAIGNS...TO PROMOTE MECHANICAL SLUDGE EMPTYING AND COMPOST USE

In Dhaka, WSUP provided the SWEEP SME with technical and business management training to improve their ability to deliver services safely and profitably, and supported DWASA to develop a promotional and marketing strategy for the SWEEP brand. This marketing drive included an SMS, video, leaflet and poster campaign to raise awareness of the new service. Similarly in Sakhipur, the municipality organised mass campaigns including street shows, student outreach, and an agricultural fair to promote mechanical sludge emptying and compost use. In Faridpur, these interventions were driven by the PPP actors (the municipality and private operators) with support from Practical Action, who organised large campaigns and street drama to increase demand and willingness to pay for these new FSM services.

National partners such as ministries and their line agencies, the Bangladesh Urban Forum, civil society organisations, community-based organisations, researchers and universities are all well-placed to provide this kind of crucial strategic support. In the three case studies, capacity building on community mobilisation, awareness raising campaigns and marketing around FSM service and reuse of human waste was collaborative and iterative amongst national stakeholders, supported by WSUP, Practical Action and WaterAid Bangladesh.

ONE KEY TRIGGER FOR SYSTEMATIC CHANGE IN FARIDPUR WAS THE MUNICIPALITY'S COMMITMENT TO DELIVERING CITY-WIDE FSM

DRIVERS OF CHANGE AND LESSONS LEARNED

Drivers of change

These experiences **highlight the importance of achieving public sector ownership**. One key trigger for systematic change in Faridpur was the municipality's commitment to delivering city-wide FSM, allocating a large plot of land for a treatment plant and introducing a 30-year City Master Plan. Sakhipur municipality also leased land for the co-composting plant after observing the severity of the FSM problem and identifying possible solutions. In Dhaka, DWASA chose to take part in the PPP as leasing their vehicles to private actors minimises risk, they receive monthly revenue from leasing fees, and the model's scalability meant they could enter the FSM market without internal restructuring. Buy-in is not just important for financial support, land and equipment: working alongside the public sector also lends credence to companies starting to work in FSM.

Figure 15: SWEEP vacuum tanker in operation in Dhaka

The **complexity of the political economy of urban sanitation** provides opportunities and challenges. Political unrest in 2015 delayed implementation of the Faridpur model and treatment plant construction, but the Municipality's political commitment and electoral interest in achieving city-wide FSM overcame this setback. In Dhaka, the Commercial Manager of DWASA was an early 'champion' of the SWEEP model. Stakeholders' willingness to take risks and consider alternative options drive new models, particularly if there is a shared vision of what needs to change. A willingness amongst donors to push for innovation is also valuable.

Successfully engaging the private sector is crucial. In both Dhaka and Faridpur, competitive bidding processes ensured companies that were willing

and able to enter the FSM market were selected. Presenting a business case to entrepreneurs may be necessary to overcome the perception that mechanical emptying businesses operating in low-income areas are not financially viable. Estimating the revenues of existing FSM service providers in Faridpur was difficult, due to the absence of formal structures or track records of income generation; this was overcome through the use of a series of costing tools developed by the University of Leeds. The resulting baseline information obtained allowed for the **creation of a strong business model**. Models should offer clear benefits to the private sector, lessening the risks of entering the FSM market by lowering start-up costs and ensuring that companies see a faster return on their investment.

Main lessons learned so far

Mechanical FSM services that serve the poor can be viable in urban Bangladesh

Providing that institutional support and appropriate differential pricing strategies are established, lower income consumers can be served without jeopardising a company's bottom line. Serving a minimum target of low-income areas can be built into service level agreements between public and private partners, as was the case in Faridpur and Dhaka. Identifying the price points for lower- and higher-income customers allows SMEs to develop an appropriate differentiated pricing strategy, something that WSUP is currently designing in Dhaka. Implementation of a simplified model based on SWEEP's experience in Dhaka so far found that retaining the existing tariff for lower-income customers and raising the tariff for higher-income customers (by 23 percent, a price that customers are still willing to pay) increases the percentage of customers from low-income areas from 16 to 30 percent, and achieves a comparable net profit margin for the SME (Walcott, 2016b).

Awareness raising and demand generation campaigns are strong drivers

The positive impact on demand in Faridpur led to the prioritisation and acceleration of activities that promoted the service, including street drama, cleanliness drives, quiz contests and cycling events. Similarly in Dhaka, WSUP worked with DWASA and the SME to design marketing activities to drive demand and hired 'brand ambassadors' to conduct door-to-door visits in target areas. The high quality of the compost produced by the plant in Sakhipur speaks for itself: positive feedback from farmers has driven demand for the product after it was used to grow a wide variety of plants and crops.

Detailed information about customers, demand, pricing and tariff structure

FSM business models rely on detailed information capture and analysis to provide learning about the market and inform future development, to ensure tariffs are well-structured and to ensure services are equitable and pro-poor. Simple tools to assess all costs and revenues in the whole FSM value chain are helpful to analyse data and support the design of sustainable business models.

PPPs offer a strong framework in which multi-stakeholders can operate

PPPs offer clear advantages for all parties. The private sector benefits from reduced risk from market entry through lower start-up costs, greater flexibility and a faster return on their investment; and the public sector is able to service customers in a scalable manner. Creating a steering committee that sits within the municipality in Faridpur has led to pro-active facilitation of the PPP and business model amongst the major participants – a factor that will be crucial for scaling up the model for citywide service provision. Following the success in Dhaka, SWEEP has now been replicated in Chittagong and has been operating since early 2017. Experiences from Dhaka have been applied; for example, the contract between the private business and the public body in Chittagong includes a fine if the SME does not meet a set target for low-income customers served. The flexibility of PPPs meant that new partnerships could be forged that better suited the Chittagong context; for example, the agreement is between the SME and Chittagong City Corporation rather than the utility.

OUTSTANDING CHALLENGES, NEXT STEPS AND PLANS FOR SCALING UP

Increasing low-income customers' access to FSM services is central to scaling up. To operate at scale, businesses need to operate on the line between reaching the easiest customer base (often the better-off and least marginalised) to maximise revenue, and offering an affordable service to the largest number of people. In Dhaka, WSUP are assessing how to encourage private sanitation entrepreneurs to increase low-income customers' access to their services. This could mean incentivising companies by providing business planning/marketing support to those that achieve pro-poor targets, or ensuring that future contracts include a clause that mandates operators to meet a target of low-income households. The current model works in Dhaka because only leased vehicles operate in the city. In the future, if FSM businesses supply their own vacuum tankers, a new

licensing and leasing model will have to be designed whereby the licence fee contributes towards disposal costs and stipulates a minimum percentage of low-income customers that must be served. Designing business models that include a cross-subsidy pricing structure should be considered a key driver in socially inclusive service provision and demand creation.

The capacity to generate sufficient and sustained demand is a condition for scaling up. A significant number of households in Bangladesh have toilets connected to surface drains or are happy to rely on manual scavenging, and are not necessarily aware of a more hygienic mechanical emptying service and the cost. Moving from the start-up to scale up with supporting investments from the public, non-profit or private sectors means that businesses can further optimise marketing and sales. These investments in advertising, awareness raising and marketing prove helpful in identifying and closing transactions more efficiently with an increased customer satisfaction, whilst ensuring safer, more hygienic disposal of waste. If demand creation steadily increases in Dhaka, and if DWASA continues to support the model and allow for disposal within the sewerage network, more vacuum tankers could be leased under the SWEEP brand.

Engaging the private sector in human waste treatment and compost marketing is new in Bangladesh and has been slow and challenging, but business development is growing. Clearly demonstrating the viability of FSM will generate more business interest. The costs and revenues of a business model have to be regularly updated to orientate the PPP towards more optimal pricing and subsidisation. These can be part of the revenue flows between the municipality and/or utility and the private businesses involved in FSM. Scaling up could require businesses to revisit their initial models and undertake up-to-date analyses of containment conditions. The marketing potential of safe, dried sludge co-composted with kitchen waste lies in simplifying its certification process and generating greater interest from farmers.

The Bangladesh context offers potential for establishing a strong connection between waste management and agriculture through the production of organic fertilisers, linking waste management in urban areas and the need for improved agricultural yields and food security in rural areas. Food security is particularly important in a country with one of the highest population densities in the world and where organic matter in soils is becoming depleted. The case studies show the viability of using treated bio-solids as soil enhancer on a small but growing scale. These initiatives are valuable and the Agriculture Extension Service has become interested in the work conducted in Faridpur, and other national level organisations and stakeholders may be engaged to expand upon this work. Another question is: could the production of organic fertilisers and soils enhancers drive demand for FSM services, and could this be the missing link to attract private sector investment consistently and at scale?

Finding businesses who are interested in taking on FSM is a key factor for scaling up. In Dhaka, the SME Gulshan Clean and Care was already in operation as a cleaning company, and was a critical asset to build upon and set up SWEEP as a marketing brand. The SWEEP business is profitable and the entrepreneur is considering investing his own capital into the FSM business to ensure its long-term success well beyond the intervention. In Faridpur on the other hand, the lack of business competition in the sanitation and waste management sector initially represented a challenge for attracting businesses with and expertise and who are willing to take the risk engaging in the sector. Selecting locations where active businesses are already present makes development easier. Larger cities often provide a more vibrant environment and interest for entrepreneurship, but as the Faridpur case demonstrates, private sector interest is not limited to large cities.

Addressing the cultural barriers around reusing human waste as compost to improve soil fertility is critical for upscale. As this is a relatively new approach in Bangladesh, the challenge remains to change perceptions and the stigma around faeces, those who manage it, and its reuse. Human waste can be turned into new resources, which Bangladesh needs and towns like Sakhipur provide evidence that such a model can succeed. However, a full-life cycle cost analysis needs to be carried out to ensure sustainability at scale.

Finding an adaptable design for treatment plants is another challenge. Facing intense annual rainfalls, FSM stakeholders and funders should adopt strategies to mitigate risks to safe FSM presented by flooding. The rainy season has significant impact on treatment as the higher moisture content or floods create challenges in drying treatment. The Faridpur case demonstrates that treatment plants on raised land can mitigate this risk. An adaptable and modular design should be considered for expanding treatment facilities as the FSM business grows.

The recent approval of the National Institutional Regulatory Framework for FSM is a significant step towards improving the enabling environment for sanitation, which is key to the long-term success of emerging FSM businesses. Many local governments held back from full engagement in FSM until a clear direction was given by the national government. The IRF provides that guidance and raises new questions about what this really means to local governments. What are the next steps now that the IRF is finalised? Does this framework need to be completed with actual implementing rules and policies? The question of its strict enforcement is still outstanding as the sanitation sector remains under-regulated and existing regulations are often unenforced. Mandates are now recognised at the national and municipal level, and efforts to address them are underway with the development of national framework for FSM. However, it is likely that any resulting wide-scale changes will take a number of years to implement. Finally, the question remains of how innovative programmes such as these can be integrated into the IRF so that other local governments can learn from these models. Opportunities and next steps should be explored to see how the national government might reach out to local governments, and how might this be conducted effectively, possibly through outreach from stakeholders like ITN-BUET.

The National FSM network is a valuable advocacy tool for FSM initiative start up and scale up. Recently created as a strategic sectorial group for innovation, knowledge and policy influencing, this network of 60 stakeholders from national and local level government agencies, development partners, academia, I/NGO, and private companies will be engaged in regional and international programs. Its first multi-stakeholder convention included the participation of sweepers in workshops on rights and dignity for septic tank emptiers, indicating a strong momentum emerging around not only the business potential of FSM, but also the rights of service users and providers to healthier lives. It brings a valuable support building the nexus between farming and urban sanitation, bolstered by evidence generated by case studies such as the Sakhipur co-composting project. Discussions to extend funding to support the sustainability of the partnerships and services are currently taking place.

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ABBREVIATIONS AND ACRONYMS

BASA	Bangladesh Association for Social Advancement
BMGF	Bill & Melinda Gates Foundation
CLTS	Community Led Total Sanitation
DPHE	Department for Public Health Engineering
(D)WASA	(Dhaka) Water Supply and Sewerage Authority
FSM	Faecal sludge management
GDP	Gross domestic product
ICDDR, B	International Centre for Diarrhoeal Disease Research, Bangladesh
IRF	Institutional Regulatory Framework
ITN-BUET	International Training Network Centre – Bangladesh University of Engineering and Technology
I/NGOs	International/local non-governmental organisations
IWMI	International Water Management Institute
LGD	Local Government Division
LGED	Local Government Engineering Department
MDG	Millennium Development Goal
NFWSS	National Forum for Water Supply and Sanitation
ODF	Open defecation free
OSS	On-site sanitation
PPP	Public private partnership
PSU	Policy Support Unit
RAJUK	Capital Development Authority of the Government of Bangladesh
SDC	Society Development Committee
SME	Small and medium enterprise
TPO	Treatment plant operator
WSUP	Water & Sanitation for the Urban Poor

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Towards a Model Sanitation City: Operationalizing FSM Regulations in Warangal

V. S. Chary, Y. M. Reddy, S. Ahmad

EXECUTIVE SUMMARY

Warangal is the first city in India to introduce and implement faecal sludge management (FSM) regulations. Evidence-based advocacy, leadership at city level, citizen engagement, gender focused planning, capacity building of stakeholders particularly the mechanised desludging operators, extensive use of information and communication technology tools for monitoring have played an important role in implementing the regulations.

In the last year, the city government through FSM regulation has successfully introduced: a) licensing and training of masons (as toilet builders) to ensure toilets are built to design specifications, b) site inspection by the sanitation team prior to issuance of building plan approval, c) licences to operate mechanised desludging and service level agreements with private operators, d) usage of personal protective equipment by the desludging operators, e) a mobile app in the vernacular language for record keeping on desludging, f) a dedicated helpline for citizens seeking support with FSM operations, g) awareness campaigns on safe FSM and scheduled desludging and h) planning for two treatment plants to cover the whole city. Also, other urban sanitation interventions such as gender friendly public toilets

Real time recordkeeping of desludging with built-in alerts for the next desludging cycle combined with a comprehensive property database is being developed will enable scheduled desludging of septage in the future. Further, city government has earmarked land and financial resources for two faecal sludge treatment plants (FSTP) one of which would be operational by end of August 2017 demonstrating its commitment to safe FSM. The tendering process for the second FSTP (co-treatment with municipal solid waste) through a public private partnership (PPP) is underway.

Lessons from Warangal are being scaled up with the introduction of state level FSM regulations and operational guidelines. Many cities from India and outside the country have visited Warangal to learn about its experience with a view to replicating the model in their own cities.

CONTEXT

Over 65 percent of people living in urban India rely on onsite sanitation (septic tanks and pits) which operate in the near absence of a regulated system to manage sanitation across the value chain.[1] As a result, there is scant management of faecal sludge. The existing standards for the design of septic tanks and the requirement for periodic desludging are not followed. Emptying and transportation of septage is not based on scientific principles, and in most cities, there are no septage treatment facilities. Indiscriminate disposal of septage has significant health and environmental implications. The Ministry of Urban Development published an Advisory Note and Primer on FSM and Septage Management in Urban India in 2013 and 2016 and encouraged urban local bodies (ULBs) to formulate their own by-laws and rules for management of septage in the city. The Greater Warangal Municipal Corporation (GWMC), recognising the importance of safe FSM, took a lead in developing a regulatory framework covering the entire sanitation value chain.

FSM SERVICES IN WARANGAL

Warangal city, which has a population of 610,000 (2011), is the second largest city in the newly formed state of Telangana, India.[2] The Administrative Staff College of India (ASCI) conducted a detailed diagnostic study in 2015 to understand the status of FSM in Warangal. Continuous interaction and in-depth interviews with FSM operators and functionaries of the GWMC, field visits and focus group discussions with other stakeholders during 2015–2016, provided a deeper understanding of FSM services in Warangal.

Toilet directly connected to open drain

Dysfunctional pit latrine

Figure 1: Insanitary toilets

In 2015 about 77 percent of households had access to onsite sanitation (59 percent septic tanks, 18 percent pit toilets).[3] The design and construction of toilets was not regulated and most were insanitary pit toilets (typically comprising both single and twin pits) and septic tanks (in many cases without soak pits) discharging directly to open drains. Building approval requires citizens to submit house construction plans, including a septic tank design that meets the standards for construction of septic tanks. However, this was largely ignored. Neither did GWMC staff carry out field inspections to ensure compliance. ASCI team field visits to residential areas with low toilet coverage of toilets, particularly to the slum areas of Ambedkar Nagar, BR Nagar, OS Nagar, revealed that toilets did not meet construction standards, including some new toilets constructed under the Swachh Bharat Mission (Figure 1).

PRIVATE OPERATORS WERE NOT REGULATED BY THE CITY GOVERNMENT AND GAM, AND DID NOT OFFER DESLUDGING SERVICES

Desludging was not undertaken regularly and customers and desludging operators had limited appreciation of the reasons for regular desludging or knowledge of the associated requirements, standards and operating procedures. Private operators were not regulated by the city government and GWMC, and did not offer desludging services**.** Desludging was being carried out only when the septic tanks were full and the household noticed a backflow. The operators were found to be unaware and non-compliant with regulations and procedures related to transportation (closure of valves, fixing of routes, spillages, traffic conditions etc.). The operators, workers, and officials of GWMC had not received any formal training about FSM procedures. There was no process of formal screening, training and licensing of operators. The municipal sanitation team were not aware of the risks associated with septage handling and disposal practices and treatment technology options.

The transportation of faecal sludge collected from septic tanks did not follow *Central Public Health and Environmental Engineering Organisation (CPHEEO)* guidelines.[4] Desludging operators and workers were not equipped with protective gear such as gloves and masks. The trucks were not equipped with any safety kit. Also, manual emptying using buckets was practiced in areas where desludging trucks could not reach or where the sludge was too thick or solidified for the pump to work effectively.

Although the truck used by the private desludging operators were found to be in compliance with design requirements, the operators and workers had not received formal training programmes on the transportation and associated aspects, such as use of personal protective equipment and disposal, per regulations and procedures. There was no documentation of the volume of faecal sludge generated, treated and disposed.

The faecal sludge generated in the city was not properly treated and disposed. Sludge collected from households was disposed on agricultural land, drains, low lying areas and water bodies around the city because there was no designated place for disposal and/ or treatment. There was no effective monitoring FSM by the municipal officials due to lack of operative regulation and supporting guidelines. Hence there was a need to develop comprehensive faecal sludge management guidelines.

FSM IN NATIONAL AND CITY URBAN SANITATION POLICY

GWMC addressed this multi-faceted FSM challenge by introducing FSM regulations and septage management guidelines derived from provisions and specifications on septage management in various national level guidelines and regulations. These included the 2005 National Building Code, 2012 revised CPHEEO Manual on Sewage and Sewerage Treatment, 2013 Advisory Note on Septage Management in Urban India, and the 2008 National Urban Sanitation Policy.[5]

The National Urban Sanitation Policy (NUSP) aimed to develop a conducive environment for the adoption and implementation of FSM, and called for the creation of community driven, sanitary, healthy and habitable cities through provision of toilet facilities and safe disposal of waste after treatment. The scope extends to all the projects, national government programs and schemes that facilitate and support sanitation services, urban development and improved delivery of services in urban and peri-urban areas of India. The policy sets the context, priorities, direction and to facilitate, nationwide implementation of FSM services in all ULBs.

To put the NUSP into action the Ministry of Urban Development issued the Septage Advisory, which focuses on the development of a septage management sub-plan as a part of the city sanitation plan. The advisory emphasises the importance of a multi-stakeholder approach through establishment of city sanitation task force as advocated by NUSP. Each state is expected to have a FSM policy and the ULBs should have resolutions to implement this policy directive.

The legal context for FSM includes (a) municipal building by-laws, which provide a framework for control of effluent, sewage and septage discharge; (b) environmental laws which apply to the final and safe disposal of post-processed residual faecal sludge and septage to prevent contamination of ground water, surface water and ambient air and possible use as compost; (c) laws prohibiting "manual scavenging", which bans dry latrines and hazardous cleaning of sewers and septic tanks; and (d) institutional laws that provide for the establishment, powers and functions of local authorities.[6,7,8]

GWMC formalised FSM regulations and supporting operative guidelines by issuing a council resolution on 25h March 2016, **making Warangal the first**

Desludging operators have no safety equipment for desludging septic tanks

Disposal of faecal sludge directly onto a field

Septage disposal point at Alankar bridge

Figure 2: Faecal sludge transportation and disposal in Warangal

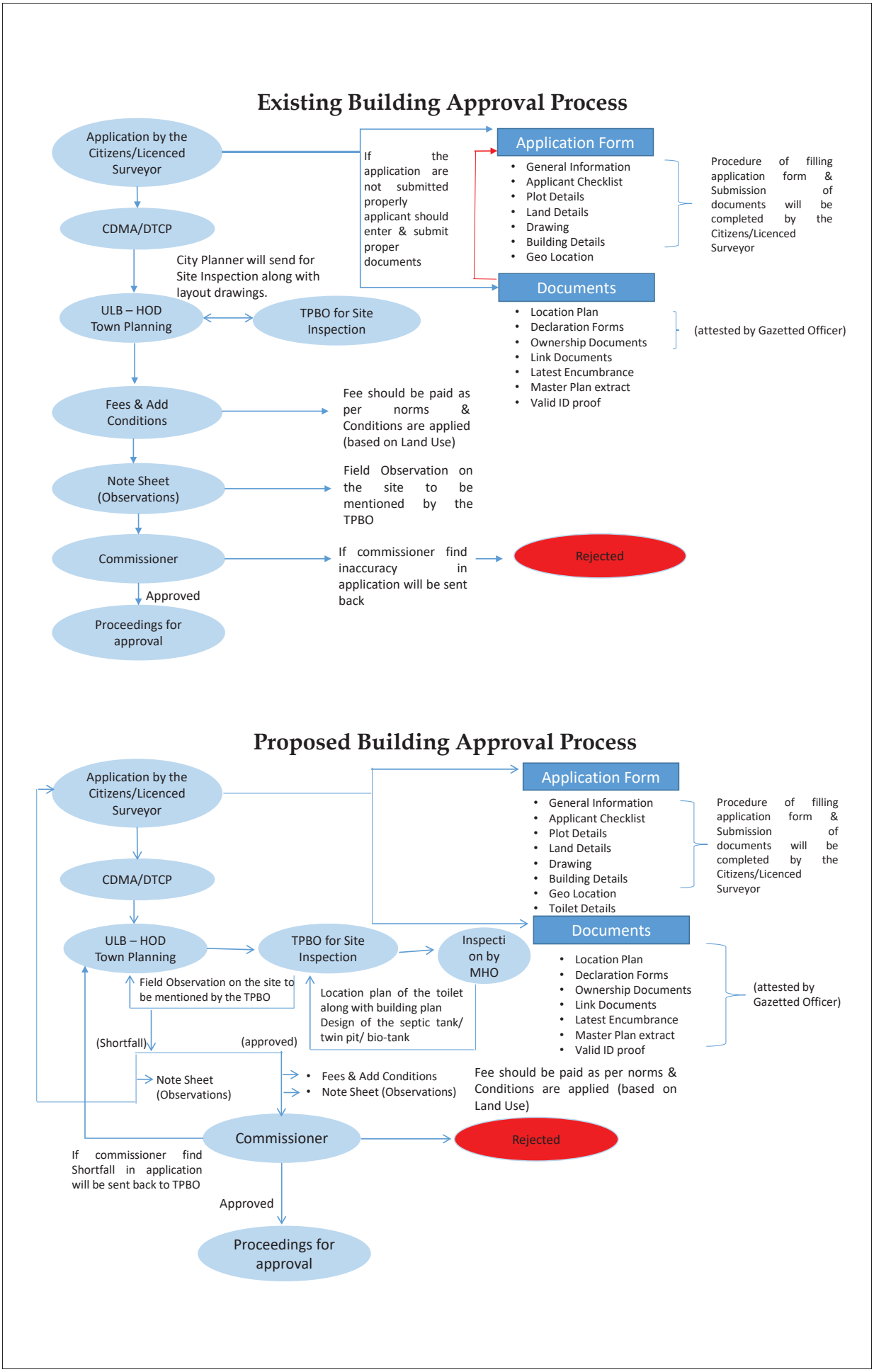


Figure 3: The previous and revised building plan approval process

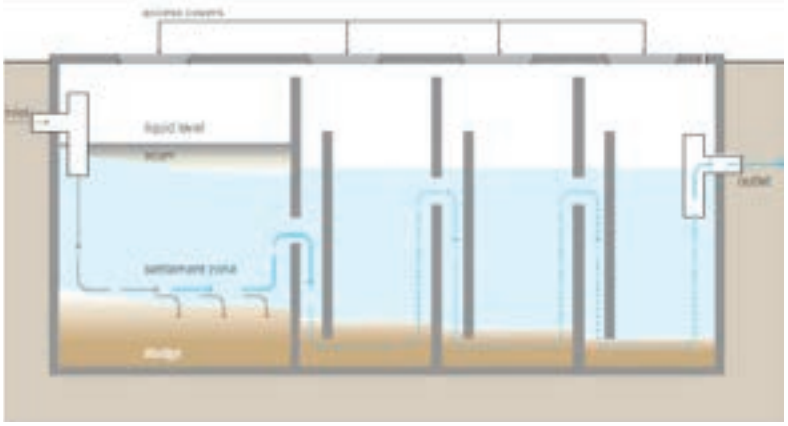


Figure 4: Design of the three chamber septic tank

city in India to introduce a comprehensive FSM regulatory framework. The objective of the regulation and guidelines was to promote a comprehensive and integrated approach to FSM and septage management covering collection, storage, desludging, transportation, treatment, disposal and reuse.

THE OBJECTIVE OF THE REGULATION AND GUIDELINES WAS TO PROMOTE A COMPREHENSIVE AND INTEGRATED APPROACH TO FSM AND SEPTAGE MANAGEMENT

The guidelines cover the following key elements of septage management:

- Design and construction of septic tanks
- Conversion of insanitary latrines into sanitary latrines
- Septic tank pumping and desludging
- Septage transportation
- Treatment, disposal and reuse of septage
- Information, education and communication
- Training programs
- Record keeping and reporting (MIS)
- Help line for septage management (S-line)

The GWMC council defines the policy and commissioner and GWMC acts as a regulator. The GWMC sanitation department ensures effective implementation of the regulation. Currently, there is no independent regulator for FSM.

Following the introduction of regulation in Warangal, the Ministry of Urban Development, Government of India released National Policy on Faecal Sludge and Septage Management (FSSM), February 2017. The Warangal experience was used as a reference while developing the national policy.

OPERATIONALIZING THE FSM REGULATIONS

The city has developed an institutional framework defining the roles and responsibilities of stakeholders and enforcement and monitoring strategies for successful implementation of FSM systems. During the last year, the city government has introduced several initiatives:

Improving design and construction of septic tanks
Adoption of improved designs of septic tanks for households, as well as the use of advanced septic tanks (three chamber septic tanks that offer better settling capacity and retention time) and Decentralized Waste Water Treatment (DEWAT) systems by institutional and bulk consumers such as hotels, colleges and apartments. This is being achieved by adopting regulations on septic tank designs and construction methods as part of building plan regulations. As a first step, revision of the building plan approval process means that the town planning department and/or sanitation department of the municipal corporation approves the septic tank design during the building plan approval process and also inspects the septic tanks during their construction to ensure they meet the approved design. These inspection reports are filed with GWMC.

Conversion of insanitary latrines to sanitary latrines
The GWMC public health department has completed a survey of all households to identify the insanitary latrines and improperly constructed septic tanks. The information will be used to educate and give notice to households with insanitary toilets to bring them into line with the approved designs. Funding support

PROCEEDINGS OF THE COMMISSIONER (FAC) – GREATER WARANGAL MUNICIPAL CORPORATION

Signature valid

మల బురద (సెప్టిక్ ట్యాంక్) నిర్వహణ లైసెన్స్ ఆపరేటర్ల వివరములు

Details of licensed Fecal waste operators

క్రమ సంఖ్య SI.NO	అనుమతి పొందిన లైసెన్స్ ఆపరేటర్ల పేర్లు Name of the licensed Operator	అడ్రస్ Address	సంప్రదించవలసిన ఫోన్ నంబర్స్ Contact No.
1	డిల్లీ సంపత్ రావు Mr.Dilly Sampath Rao	ఎస్ ఆర్ సెప్టిక్ క్లీనర్స్: # 1-1-27/F, చైతన్యపురి కాలనీ, కాజిపేట్, వరంగల్. S R Septic cleaner, # 1-1-27/F, Chainthanyapuri Colony, Kazipet, Warangal.	9849145043/ 9866584455
2	సిఎచ్.అజయ్ సింగ్ Mr.Ajay Singh	ఎంఎస్ యూనివర్సల్ టాయిలెట్స్: రిజిస్ట్రేషన్ నెం: 46 of 2008, కెటిసిఎం కాంప్లెక్స్, నియర్ ఓపెన్ నాలా, లింగంపల్లి, హైదరాబాద్ MS Universal Toilets, Reg: 46 of 2008, KTCM Complex, Near Open Nala, Limgampally, HYD	8187814905
3	సిఎచ్.అజయ్ సింగ్ Mr.Ajay Singh	ఎంఎస్ యూనివర్సల్ టాయిలెట్స్: రిజిస్ట్రేషన్ నెం: 46 of 2008, కెటిసిఎం కాంప్లెక్స్, నియర్ ఓపెన్ నాలా, లింగంపల్లి, హైదరాబాద్ MS Universal Toilets, Reg: 46 of 2008, KTCM Complex, Near Open Nala, Limgampally, HYD	8187814905

Figure 5: Copy of the order to licence desludging operators

of USD 90.00 is being made available to households for the conversion. To date, 176 of 181 applications have been approved. Of these 176 households, 148 have completed the conversion of their toilets. Toilet conversion notices have been issued to more than 12,000 households.

Septic tank pumping and desludging GWMC has established a formal process of licensing desludging operators. As of 26 October 2016, GWMC had issued licences for collection and transportation operations to three operators running eight trucks. The licence is valid for five years and needs to be renewed every year.

While the GHMC reserves the right to regulate and fix the user charges, it has decided to leave this to market forces. Currently an operator charges USD 30.00–40.00 per visit. Households are reminded to engage the licensed operators for sludge collection. The contact details of licensed operators is available on GWMC website. GHMC has sent a written request to the police commissioner to seize the vehicles and operators of unlicensed desludging operations. Multiple rounds of training and demonstrations have been organised to explain the approved standards and procedures for pumping and desludging and about the importance of using personal protective equipment (PPE).

Septage transportation Licensed desludging operators have trucks that meet the approved standards for desludging and transportation, and trained workers equipped with uniforms, safety gear,

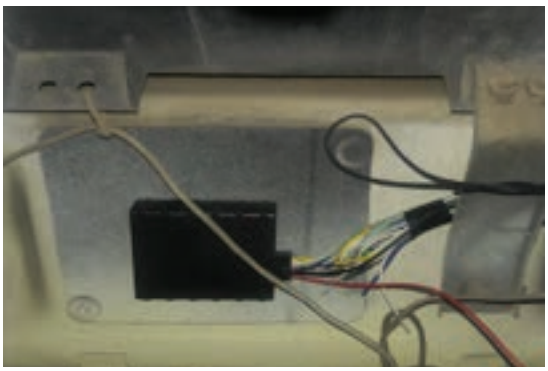
Figure 6: Licensed operator with an emptying vehicle truck

tools and vacuum trucks. The vehicles have been fitted with GPS by the operators at a cost of USD 120.00 per truck. For the purpose of monitoring vehicles, the data is tracked by GWMC.

SUITABLE TECHNOLOGIES THAT MEET THE LEGAL REQUIREMENTS HAVE BEEN IDENTIFIED

Septage treatment, disposal and reuse Following a series of interactions with technology vendors, suitable technologies that meet the legal requirements have been identified. GWMC has earmarked two land parcels of five acres and two acres that meet the environmental requirements and standards for construction of septage treatment plants. Detailed Project Reports (DPRs) have been prepared and appropriate financing models for construction and operation and maintenance (O&M) of septage treatment and disposal facilities have been finalised.

One technology solutions that has been identified is co-treatment with municipal solid waste (bio-methanation). The tender process began in June 2017. The private partner is expected to make a capital investment of USD 2.5 million, and absorb the O&M costs for 15 years. The second solution is treating



GPS tracker inside a vehicle

FSM vehicle location: red arrows show locations of vehicles

Vehicle route map: Route is marked in red, blue arrows indicates the direction in which vehicle travelled

Figure 7: GPS tracking of septage trucks

faecal waste using a thermal process called pyrolysis. The plant is being established with an investment of about USD 0.23 million. The memorandum of understanding was signed on 25h March 2017 and plant with a capacity to treat 15 kl of septage per day is expected to be operating by August 2017. These disposal options are approved by Government of India as well as State Pollution Control Board.

RESIDENT WELFARE ASSOCIATIONS AND WOMEN SELF-HELP GROUPS IN SLUMS HAVE BEEN ENGAGED IN PROMOTING SAFE FSM PRACTICES

Information, education and communication GWMC has held awareness raising events in slums and other areas and also established sanitation resource centres in some slums to promote adoption of proper toilet designs, construction methods, periodic desludging and safe sanitation practices. Workshops have been held with masons, builders and desludging operators to expose them to improved designs and methods of construction. Posters have been displayed on public toilets and on septic tanks to raise awareness and informing citizens where to seek information. School children have participated in information, education and communication (IEC) campaigns. Resident welfare associations (RWAs) and women self-help groups in slums have been engaged in promoting safe FSM practices.

Training programs GWMC is supporting capacity building of stakeholders including its own staff through appropriate reputable institutions such as ASCI and CDD. An organisational strengthening and training needs assessment study has been commissioned to Kakatiya Institute of Technology and Science (KITS), to identify the training and capacity building requirements of each stakeholder. CDD has been engaged to design and deliver a 'toilet builder' training program leading to certification and licensing of masons. More than 70 masons have been licensed so far and their details are available at the GHMC office and on the GWMC website. Masons trained in the first round of training were invited to share their experiences with the participants of the second training program. Regular interaction with trained masons and field visits were carried out to assess the quality of their construction post training. A formal training effectiveness assessment has been commissioned to KITS.

MASONS TRAINED IN THE FIRST ROUND OF TRAINING WERE INVITED TO SHARE THEIR EXPERIENCES WITH THE PARTICIPANTS OF THE SECOND TRAINING PROGRAM

Record keeping and reporting (MIS) GWMC is building a database of insanitary latrines, location of septic tanks, details of operators responsible for collection of sludge and details of septage treatment plants. As mentioned, the septage vehicles are being fitted with GPS and the details are being used by GWMC for monitoring. An FSM tracker mobile app was developed and is used to capture information on septage collection in real time and aid effective implementation of the regulations. All the licensed operators are required to report information as required by GWMC. A daily follow up system is in place to encourage operators to report information. Detailed records of operations, including household, area and location, type of septic tank, age of septic tank, date of desludging, quantity of septage, user charges collected, accidents and spillages and the next date for desludging are maintained. In November 2016, 41 records were made by the eight trucks run by the three licensed operators. In December 2016, and January, February, March and April 2017 the number of records made were 69, 86, 87, 110 and 126 respectively.

A draft framework linking information gathered through mobile app to the city property database has been developed to help ensure scheduled desludging.

GWMC HAS ESTABLISHED A SANITATION HELPLINE CALLED S-LINE AS THE SINGLE POINT CONTACT FOR CITIZENS TO REACH OUT FOR FSM SERVICES

Helpline for septage management GWMC has established a sanitation helpline called S-Line as the single point contact for citizens to reach out for FSM services. Customers can use the GWMC toll free phone line to request new toilets, get technical support for toilet construction such as toilet design, construction materials and details of licensed masons.

Mason training programmes

Sanitation improvement workshop for sanitation inspectors

Desludger operator training in PPE and use of the FMS tracker mobile app

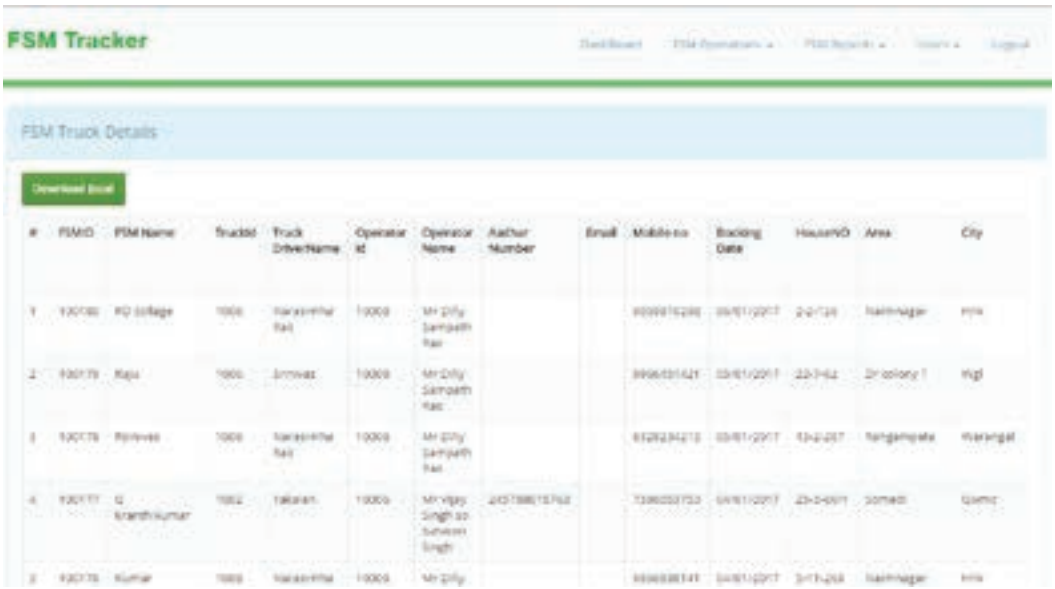
Campaigns related to the sanitation helpline

Figure 8: IEC initiatives and training programs

Customers can also use the helpline to access citizen services related to desludging services, and subsidy flows, and to make complaints and suggestions for instance on the provision of public toilet facilities. The S-line services are institutionalized under the GWMC information technology department and works closely with the corporation's sanitation and town planning departments. A project implementation unit (PIU) within GWMC has been established for the speedy implementation of sanitation improvements. Led by an additional commissioner, town planners, town level federation members and ASCI team members, the PIU meets once a week to review the progress of work.

Launched in May 2016, S-line has become popular and on an average receives 45 requests a day. Sixty percent of callers are women and 80 percent of the calls received are for new applications. During the four-month pilot phase, 542 grievances were resolved and technical assistance was provided to all the 160 callers. S-line has started receiving calls to book trucks for desludging. To date, S-line was able to facilitate GWMC to release subsidies amounting to USD 615,384 to 2,000 new beneficiaries and to clear pending subsidies for close to 4,000 beneficiaries. The successful pilot is being scaled up city wide towards making Warangal a model sanitation city.

FSM Tracker app downloadable from the Google Play store



The FSM Dashboard provides real time information for analysis and decision making

Figure 9: FSM tracker and dashboard

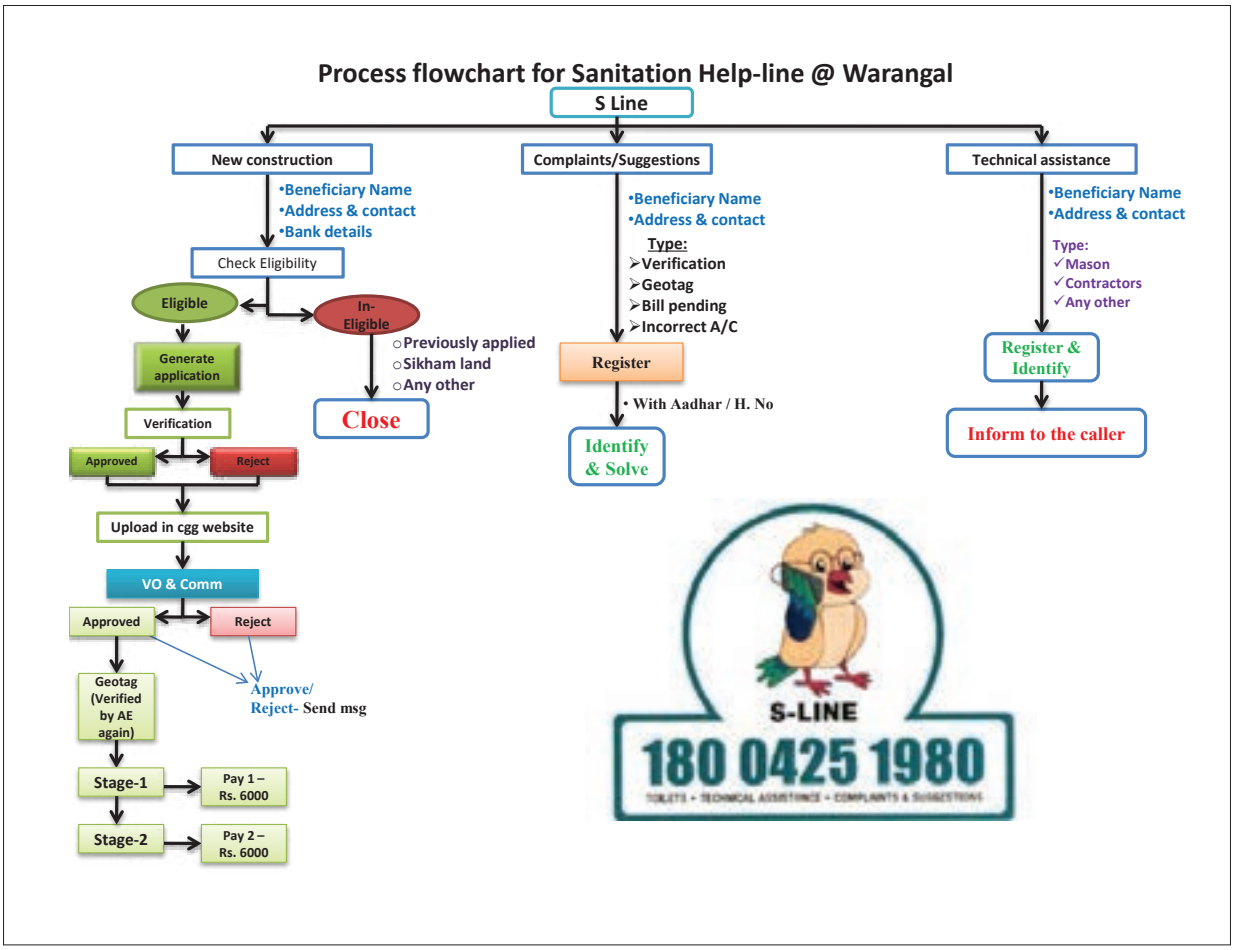


Figure 10: S-line process flow and operations

Figure 11: The S-Line office

FINANCIAL AND ECONOMIC ASPECTS AND BUSINESS MODELS

The combined subsidy of the national and state governments for individual toilet provision is USD 182.00. Households have to cover any additional costs for construction of the toilet. Public toilets are financed through a PPP mechanism, with a fee of USD 0.03 for toilet use and USD 0.08 for bathing. The operators are procured through a competitive bidding process.

The desludging operations are provided by the private firms operating in a competitive environment. The cost of desludging ranges from USD 24.00 to USD 40.00 based on the capacity of the septic tank. The tariff for desludging operations is left up to market forces.

As mentioned, one of the faecal sludge treatment plants (co-treatment) is being established using the PPP model. The private operator will cover capital expenditure and operating expenditure for 15 years.

In return, the private operator will be entitled to retain the proceeds from the sale of gas. The second FSTP is being established under a corporate social responsibility model with the private operating covering capital expenditure and GWMC covering O&M expenditure.

CAPACITY DEVELOPMENT

At the request of GWMC, a detailed capacity enhancement needs assessment was carried out by ASCI. Stakeholders were identified and mapped using an influence and interest matrix. Taking on board a recommendation of the needs assessment, ASCI developed a curriculum to build the capacity of each stakeholder. Training programmes were conducted at different levels – from masons to the city leadership team including elected representatives. Hand-on training programmes were provided for desludging operators. Study tours were also carried out for elected representatives. The capacity of civil society groups were also built through exposure visits and short term training/peer learning. Kakatiya Institute for Technology and Sciences (KITS) University was engaged as knowledge partner for sustained capacity building.

DRIVERS OF CHANGE AND LESSONS LEARNED

Key triggers that enabled the situation to change in Warangal:

Evidence based advocacy Compelling evidence gathered through diagnostic study of FSM practices revealed potential public health and environmental risks and inverse linkage to health. These findings were shared extensively with city stakeholders and state government. Bringing evidence into the public domain was a wakeup call and led to stakeholder consensus for action.

City level leadership Committed leadership at state and city level which recognised the need and urgency of addressing unregulated septage management practices. Introduction to national and international good practices through exposure visits led to confidence building.

Environmental concerns Evidence of contamination of drinking water bodies in faecal waste disposal areas as reported by local media led to public outcry for action.

Civil society participation Active dialogue with RWAs, City Sanitation Task Force members, town level federation members, non-governmental and private sector players led to ownership of FSM initiatives and acceptance of new practices.

Active support for desludging operators The two major private desludging operators experienced difficulties disposing sludge due to growing citizen vigilance. Prior to the regulation, they had requested that the city government earmarked land for sludge disposal. Operators welcomed regulation and asked the city government to prioritize FSTP. Another reason for their support is the perceived risk to their business from small time, manual/semi manual desludging operators and the need to create a level playing field.

Lessons learned during the past year from implementing FSM regulations in Warangal are:

Establish a faecal sludge treatment plant as early as possible Because of delay in establishing FSTPs, operators continue to dispose sludge in an unregulated manner and citizens did not see significant change. Technology selection process, DPR preparation and earmarking of land for FSTP should begin early on in the project cycle and FSTP should be prioritised and implemented alongside other components of regulations.

Select FSTP sites close to the market The land parcel identified for FSTP is over 20 km away from the city limits. Selection of suitable land parcel(s) closer to the market, preferably within a travel distance of 10 km will enhance compliance and improve financial viability of the initiative.

Define institutional arrangements for FSM There is no clear assignment of the roles and responsibilities of stakeholders for safe management of faecal sludge. State government could play an enabling role and define the responsibilities of, for example, citizens, GWMC, Pollution Control Board and civil society groups. Also, at the municipal level, organisational structure and staff responsibilities should be clearly defined to ensure the success of FSM activities.

Strengthen data systems at municipal level The city level database of toilet coverage, toilet typology and property details is disorganised, hindering effective planning of FSM. It is important to strengthen data systems using GIS tools to enable effective planning and introduction of scheduled desludging of toilets.

THE WAY FORWARD

Following the successful enactment of FSM regulation, the city is geared up to address outstanding challenges by undertaking various initiatives along the sanitation value chain:

Establishing FSTPs A detailed FSTP project report has been prepared, land and financial resources have been earmarked, and a technology partner identified.

A public private partnership model based on SLAs is being considered for FSTP.

Introducing city-wide GIS mapping International best practices have been identified, consultant and technology finalised, and mapping households and linking the data to desludging schedule is underway.

Conversion of insanitary to sanitary toilets The city has appointed designated officers for each of its 58 election wards for better supervision and coordination of works. S-line is being scaled up for the quick processing of applications, fund disbursal and toilet construction/repair.

Conducting awareness campaigns involving RAW, bulk generators and municipal functionaries, emphasising the need for conversion of insanitary to sanitary toilets, periodic desludging practices etc. Monitoring environmental quality around existing disposal areas to sensitize residents is also planned.

Monitoring desludging operators to ensure the use of PPE and other commitments outlined in SLAs is a must. The city has appointed a sanitary office responsible for monitoring desludging operators. Study tours and exposure visits for the desludging operators are being planned.

Determining desludging fees Currently the price charged by the operators is market determined. However, going forward as the number of operators increase and periodic desludging sets into motion, it may be prudent to regulate prices to protect the public interest.

Enforcing strict restrictions on the growing number of unlicensed operators and charge fines for non-compliance of scheduled desludging by households and bulk generators.

In summary, Warangal City has introduced several innovative processes and solutions (S-line, co-treatment of faecal sludge and municipal solid waste, FSM tracker, GPS systems in desludging trucks to name a few) to operationalize FSM regulation. Also other necessary sanitation interventions such as gender friendly public toilets. The response from stakeholders is encouraging thanks to concerted evidence based advocacy. The city is poised to address challenges, deepen implementation and earmark financial resources. PPP models are also considered. Lessons from Warangal are being scaled up across the State of Telangana through the introduction of State level FSM policy and operational guidelines.

NOTES

[1] National Policy on Faecal Sludge and Septage Management (FSSM), Ministry of Urban Development, Government of India, 2017

[2] Census, 2011

[3] *Report on City-Wide Plan and Technical Proposals through PPP for Delivery of Sustainable and Equitable Sanitation Services in Warangal Phase- I, ASCI 2015.*

[4] Central Public Health and Environmental Engineering Organisation (CPHEEO) is the Technical Wing of the Ministry of Urban Development, Government of India

[5] Ministry of Urban Development, Government of India (2008) *National Urban Sanitation Policy*, 2008

[6] 2013 Prohibition of Employment as Manual Scavengers and their Rehabilitation Act

[7] Specifically, the Building Code of India as applicable to septic tanks, soak pits, cess pools, leach pits, drainage fields etc. and the 2016 Model Building By-Laws framed by the Town and Country Planning Organisation.

[8] Specifically (Municipal Law, the 1986 Environment (Protection) Act, and the 1974 Water (Prevention and Control of Pollution) Act), and 2016 Solid Waste Management Rules

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ABBREVIATIONS AND ACRONYMS

ASCI	Administrative Staff College of India
CDD	Consortium of DEFATS Dissemination
CPHEEO	Central Public Health and Environmental Engineering Organisation
DEFATS	Decentralized Wastewater Treatment System
FSM	faecal sludge management
FSTP	faecal sludge treatment plant
GWMC	Greater Warangal Municipal Corporation
NUSP	National Urban Sanitation Policy
PPP	public private partnership
S-line	Sanitation Helpline
SLA	service level agreement
ULF	urban local body

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Moving Towards Improved Urban Septage Management at Scale in Indonesia

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EXECUTIVE SUMMARY

Indonesia made substantial progress towards achieving its sanitation targets leading to the Millennium Development Goals (MDGs). This encouraged the national government to set universal access targets for sanitation in the 2015–2019 National Medium Term Plan. Recognizing affordability constraints, onsite systems will remain the main wastewater management option in most urban (and rural) areas, making improved urban fecal sludge management essential. Fecal sludge management (FSM) will also be a key factor in Indonesia meeting the Sustainable Development Goal (SDG) targets for sanitation.

One key lesson learned in the past five years is that high level local commitment, a clear institutional setting, and appropriate local regulations are essential foundations to improve FSM services**.** This is *the* key to the success of Indonesia's decentralized system. The commitment of local government must also be demonstrated through adequate budget support. The designated institution needs a clear mandate, and roles and responsibilities that are specified in local regulations. The city water utility is often the most appropriate institution to manage FSM – in cities where the water network serves most of the residents. Where this is not the case, alternatives need to be considered. A clear regulation must define the responsibilities of all stakeholders**.**

Another key lesson is the importance of the technical and financial aspects. The operational models (scheduled or non-scheduled emptying) should be selected to suit the conditions of local government, the capacity of the operator and treatment plant, and city conditions. Adequate revenue for operation and maintenance must be available to ensure sustainability. Local governments need to provide adequate funds to support the services until they achieve economies of scale and recover costs through tariffs.

A third lesson is that on-going promotion is not an optional extra. Although the customers in the pilot stage were households with a standard septic tank, promotion to all households' is essential to ensure that the services can be delivered at scale. Therefore, raising public awareness and understanding, and people's willingness to engage desludging services is extremely important.

CONTEXT

Indonesia is the world's fourth largest country by population, with a population of 260 million people (2016). Its current population growth is at the rate of 1.38 percent per year, a decrease from 1.49 percent 10 years ago. The country's GDP is USD 725.6 billion or around USD 2,797/capita (2016), up from USD 528 billion in 2010 (USD 2,213.7/capita).[1]

Urban areas in Indonesia are growing rapidly, and an estimated of two thirds of the population will be living in urban areas by 2035. Urbanization is a major factor contributing to the country's economic growth. However, Indonesia still needs to catch up on infrastructure development to transform the potential of its growing urban population into real economic growth. Currently, the urban poor population makes up 7.73 percent (10.48 million people) of the total 27.76 million poor people in the country (10.7 percent of the country's total population).

Urban sanitation and FSM services

Indonesia made good progress towards achieving its sanitation targets in the MDGs, and by 2015, 61 percent of the population had access to improved sanitation, up 36 percentage points from 1990.[2] This considerable achievement, along with other motivators has encouraged the national government to push the sanitation agenda forward by setting universal access targets for sanitation in its 2015–2019 National Medium Term Plan. The target recognizes the continued dominance of on-site sanitation systems, as well as the importance of improving these systems by employing fecal sludge management (FSM). Recognizing affordability constraints, onsite systems will continue to the main wastewater management option in most urban (and rural) areas (Figure 2).

Consequently, improved urban FSM is essential. FSM is also recognized as the means for the country to move towards its SDG targets on sanitation.

URBAN SANITATION IS STILL UNDERDEVELOPED AND URBAN SEWERAGE ACCESS IS ONE OF THE LOWEST RATES IN ASIA

Urban sanitation is still underdeveloped and urban sewerage access is one of the lowest rates in Asia. Less than two percent of the urban population has access to a sewer connection despite an estimated 82 percent of the urban population having access to improved sanitation. The majority of urban residents use onsite sanitation systems with pour-flush pan toilets provided by the household. Despite having these so-called septic tanks ('tangki septik' in Indonesian), 84 percent of fecal waste is contained in soak-pits or unsealed tanks.[3]

Almost 70 percent of onsite units have never been desludged, and less than 5 percent are desludged at five-year intervals. Most sludge emptying services are carried out by mechanical vacuum tankers operated by informal private businesses or local government departments and units. They operate on an on-demand basis, usually due to tank overflows, blocked toilets or bad smells. The typical cost of emptying is USD 15.00 – USD 50.00, but can be as high as USD 77.00.

Data from 2012 shows that around 90 percent of the 150 sludge treatment plants built since the 1990s are either no longer in operation or perform poorly.[4] Overall, less than four percent of septage in Indonesia is safely treated (Figure 1).

The evidence of the poor condition of on-site systems and septage disposal and treatment has driven the national government to start improvements by reviewing and updating the institutional arrangements, regulations, financial resources, and operational aspects of the whole sanitation service chain, and to improve the existing on-demand desludging services and introduce scheduled desludging services, wherever possible.

FSM in National and city urban sanitation policy and regulation

In addition to the National Medium-Term Development Plan 2015-2019 a new environmental law (No.32/2009) on Environmental Protection and Management and a new regulation No. 68/2016 on effluent standards

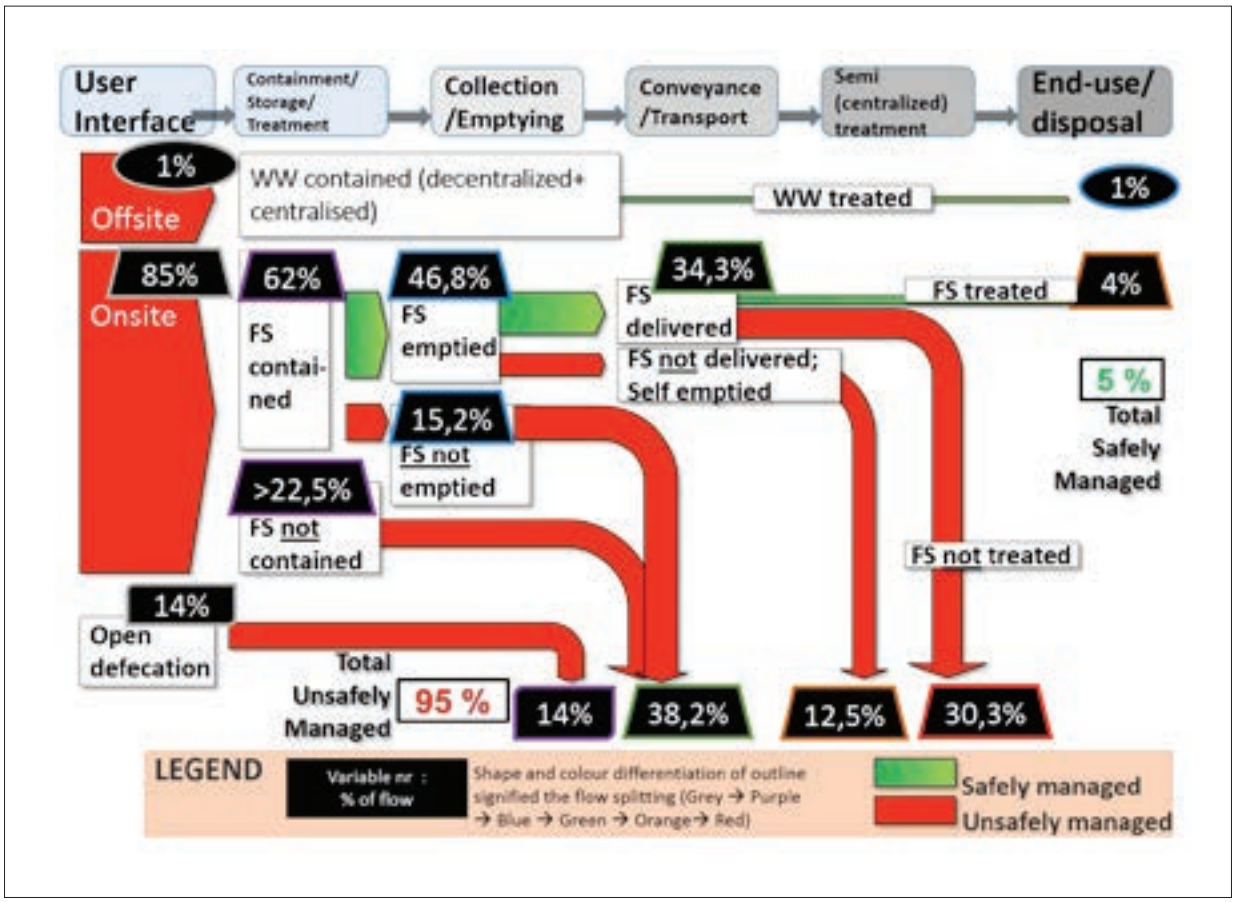

Figure 1: Fecal waste flow diagram for urban sanitation in Indonesia

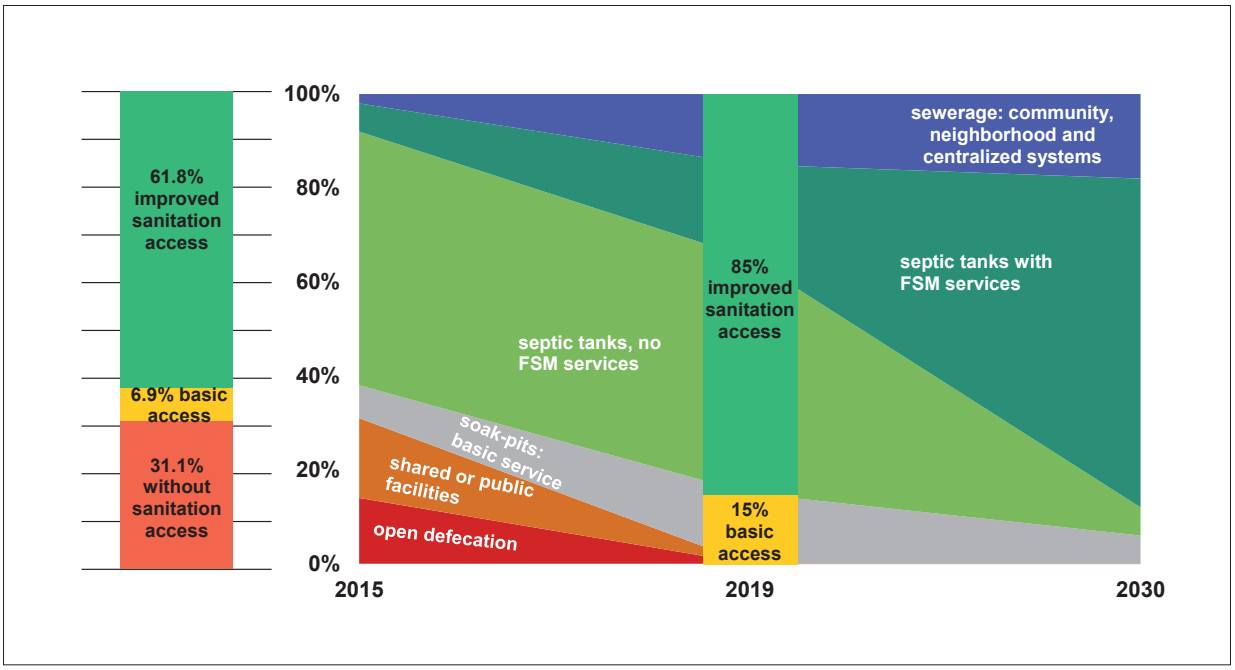

Figure 2: Schematic diagram of Indonesia existing-to-target sanitation access

issued by Ministry of Environment and Forestry have encourage the national government to push local governments to take responsibility for their wastewater management, including improving fecal sludge management. An upcoming regulation which reflects the national government's commitment to having safely managed sanitation creates is driving a systematic and comprehensive approach to FSM application in Indonesian cities.

Decentralization of government began in Indonesia in 1999. Under Law No. 23/2014 on Local Governance, wastewater management, and development, operation and improvement of FSM is the responsibility of local government (city and district governments). For this reason, national government initiated a facilitation process to strengthen the local governance of sixteen cities with the support of development partners. As of 2016 this process had been replicated in more than 20 cities and these cities are currently at different stages of implementation. This is due to the varying level of commitment of city decision-making stakeholders, development of city regulations and readiness of the designated institutions to be responsible for regular desludging or/and improving the on-demand emptying system. For this case study, four cities have been selected and from which the lessons learned on improving FSM are drawn. The cities are: Balikpapan, Bekasi, Malang, and Tabanan.[5]

FSM completes the current efforts by government to manage domestic wastewater. It provides an appropriate wastewater management option to complement offsite sewerage systems (Figure 2), which few cities have. As a system, FSM supports government efforts to improve on-site sanitation, which until recently focused solely on the construction of sludge treatment plants. FSM in Indonesia aims to improve the institutional, regulation, financial, and operational aspects of the whole sanitation service chain, by improving existing on-demand desludging services and introducing scheduled desludging services.

SUMMARY OF FSM INTERVENTIONS

Together with several sanitation development partners, government has prepared and piloted models for a comprehensive approach to ensure that septage is safely and sustainably collected, transported, treated and reused. The national government promotes to local governments the importance of having improved FSM. As the first step on the advocacy agenda, an assessment of sanitation service delivery performance is conducted using a city Fecal Waste Flow Diagram or SFD. The fecal waste flow diagram for Balikpapan is shown in Figure 3. The diagram shows the proportions of fecal waste that are safely managed and discharged unsafely to the environment. It has been used in eight pilot cities and currently being shared with more local governments and city facilitators to scale up the application as an advocacy tool to highlight real challenges. It has also served as a tool to help local government to prioritize investments to improve the sanitation conditions.

FSM models

Two models for improved fecal sludge management are being used: scheduled and non-scheduled (also known as on-call, on-request, or on-demand)

emptying services. Although the government's vision is to have the cities implementing scheduled desludging, the on-demand services will be used in the short to medium term as a transition to scheduled emptying and in places where there is insufficient capacity to develop and operate scheduled emptying services. Currently, Ministry of Public Works and Housing data (as of June 2017) show that out of 488 cities in Indonesia, only 15 percent has a unit responsible for wastewater management (through technical units or utilities) while most of them (75 percent) still use local government offices, which do not allow for separation of the role of regulator and operator.

NATIONAL GOVERNMENT REQUIRES LOCAL GOVERNMENTS TO PREPARE PLANS FOR IMPROVED FSM BEFORE THEY CAN ACCESS SUPPORT TO BUILD SEPTAGE TREATMENT PLANTS

Scheduled desludging has been introduced in these four cities while simultaneously improving the existing on-demand emptying system. Defined as mandatory regular desludging for all or targeted onsite units, implementation of the scheduled desludging has several prerequisites, including local regulation requiring all onsite units to be emptied regularly. It also needs a well-organized and designated operator. To prepare for effective scheduled desludging, national government expects cities to first improve their on-demand desludging services, which includes preparing for and improving onsite units, septage treatment plants, payment mechanisms, and monitoring and evaluation processes.

Although initiatives on FSM are supported by a variety of institutions, including development partners, there is a common approach to providing technical assistance to the cities. The approach is divided into three steps: (1) formative research to assess the current situation and challenges, which are critical to design a response, (2) identify informed choices relevant to the city and also important for the national government to contribute to the development of policies and guidelines as well as contributing to other cities developing FSM approaches, and (3) improving the FSM services by working on different aspects, including as institutions, regulations, financial and operations, promotion programs and strengthening the private sector involvement. See Figure 4.

To reflect and incentivize the commitment of local governments, the national government requires local governments to prepare plans for improved FSM before they can access support to build septage treatment plants. This includes wastewater institutions

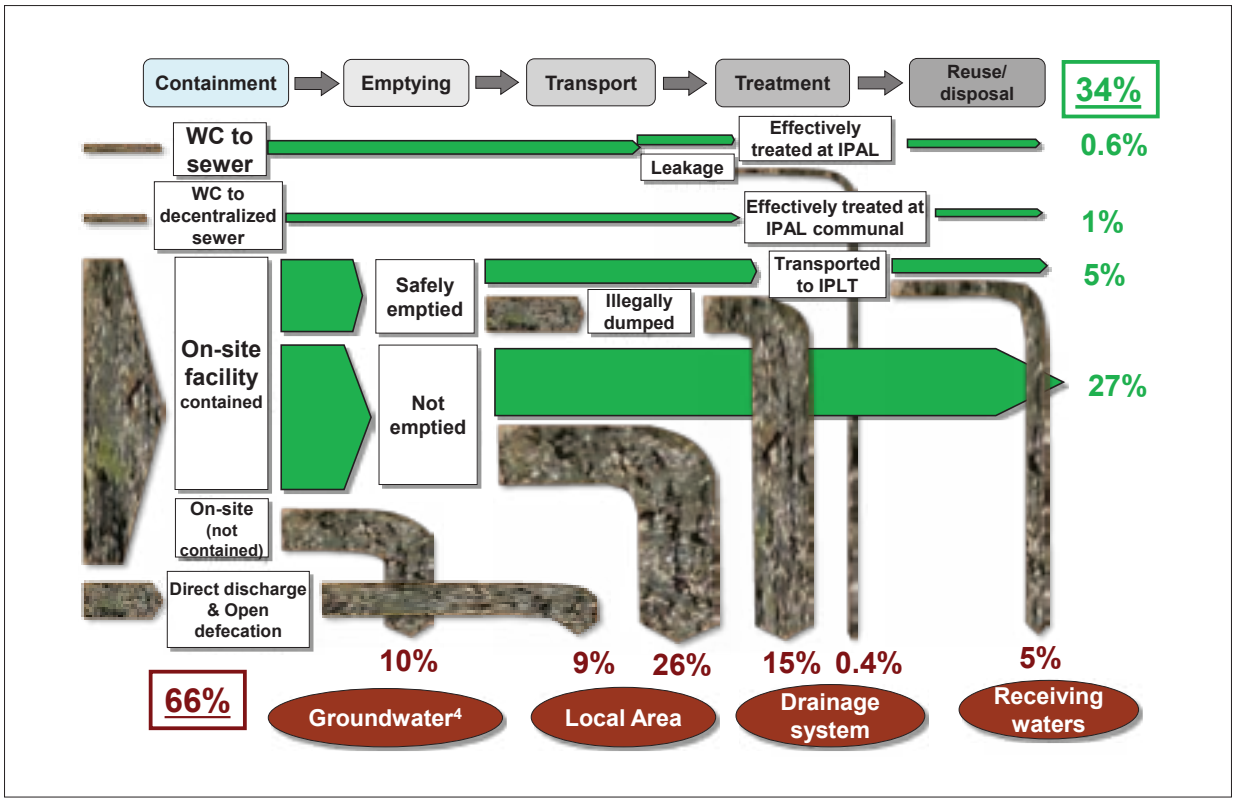

Figure 3: Fecal waste flow diagram for Balikpapan

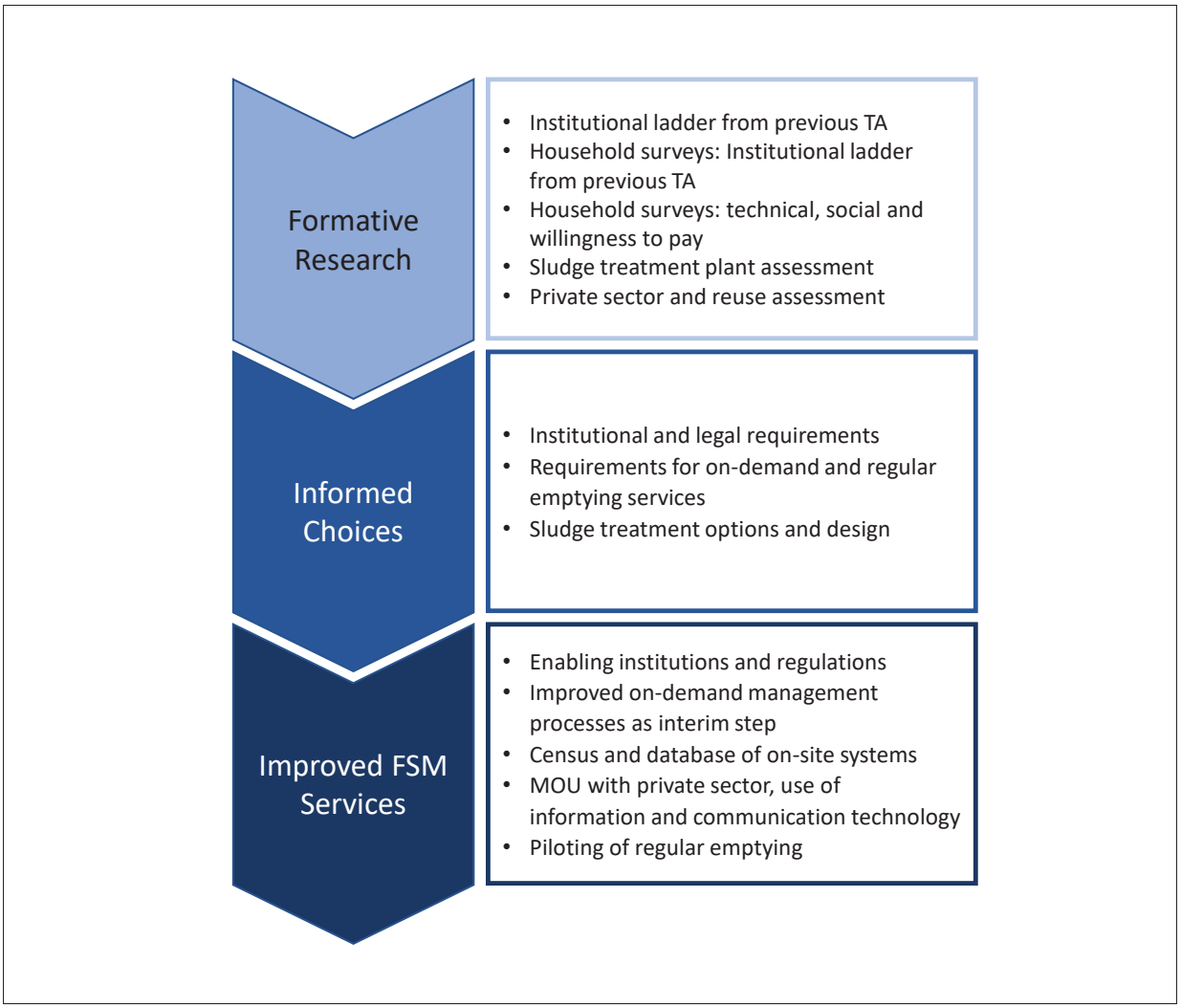

Figure 4: Typical technical assistance approach to improve FSM in cities

and local regulations being ready before support can be provided to the cities.

Enabling the managing institutions

Usually, FSM falls under the responsibility of the Office of City Cleanliness, which in some cities is also responsible for parks and cemetery management. However, FSM in this context is limited to the management of septage treatment plants and government desludging trucks. Another office, usually the Office of Public Works, or in some cities the Office of Human Settlements, deals with offsite sanitation systems, most of which are communal managed sanitation systems or other small systems at a community scale. Generally, an ongoing challenge is the uncertainty about institutional responsibility for sanitation at local level, along with the variety of departments involved, and frequent gaps in responsibility for some components in the sanitation service chain.

In 2016, Government Regulation 18/2016 on Local Government Apparatus brought about a rearrangement of offices at local level. This has impacted the offices managing wastewater, septage treatment plants, and the environment. Although many cities are still adjusting to the new arrangements, it is expected that this will increase the efficiency of fecal sludge management at local level.

Therefore, one of the main activities of the national government is to support the local government to define the designated institutions, which differ from one city to the another. This requires a mandate from the Mayor, detailing the roles and responsibilities for FSM. Support has been given to the city of Balikpapan to improve their water utility to manage FSM and to the cities of Bekasi and Tabanan to improve their technical service units. In Bekasi, support was also helped to redefine the structural arrangement and the scope of tasks assigned to the technical service unit. This involved transferring management authority from the Office of City Cleanliness to the Office of Public Works and extending its tasks to manage all wastewater management of the city.

Malang would prefer to adopt the Balikpapan model of the water utility managing the city's fecal sludge.

Despite its willingness, the utility is finding it difficult to extend its role to managing domestic wastewater due to its formal mandate. The city's existing technical service unit requires restructuring and capacity building to handle FSM implementation. Therefore, the Mayor needs to make a formal decision about which institution is responsible of FSM and overall city domestic wastewater management.

Preparing local regulations

Local sanitation regulations are very important to FSM implementation, due to the decentralized governance system. Most cities do not have a specific regulation for domestic wastewater management, let alone fecal sludge management. However, several cities have separate regulations covering onsite desludging arrangements and tariffs, although exact figures are unknown.

In Balikpapan, prior to 2014 there was no legal basis for a water utility managing a small sewerage system. This allowed the local government to legally clarify the mandate of the water utility to that of managing all wastewater, including FSM implementation. A local regulation (10/2014) states that the city water utility is the sole institution responsible for wastewater management in Balikpapan. Local regulation 8/2016 on wastewater management obliged building owners in non-sewered areas to build septic tanks that comply with the government technical standards and to desludge regularly. This provision also applies to communal decentralized wastewater systems. Mayoral Decree 24/2016 regulates the technical implementation of the law, for example the technical criteria for building permits for on-site sanitation systems area, the specifications for septic tank access lids and holes, the calendar for scheduled desludging, and that septage must be disposed of in the city's septage treatment plant.

Bekasi issued Mayoral Regulation 45/2015 on domestic wastewater management, and plans to issue a higher level local regulation. In Tabanan, the regulation existing prior to city facilitation regulates only the tariff for septic tank desludging services. Following facilitation, Tabanan has prepared a draft Mayoral Regulation on domestic wastewater management, including regular and on-call desludging, as well as draft revision to the local regulation on desludging tariffs and a draft of its implementing regulation in form of Mayor's Regulation.

In Malang, Local Regulation No. 2 on domestic wastewater management was issued in 2017. Other than requiring some time to see its impact on FSM implementation, the regulation appears not to provide clear directives on the role of the water utility in FSM.

Implementing the advocacy and promotion agenda

As local government has full authority for FSM, advocacy is necessary to get the top decision makers at city level on board for full improvement of FSM. Advocacy is usually carried out through courtesy visits to local government heads and heads of related offices in local government, especially the heads of the development planning agency, office of public works/ human settlements, office of city cleansing, and water utilities, as well as technical consultation visits to technical personnel in those offices. Local working groups on water and sanitation have also been one of the entry points for advocacy with local governments, as seen in the case of Balikpapan case. The SFD was also used in Balikpapan to present field research data to the local working group on water and sanitation, helping the group to understand the scale and nature of the challenges and identify the urban sanitation priorities to address the challenges. Balikpapan, Bekasi, and Tabanan have prepared advocacy and promotion plans for improved desludging services. This includes planning, design and production of advocacy and promotion tools, and implementation of promotion events. Promotional videos were made for these cities, and some cities engage staff from the wastewater institutions as the talents. Discussions have also been held with mayors or district heads and with parliament members and media representatives.

PROMOTIONAL VIDEOS WERE MADE..., AND SOME CITIES ENGAGED STAFF FROM THE WASTEWATER INSTITUTIONS AS THE TALENTS

Since the advocacy, the mayors of Bekasi, Tabanan, and Balikpapan have committed to implementing FSM. In Bekasi, improvements to the technical unit include increasing the number of staff from 20 (on a salary of USD 60.00/month) to 45 (on a salary of USD 300/ month). The former managed a 120 m3/day operation using conventional technology (not to full capacity); the latter, a 270 m3/day operation using a fully mechanical system to increase desludging, and provide additional customer services and marketing for expand its reach. Another key improvement was the increase in the local government budget for the technical unit to USD 540,000 (in 2017). This budget increase is clear evidence of support from decision makers, including the local parliament.

In Tabanan, however, the commitment has lacked follow up. For example, the FSM budget has not

changed despite the increase in income from on-call FSM services in 2016, and the annual plan does not include a regular desludging pilot for 2017. In addition, the local government has not made any progress with the draft regulations and has yet to firm up the decision on desludging tariffs and the institution responsible for fecal sludge collection.

Developing a census and database of on-site units
This will enable local governments to have a complete record of their scheduled and on-demand desludging customers. An Android app has been developed that allows the census enumerators to input data directly into their phones and send the data instantly to the central processing computer to be combined with other data. The tool has been used in selected cities, including Balikpapan, Tabanan and Malang and has made e-censuses quicker to complete. The app also allows operators managing the desludging operation to monitor the transport to, and discharge of septage at treatment plants (Figure 5). Bekasi and Balikpapan have already introduced the app. Other software been developed to support the payment system.

Improving septage treatment plants
The national government has assessed 150 septage treatment plants, and selected cities that need a more thorough assessment and support from donor programs. Engineering designs for their upgrading or replacement have been developed, based on the new design and operational guidelines for improved septage treatment plants. The national government has provided funding to develop the plant in Bekasi, and has plans for two other locations, which will soon need to treat more sludge.

Establishing tariffs for scheduled and on-demand emptying services
The mechanism and method for calculating desludging tariffs for cities have been developed, factoring in all capital and operational expenditures and expected incomes. The tariffs also take into consideration financial support to be provided by local governments. Advocacy support was provided to the cities of Balikpapan and Tabanan to ensure the tariff is approved by local government and local parliament.

Preparing the operation design and management system
Standard procedures for desludging, transportation and treatment operations were developed based on an operational algorithm identified together with local actors. In Balikpapan and Tabanan, workshops were conducted to introduce, improve and formalize the SOPs. Technical and administrative SOPs are also established through the support from government's development partner.

Strengthening partnerships with the private sector
In many cities, private emptying services will remain an important element of the improved FSM. Considering the current condition of most private companies, basic requirements for future private partners must be formulated and agreed. This includes technical and administrative requirements. Memoranda of understanding or contracts governing these public-private partnerships have been signed

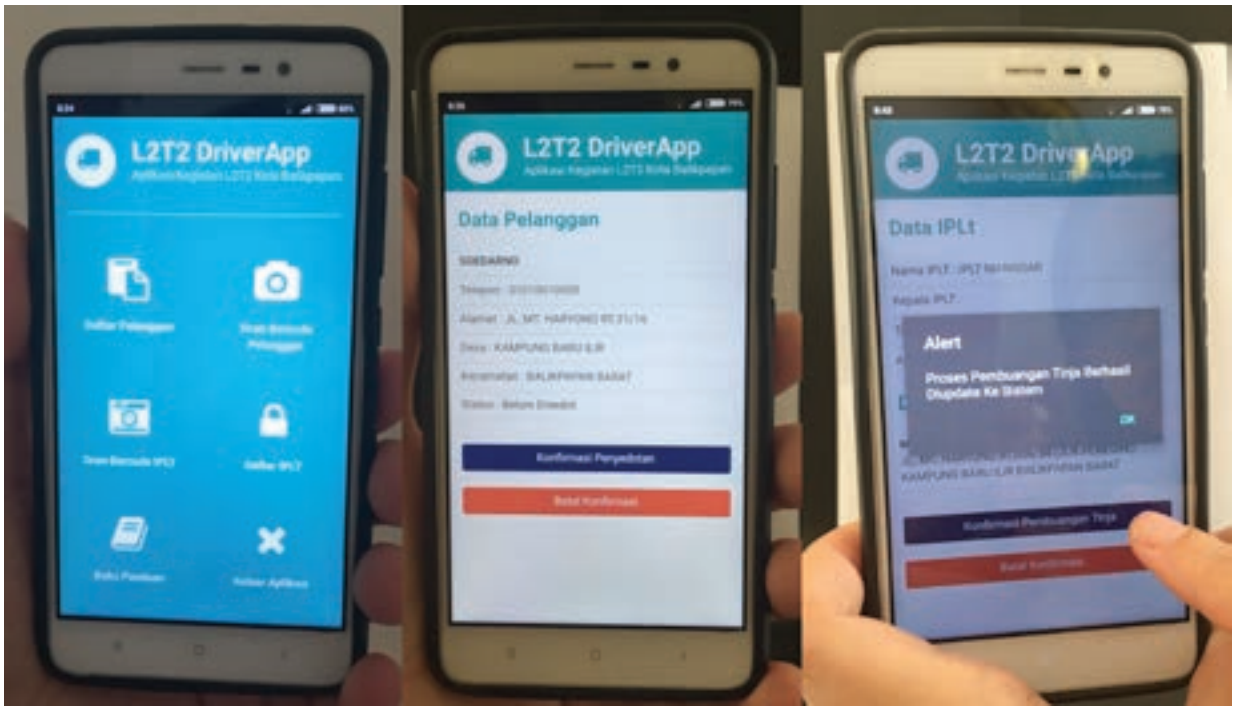

Figure 5: Android application for desludging operation made for the city of Balikpapan

	Balikpapan	Bekasi	Malang	Tabanan
Institutional arrangements (operators)	Water utility (mandated in local regulation in 2014)	Technical Unit for domestic wastewater management	Not yet firm between water utility and technical unit	Technical Unit for solid waste and septage management
Regulation	Local regulations on • mandate of wastewater management to water utility • sanitation, including domestic wastewater. and Mayor's Regulation on technical implementation	Mayoral decree for domestic wastewater management	Local Regulation on domestic fecal sludge and wastewater management including: • rules for collection, desludging, transporting, and disposal/treatment • permits for the private sector on fecal sludge and wastewater management • tariff levels	Not available; four regulations are still in draft, not yet legalized.
Tariff applied	• Regular desludging USD 0.73/house/month • On-demand desludging USD 38.00-46.00/service	Different on-demand tariffs depending on type of building function served. For houses, the tariff ranges from USD 3.5 – 7/service.	On-demand USD 2.3/service based on Local Regulation 1/2008 on wastewater and fecal sludge management	Regular desludging USD 0.65/household/month On-demand desludging USD 15-23/service Both are not yet legal
Mechanism for Payment	Combined with water bill (for city water utility customers) and door-to-door (for other customers)	Payment made to the officer after service has been completed	Payment made to the officer after service has been completed	Uses local community organization as a third party to collect monthly payments
Commitment from Mayor	Local budget has been allocated for selected activities	High level of commitment from mayor. Significant increase in budget for fecal sludge management and in treatment capacity.	Not yet available Need more advocacy to convince the Mayor	Commitment from local government is limited, no budget was allocated, and difficult to finalized local regulations
Involvement of private sector in desludging	**Yes**	**No**	**Yes**	**No**

Table 1: Four city examples of implementation models of improving fecal sludge management in Indonesia

in Balikpapan. In Tabanan, private sector desludging companies has yet been involved in its FSM improvement scheme.

The national government through Ministry of Public Works and Housing conduct local government capacity building by providing consultants to assist the cities in developing FSM services. Technical capacity development is the responsibility of Ministry of Public Works and Housing, while general FSM management falls under the Ministry of Home Affairs. However, in practice, at the national level general FSM management is handled by both the Ministry of Public Works and Housing and the Ministry of National Development Planning through a national water and sanitation working group the development of a City Sanitation Strategy.

FINANCIAL ASPECTS

Improvement of FSM requires capital and recurrent funding from a range of stakeholders. Even though the main responsibility for FSM lies with local government, currently the main source of capital funding to develop improved FSM comes from the national government. This includes funding for planning and preparation as

well as capital investment for major infrastructure. Thus, the Ministry of Public Works and Housing builds the treatment facilities, and these assets are later transferred to local government. Other capital investment, especially in tanker trucks, comes from the private desludging service provider or the local government.

A MODEL FOR CALCULATING REGULAR DESLUDGING TARIFFS WAS DEVELOPED TO ENABLE THE CITIES TO CALCULATE THEIR OWN TARIFFS

Capital funding

While the capital investments are funded by national government and/or the private sector, the cost of FSM operation and maintenance should as far as possible be covered by tariffs to ensure the sustainability of the operations. Thus, a model for calculating regular desludging tariffs was developed to enable the cities to calculate their own tariffs. This model also allows the cities to make financial projections from the current operation and maintenance costs of emptying, transport and treatment. It also includes management costs as a basis for tariff calculations, which are not usually taken into account in tariffs for unregulated services. Cities that manage both on-call and scheduled desludging, as in Balikpapan, typically apply a higher tariff for on-call desludging services to incentivize customers to sign up for regular desludging.

Recurrent funding for operation and maintenance

FSM operational costs are funded in part by local government, especially in the initial stage of implementation. The main source of funding for operations is the revenue from the desludging service fees collected from building owners. A World Bank study in three cities suggests that the willingness of homeowners to pay for emptying services is relatively high (Figure 6).[6] There is additional income from the fees trucks pay to discharge septage at a septage treatment plant. Local governments typically charge the trucks USD 0.77-1.15 per m^3 of septage discharged. The potential for some extra revenue from treated and processed fecal waste being sold for compost or other products is yet to be fully explored.

An interesting aspect of the regular desludging, is the expectation that its operations should be financially self-sustaining. A conservative revenue projection for scheduled desludging suggests there would be sufficient income to finance the whole FSM operation, including the treatment and management costs. This projection is often used in advocacy material with local governments.

Improving the quality of on-site sanitation

As the government increasingly recognizes the poor quality of onsite sanitation, the Ministry of Public Works and Housing has taken up an agenda of significantly upgrading on-site sanitation. A performance- and output-based program for upgrading onsite sanitation was launched in 2015. The national government also uses a special allocation fund to support the improvement of septic tanks. The special allocation fund is a grant from the national government to local governments that can be used only to fund specific activities. National government decides the specific activities, and since 2015, the option of septic tank improvement has been included in the list of activities. The fund could also be used for procuring desludging trucks for cities that are in effort of improving its FSM.

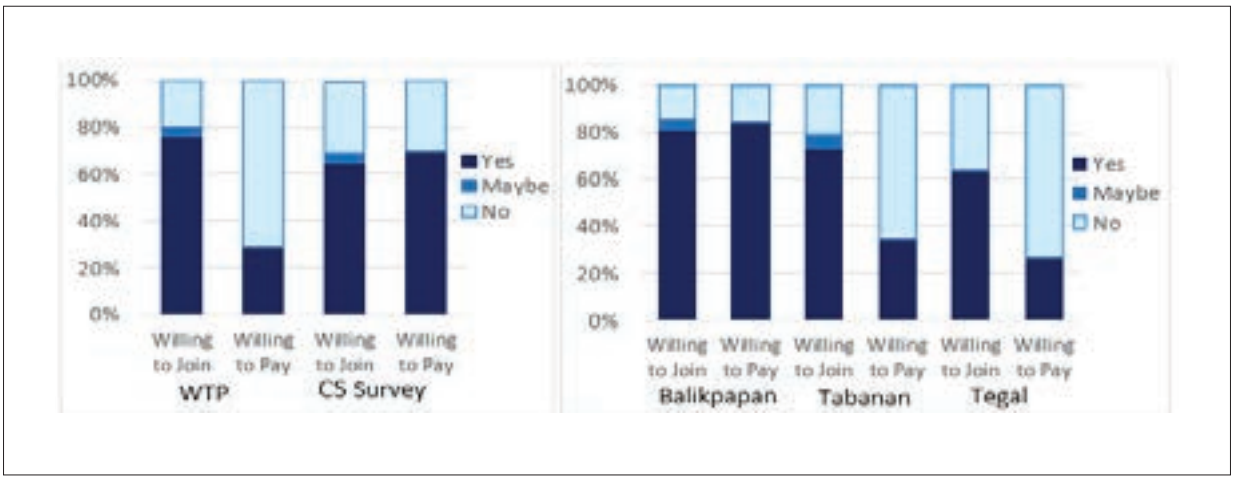

Figure 6: Willingness to join and pay for regular desludging [4]

DRIVERS OF CHANGE AND LESSONS LEARNED

From the implementation of FSM in the four cities, as well as in 12 other cities where the national government initiated the FSM, core lessons learned about what drives change, and for national scaling include:

High level local commitment through budgets, regulations and intuitional reforms is essential
The commitment of the head of the local government is absolutely crucial in the preparations for improved urban FSM, as is the willingness of designated institutions to realize this commitment. The commitment should be translated into actions, mainly allocation of sufficient funds, establishment of local regulations, clarifying the designated institution for FSM, and preparation of implementation plans. The delayed facilitation in half of the cities initially facilitated by the government in 2015–2016 was due to a lack of willingness to make a commitment. The cities did not allocate a budget for the pilot areas, including for operations and maintenance, and were reluctant to draft relevant regulations and improve their institutions.

Clarity on mandated operators and service providers
The designated institution need to have with a clear mandate, with roles and responsibilities as specified in local regulations. The capacity of the institution to manage monthly billing of customers is an important consideration in the selection of the appropriate service provider, as is the ability to introduce regular desludging. The city water utility is often the appropriate institution in cities that have a water network that serves the majority of residents. However, where this is not the case, alternatives may need to be considered.

Appropriate adequate regulations are needed
Local regulations are necessary to set the roles of local government in the provision of public wastewater services, including specifically septage management, and will be treated as the legal basis for local government in planning, implementing and monitoring the improved urban septage management, as well as in the budgeting process with local parliament. It is also important to have regulation defining the responsibilities of all stakeholders, for example: requiring building owners to have a proper septic tank, desludge periodically, and pay for the service.

Selecting operational models to suit local conditions matters
Implementing regular desludging is a more complicated operation than non-scheduled emptying, and must be suitable to meet the service coverage target. Considerations include the emptying period, zoning and scheduling, as well as the ability to charge and a mechanism to collect monthly tariffs. Availability of sufficient trucks for desludging and transport from the containment location to the treatment plant is crucial, and these could be provided through partnerships with local private tankers service providers. Where scheduled services are not feasible, a well-managed non-scheduled service will be adequate to meet customer needs.

Finance for sustainable operation and maintenance must be available
Sustainability of the services should be established and maintained through adequate revenue for operation and maintenance. Although this should be covered by the tariffs paid by customers, local governments need to provide seed funds to cover costs until the services can achieve economies of scale and costs can fully recovered from tariffs. It is important to design a payment mechanism system that will ensure high billing efficiency.

Well designed, properly-operated and appropriate capacity septage treatment plants are crucial
Quite often current capacities limit the scale of FSM to be introduced. Therefore, the capacity of local government to operate and maintain, and design, the treatment plant need to be improved. Some evaluations have reported that technical failures related to the utilization of septage treatment plants are due to miscalculations by local consultants.

On-going promotion is not an optional extra
Although the customers in pilot stage are households that have standardized septic tanks, promotion to all households needs to be undertaken to ensure that the services can be delivered at scale. Therefore, improving public awareness and understanding, and people's willingness to engage desludging services is extremely important.

NEXT STEPS AND PLANS FOR GOING TO SCALE

The development of improved FSM in Indonesian cities will continue. National government plans to support more cities with support from donor-funded programs and the local governments. Next steps and plans include:

Creating a national FSM framework and a national roadmap for FSM. As FSM implementation requires close coordination between stakeholders, a framework is required to specify the roles and responsibilities of each stakeholder, especially at the national level, in pushing the FSM agenda at local level. The framework is intended to set out the indicators for each

stakeholder and the monitoring and reporting systems from local government to national government. A monitoring and reporting system will support the country's plan to monitor its progress towards achieving the SDG sanitation targets.

Developing, improving and promoting manuals and guidelines, not just on technical aspects (especially guidance on how to design, operate and maintain septage treatment plants) but also on how to develop local regulations, prepare the operational schemes, develop an effective promotion campaign etc.

Providing intensive and sustainable capacity building to local stakeholders, i.e. local governments, potential service providers, and local consultants, which make up the support system at city level. The capacity building should include both technical (septage treatment plant designs, operation and maintenance, system capacity design) and non-technical aspect, ranging from tariff calculation, business model development and financial management. Further partnership with local universities will be developed.

Making available a variety of sludge treatment technology options to local governments, taking into account land availability, electricity supply, service area coverage, etc. An incremental approach to developing treatment plants will also be introduced to local governments, as an option that can be adopted as the customer base grows.

Including FSM development in the city sanitation strategy and master plan for domestic wastewater management. This includes developing SFD in the strategy to be used as a diagnostic tool to address domestic wastewater management challenges.

Improving the criteria for cities to receive financial or technical assistance from national government or other sources of funds. Clear readiness criteria as the basis for selection will help enable smoother implementation. Opportunities for private participation, especially design-build-operate type of partnerships, will be explored.

Strengthening collaboration with relevant development partners and international NGOs, not only in support for implementation, but also in capacity building and advocacy agendas.

Continuing the onsite sanitation quality upgrading program, by increasing the involvement of authorized certification agencies to ensure the technical quality of the system provided, and providing other financial schemes for scaling up.

NOTES

[1] An exchange rate of USD 1.00 = IDR 13,000 is used for all GDP and GDP/capita calculations.

[2] 25 Years Progress on Water Supply and Sanitation, Update and MDG Assessment, UNICEF and WHO, 2015

[3] Assessment of Sludge Accumulation and Pit Filling Rates in Indonesia, WSP-World Bank, 2013

[4] Ministry of Public Works, Evaluation of Indonesian Septage Treatment Plants, 2012

[5] Tabanan is a district, with 60 percent urban population. District is a local level of government beneath Province and has both urban and rural areas. It is headed by a district head. A district and city are on the same level, having their own local government and legislative bodies. In this case study, Tabanan will be referred to as "city" and its head of local government as "mayor".

[6] Willingness-to-pay and Customer Survey for FSM, WSP-World Bank, 2014

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ABBREVIATIONS AND ACRONYMS

MDG	Millennium Development Goal
FSM	Fecal sludge management
SDG	Sustainable Development Goal
SFD	Shit Flow Diagram or Fecal Waste Flow Diagram

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Scaling up Faecal Sludge Management in Kenya's Urban Areas

S. O. Okoth, J. K. Ronoh, A. Dubois, D. Mbalo

As in many countries across the developing world, in Kenya on-site sanitation systems predominate in towns. In most cases, faecal sludge from on-site systems is emptied and directly discharged into natural channels, or transported and disposed of untreated into the environment. In 2011, the Government of Kenya, through the Water Sector Trust Fund, commissioned a sanitation up-scaling concept called Up-scaling Basic Sanitation for the Urban Poor (UBSUP), which took into consideration the entire sanitation service chain. Key components of this concept include infrastructure, equipment, and services across the sanitation service chain. Implementation of the model is based on three key pillars: technology, social marketing and business and financing. These faecal sludge management (FSM) solutions are effective, practical, affordable, and do not require significant changes to the toilets which people currently use. From the start of the programme, seven decentralised treatment facilities (DTFs) with the capacity to serve 70,000 people have been constructed in seven towns in Kenya. The programme has also streamlined emptying services by integrating relevant laws into framing a concept for the emptiers. The goal of the programme is to provide a replicable urban sanitation service provision model that can be implemented nationally as a medium-term response to the FSM challenges in Kenya's towns.

CONTEXT

Lack of sustainable FSM continues to be a key contributor to the low access to sanitation services in Kenya. The up-scaling programme in Kenya was implemented based on the findings of the study commissioned by GIZ in 2009, 'Improving Urban Sanitation Systems: A rapid response to improve environmental sanitation'. The study revealed that the different sectors involved in on-site sanitation do not pay enough attention to the safe disposal and re-use of human waste. It further established that wastewater management in Kenya has long been neglected, with very little being done to maintain and improve systems. The treatment efficiency at the plants operated by the water service providers (WSPs) is only around 20 percent. For instance, in 2009, only 3–4 percent of human waste and wastewater produced in urban areas was treated. This means 96 percent of sludge ends up on open ground or is diverted into surface waters. The study further notes that financial and geographical factors also limit the extent to which large sewer systems can solve the sanitation crisis by reaching millions in the medium term. These limitations gave credence to the viability of on-site facilities with treatment systems. It was therefore recommended that a combined approach of large sewer systems and on-site based systems was necessary to increase access. Key to the approach was to prioritize urban low-income areas (LIAs) to close the sanitation gap between the rich and the poor. Under the water sector reforms, the Water Sector Trust Fund (WSTF) was mandated to develop and up-scale a sanitation concept.

KEY TO THE APPROACH WAS TO PRIORITIZE URBAN LOW-INCOME AREAS ...TO CLOSE THE SANITATION GAP BETWEEN THE RICH AND THE POOR

Urbanisation trends in Kenya

Kenya, with a population of 46 million people and a gross domestic product of USD 63.4 billion, is a lower middle-income country. Positive economic growth has been realised in the recent past, in tandem with increasing urbanisation, which has created a growing middle class. However, Kenya has not achieved significant poverty reduction, and poverty levels in the urban areas remain high, with over 8 million people still living in urban low-income areas. The urban population is around about 25.6 percent or 12 million people, and is growing at 4.2 percent per annum. Of the urban population, 33 percent still live below the poverty line, mostly in Kenya's 2,000-plus LIAs.

Sanitation in urban Kenya

Despite this economic growth and the formal recognition of sanitation as a basic right, investment in network infrastructure has not yet been achieved, particularly in urban low-income areas which are the least well served, although some improvements are being seen. But more seriously perhaps, investment in network infrastructure is failing to keep up with demand in urban areas, generating a large infrastructure and FSM services deficit.

In most towns, the growth in demand for sanitation services exceeds the rate at which the utilities can cope, due to increased urbanisation. The low-income urban population lives in informal conditions, with poor access to basic networked services and an increasing share of informal sector jobs. This situation points to a bleak future for sewerage systems, because on-site technologies are used far more widely than sewerage systems in most urban areas. On average, only 11 percent of Kenya's urban population is connected to sewers; and these are limited to 15 towns serving approximately 1.3 million inhabitants. This means that the remaining 89 percent rely on other types of sanitation, including pour flush with septic tanks or conservancy tanks, ventilated improved latrines and ordinary pit latrines.

EXISTING FSM SERVICES

The critical and important FSM services for on-site sanitation technologies are emptying and transportation followed by treatment and disposal. The task of sludge emptying and transportation is to be undertaken by the WSPs, as prescribed both under the 2002 Water Act and the recently revised 2016 Water Act. However, since most WSPs lack the specialised equipment (vacuum trucks), the service has largely been left to the private sector, with the public sector playing a regulatory and oversight role.

Figure 1: Manual emptier emptying a pit latrine with a bucket ©GIZ/Doreen Mbalo

Figure 2: Septic tank being emptied by a vacuum truck ©GIZ/Doreen Mbalo

Figure 3: Manual emptier discharging the collected faecal sludge in a nearby stream ©GIZ/Doreen Mbalo

Figure 4: Private vacuum truck at a designated discharge point ©GIZ/Cees Lafeber

Private entrepreneurs are issued permits by the local authority to allow them to operate their vacuum trucks within their service areas and discharge at designated sites. The emptying is usually done mechanically by vacuum truck. The average fee charged by the owner of the truck (private sector or WSP) is around USD 9/m³ in Nairobi, USD 15/m³ in Mombasa and USD 7/m³ in Kisumu. However, where people cannot afford the mechanised services or the plots are not accessible by vacuum truck, households often resort to non-regulated manual emptying. In Kisumu for instance, mechanical emptying costs on average USD 52 while manual emptying costs an average of USD 30 per trip. Studies conducted in Kibera, a slum in Nairobi, show that 33 percent of the households use mechanical emptying whereas 28 percent rely on manual emptying of their pit latrines. Other techniques used include gravitational emptying where the content of pits and septic tanks is directed to flow to lower channels by means of gravity.

By law, faecal sludge treatment services are to be provided by the WSPs. But in practice, due to limited law enforcement from the Public Health and Environmental Office and the lack of sludge disposal options, faecal sludge from on-site facilities rarely reaches a treatment or disposal facility. Manual emptiers and private vacuum trucks tend to dump sludge where most convenient, including nearby streams, rivers or lakes and bushes, thus creating environmental and public health hazards.

THE EXPLORATION OF LOWER-COST TECHNOLOGIES IS REQUIRED IF POOR KENYANS IN URBAN LIAS ARE TO BENEFIT FROM IMPROVED SANITATION

Challenges are most severe in urban LIAs where residents face financial constraints, have little space in which to build toilets, and access by mechanized emptying services is limited. Although in the long term sewerage remains the preferred option, the exploration of lower-cost technologies such as decentralized, neighbourhood-based treatment options is required if poor Kenyans in urban LIAs are to benefit from improved sanitation. In the short term, with many existing treatment plants (conventional and ponds) operating well below design capacity, it appears that sewerage networks could be extended without the need to invest in expensive additional treatment.

POLICY AND REGULATORY FRAMEWORK

The constitutional context

The Constitution of Kenya 2010 lays down the framework for development of the sanitation sector under Articles 43(1) (b) and 42 which guarantee the right of every person to "reasonable standards of sanitation," and "a clean and healthy environment". In this context, the government is required to plan and secure the necessary financial resources to execute the functions assigned to other levels of government and to ensure progressive fulfilment of the rights to sanitation and a clean and healthy environment throughout the country. These provisions are put into practice through coordination between several government agencies that have a variety of policy mandates at the national, county and city levels.

The legal and policy context

Several laws govern the management of faecal sludge. These include the 2012 Public Health Act, which prohibits nuisance caused by offensive waste that is injurious or dangerous to health. The National Environment Management Authority also has regulations about the types of vehicles that emptiers can use, and requires that emptiers hold a waste transportation permit as stipulated in the 1999 Environmental Management and Coordination Act. Recently, the Ministry of Health introduced an environmental sanitation and hygiene policy, which requires that relevant regulatory agencies, including the Water Services Regulatory Board (WASREB), provide guidelines for solid and liquid waste management. At the city level, therefore, the WSPs, which report to the Ministry of Water and Irrigation, are responsible for sanitation service provision. The WSPs are expected to take on the role of managing sludge from the on-site systems within this regulatory framework as mandated under the 2012 Act. However, some WSPs argue that they are responsible only for sewerage management, not for on-site sanitation. Furthermore, most WSPs do not have vacuum trucks, leaving the on-site sanitation service largely to the private sector, with the public sector's role being reduced to regulation and oversight.

Urban faecal sludge management under the current policy

In 2002, water sector reforms in Kenya culminated in the passing of the 2002 Water Act, which introduced new water management institutions to govern water and sanitation. Under the law, which was revised in 2016, the Ministry of Water and Irrigation (MWI) set up several institutions including the Water Services Regulatory Board and water services providers (the public water utilities in Kenya) among others

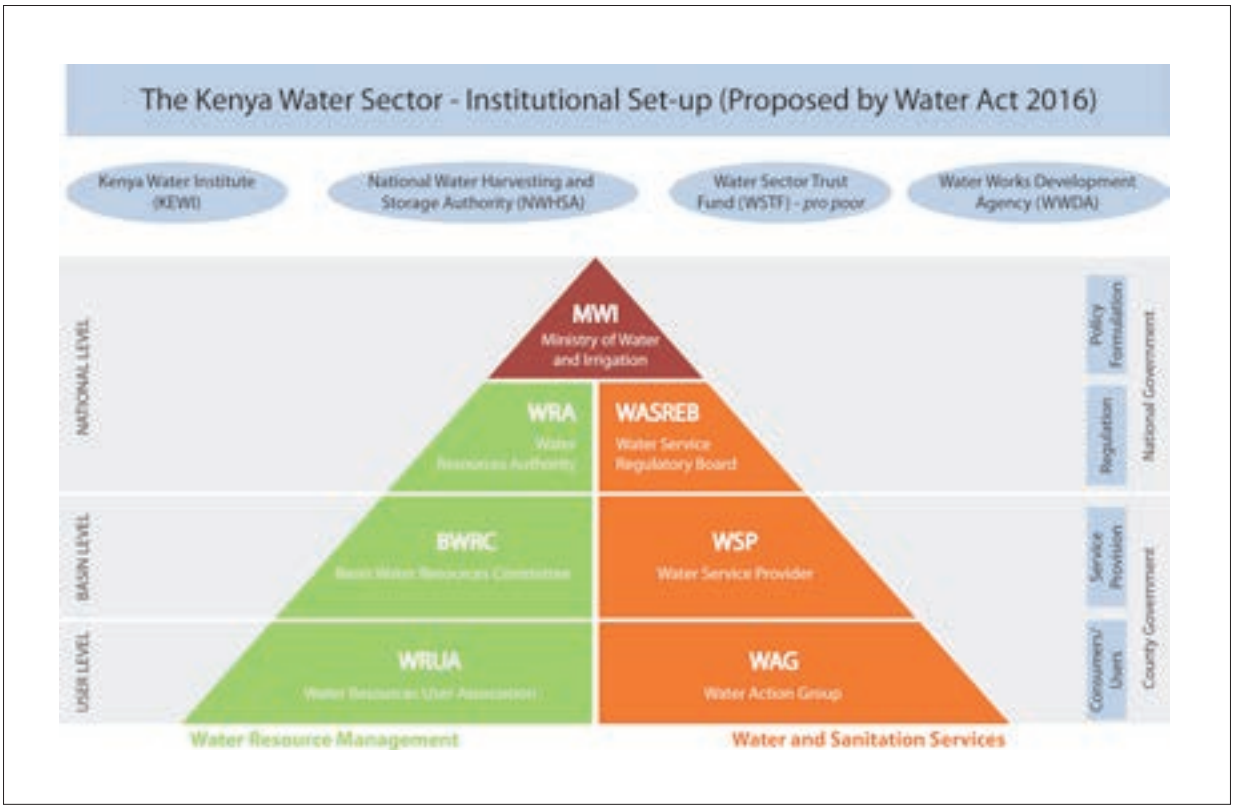

Figure 5: Water sector structure in Kenya

(Figure 5). To operationalise the new service provision structure for sanitation, MWI developed the Water Sector Sanitation Concept Paper and Implementation Plan (2009) to guide the implementation of sanitation. The WSPs were to take the lead in implementing the concept, including strengthening of FSM services. The current FSM is anchored on the 2016 Water Act, which provides a broad framework and mandates the water companies to offer sanitation services in towns and cities.

THE FSM COMPONENT OF UBSUP

About 89 percent of Kenya's urban population is not connected to sewers and depends on on-site sanitation technologies. This poses grave environment and health risks to both the urban and rural populations from contamination, which results from the haphazard dumping of sludge from on-site systems. Thus, in the medium term there is a need to emphasise improving the 'back end' of the toilet including emptying, transportation, treatment and disposal. Under the framework of the water sector reforms, the WSTF, with technical support from German Development Cooperation (GIZ), initiated a nationwide intervention to improve the sanitation situation through the UBSUP programme. The programme is built around the sanitation service chain principle. It has brought together the regulatory and legal frameworks of the various ministries and state agencies to formulate a national FSM approach, and influence new laws so that they prioritise on-site sanitation based on the principles of complete sanitation service delivery.

The programme, which targets 400,000 people in small and medium towns that do not have sewer networks, is funded by the Bill and Melinda Gates Foundation and the German Development Bank. To date, seven DTFs have been constructed, each with the capacity to treat 22m^3 of sludge per day and serve 10,000–25,000 users. This equates to 70,000-150,000 people benefiting from the FSM systems.

SEVEN DTFS HAVE BEEN CONSTRUCTED, EACH WITH THE CAPACITY TO TREAT 22M^3 OF SLUDGE PER DAY AND SERVE 10,000–25,000 USERS

The DTFs are designed to be located conveniently within the towns to provide sludge treatment for both the newly constructed UBSUP toilets and all existing toilets that are of a standard that permits containment and emptying of faecal sludge. The DTFs are small-scale decentralised wastewater treatment plants that cater for sludge from dry and wet toilets brought in by

the exhauster trucks or SaniGo. The design of the DTF also incorporates components for processing sludge into organic compost, soil conditioner, treated effluent for irrigation, biogas, and other by-products.

There are significant differences between DTFs and conventional centralized wastewater treatment systems. DTFs are intermediate technologies suitable for most small- and medium-sized towns that have no plans to construct sewerage infrastructure and rely wholly on non-sewered systems that produce faecal sludge. Unlike conventional systems, the DTF approach emphasises low investment and running costs. The UBSUP sludge management model is a better fit for FSM in those towns that do not have sewer networks and conventional wastewater treatment plants. It is an easier investment option for them too, as sewerage systems are difficult and expensive to implement, operate and maintain, particularly for a small WSP.

The implementation process

The programme commenced by conducting an integrated study to understand the sanitation services landscape in Kenyan urban areas. The study covered technology, socio-cultural, economic, religious and geological aspects of several towns in Kenya. The outcome of the study informed the project team on the most applicable model to implement the programme. This was built on the principle of complete sanitation service delivery. The holistic model considered sanitation financing mechanisms, appropriate technologies and sanitation marketing approaches within the prevailing regulatory framework and the very many relevant policy and legal provisions.

The programme model was then first tested in three towns, during which customer-aided design and feedback from the users and the implementers was used to strengthen the model. The improved model was then rolled out in ten additional towns under the nationwide approach. The upscaling phase has proved successful and the model is now being expanded within the same towns towards a citywide impact.

The programme employed an integrated design approach considering policies, people, the local economic situation and technical options, which resulted in the development of the comprehensive programme concept. Some of the critical development stages in the programme are tabulated below:

FINANCIAL AND ECONOMIC ASPECTS

The UBSUP programme is designed to create business opportunities for service delivery along the sanitation service chain for WSPs and small-scale private enterprises. Through effective social

Figure 6: UBSUP toilets ©GIZ/Dirk Schaefer

Figure 7: Sanigo ©GIZ/Alexandra Dubois

Figure 8: DTF in Machakos ©GIZ/Alexandra Dubois

Figure 9: DTF in Homa Bay ©GIZ/Leonie Kappauf

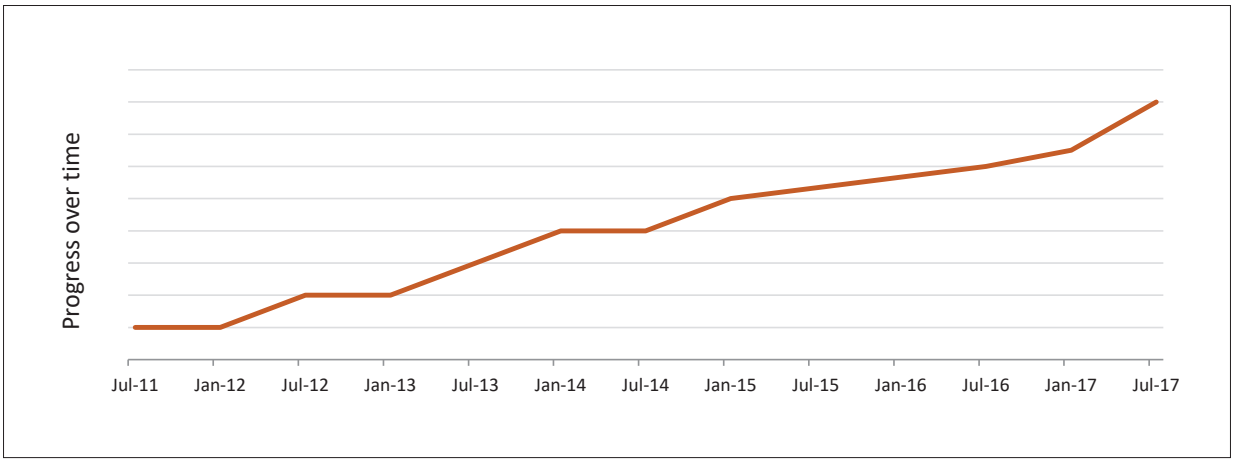

Figure 10: Programme progress over time

	Progress	Stagnation
1	Programme inception and assembly of the programme team was a straightforward exercise, as there were already experts in the WSTF.	
2		Study: Preparation of multi-disciplinary study tools to cover all aspects of sanitation service delivery including culture, technology, socio-economic status and geological and climatic conditions was difficult, as the programme had to get expertise in all these areas. Data analysis was also not straightforward.
3	Concept development and designs: there was no reinvention of the wheel. The experts relied on existing technical options for the toilets, which only needed adoption and the development of implementation and operations procedures.	
4	Financing: the financing concept for the programme detailing how funds flow from the WSTF to the WSPs for programme implementation was based on the already tested urban programme implementation concept. There was therefore no hindrance to the financing of the WSPs.	
5		DTF design: the design of the sludge treatment facility took long due to the scarcity of land for construction in densely populated neighbourhoods. After the designs, the discussions with various authorities for approval also took time as they had to understand the designs and the proposed operations model.
6	Testing and piloting: this process took off well despite initial scepticism among users on payments for toilet construction. This made the construction of toilets surge ahead of the DTFs.	
7	Revision of toilet designs through the customer aided design process was easy as there was good cooperation by the beneficiaries.	
	Selection of pilot towns	
8		There was generally slow take-off of the DTFs. This was occasioned by lack of land for the facilities. Furthermore, the technology was too complex for the local technicians, who needed to be trained on each of the DTF modules and how set them up on site.
9	Integrating the emptiers and the exhausters went well as the authorities had already understood the concept. This was partly because this was a missing link for many towns in Kenya and so the utilities and the counties saw opportunities for sludge management while the exhausters saw an opportunity for operating legally. Influencing policy was easy based on the evidence drawn up based on project activities and progress.	
10	The general up-scaling went on well in a logical sequence as had been planned by the programme from testing (one town) – piloting (three towns) – up-scaling (ten towns).	

Table 1: Programme progress and bottlenecks the programme had to overcome

marketing techniques and post-construction (output-based) incentives, the programme has promoted a total of 8,072 new toilets serving a total of 46,240 beneficiaries. The toilet models range from double vault urine diversion dry toilets (UDDTs) to flush toilets connected to septic tanks (accessible to vacuum trucks) or existing sewer networks. These comprise 98 percent pour flush and 2 percent UDDT. Among the pour flush toilets, 70 percent are connected to septic tanks and 30 percent to sewer networks. Before the next phase of the project, 5,600 toilets are to be built. The post-construction incentive is funded by UBSUP and ranges from USD 150 to USD 200, corresponding to 50 percent of the cost of toilet construction. These funds are paid by the WSP to the toilet owner upon completion, inspection and approval by WSP staff. In some cases, it was observed that local tradespeople were offering payment by instalments to their less fortunate clients once the construction was completed and the money from the post-construction incentive had been received.

The WSPs are expected to generate revenue through billed water services. The sewer services are charged at 75 percent of the basic water bill. This revenue stream is generated from the new toilets connected to sewer networks. However, in most cases, both the new and existing standard toilets are connected to septic tanks, which need periodic emptying. The WSPs that own vacuum trucks offer the service of collecting and transporting the wet sludge from septic tanks and pit latrines. Areas where WSPs do not have vacuum trucks are usually served by existing private entrepreneurs. Emptying tariffs applied by the public and private sector vary from USD 80 (8m^3 truck) to USD 150 (18m^3 truck). In the case of UDDTs, local groups of emptiers are identified, trained and equipped by the WSPs with customised motor tricycles called SaniGo, valued at USD 400. An emptier operating a SaniGo charges the toilet owner an average of USD 20 to empty one UDDT vault, and provides the service twice a year. The SaniGo can transport up to 1m^3 of dry faecal matter, which is equivalent to two vaults. UBSUP encourages the WSPs to outsource collection and transport services to private entrepreneurs in order to ensure a steady supply of wet and dry faecal sludge for further treatment.

THROUGH EFFECTIVE SOCIAL MARKETING TECHNIQUES AND OUTPUT-BASED INCENTIVES, THE PROGRAMME HAS PROMOTED A TOTAL OF 8,072 NEW TOILETS, SERVING A TOTAL OF 46,240 BENEFICIARIES

To ensure completion of the sanitation service chain, appropriate faecal sludge treatment facilities for WSPs without existing sewerage treatment plants are being provided. Out of the 23 towns where UBSUP toilets were constructed, thirteen DTFs, valued at USD 80,000 each, have been funded by the project. Each DTF is owned and operated by a specific WSP. To date, seven DTFs have been completed and are in operation. Each DTF can receive up to 22m^3 of wet sludge per day, which corresponds to approximately three vacuum trucks. The WSPs charge between USD 10 and USD 24 according to the capacity of the vacuum truck discharging at the DTF. The tariff is set with reference to fees applied for discharge at conventional treatment plants, but taking into account additional parameters such as the reduced distance for the vacuum trucks, the recovery of capital and running costs for the DTF, and affordability to customers (pro-poor).

CAPACITY DEVELOPMENT

Supported by a strong institutional set-up where mandates and responsibilities are clearly defined, competencies and skills in the Kenyan Water Sector are considered to be quite developed. In contrast, the WSTF has said that support was needed in the sanitation sub-sector, which has been recently introduced, in order to ensure service provision in the urban areas of Kenya. The UBSUP programme is a new concept which introduces technologies that are new

Tariffs for discharge in the DTF			
Truck size	Small (5-9 m³)	Medium (10-14 m³)	Large (15-20 m³)
Fee per discharge	USD 10	USD 17	USD 24

Table 2: Recommended tariff structure for discharging in the decentralised treatment facility

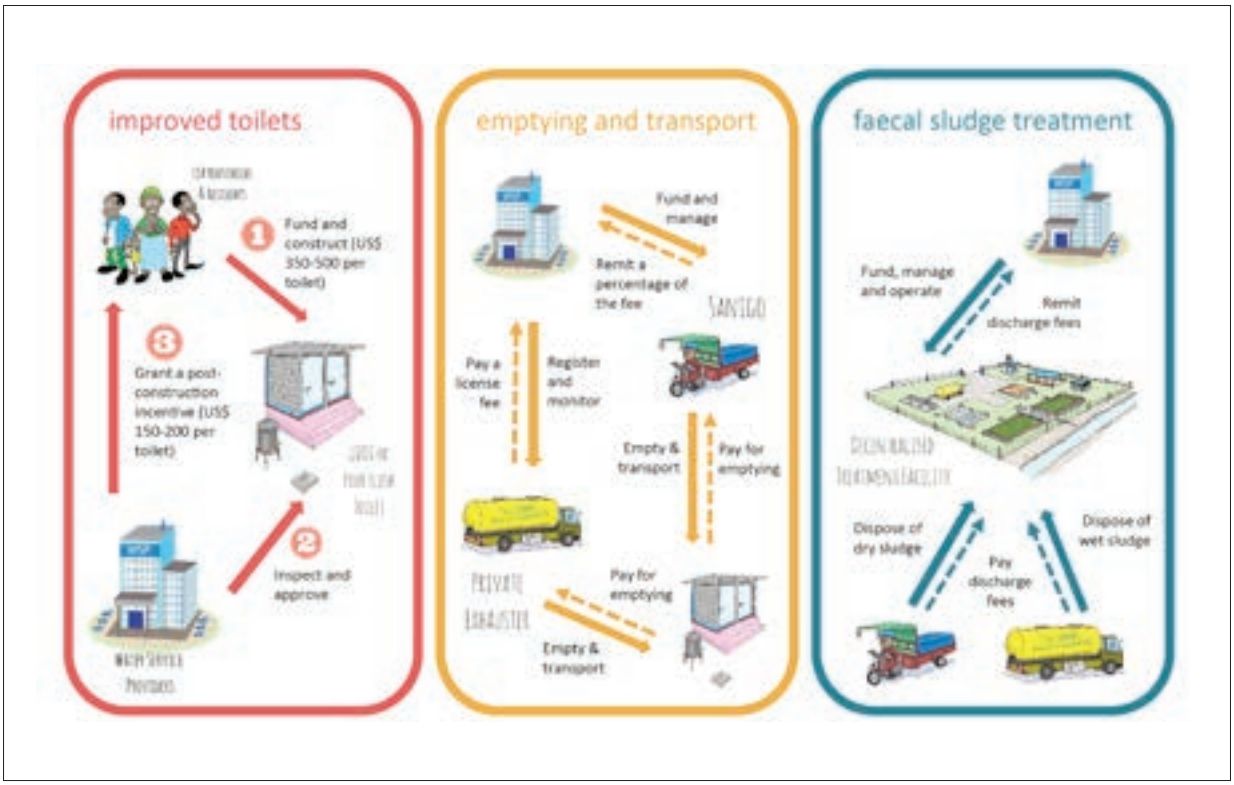

Figure 11: Up-scaling Basic Sanitation for the Urban Poor business model

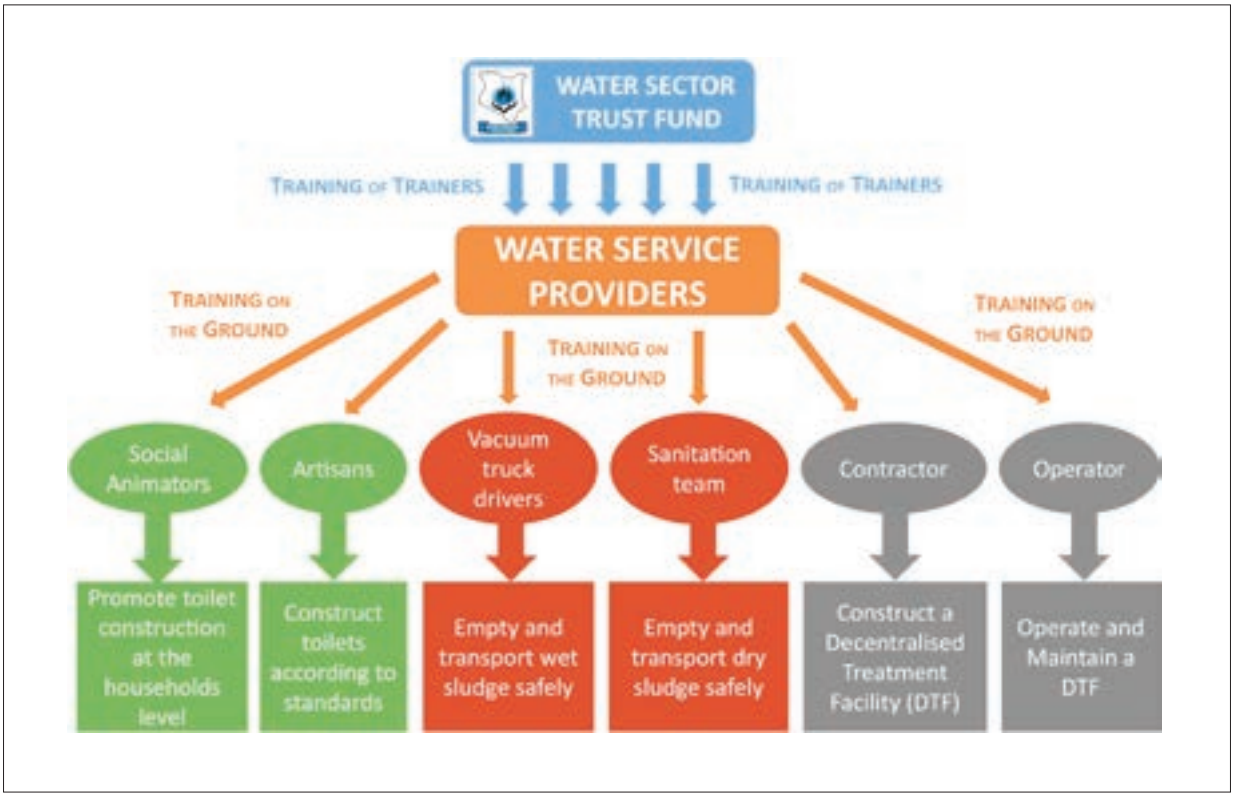

Figure 12: UBSUP training cascade

to the Kenyan context, therefore, capacity development of the programme stakeholders is paramount.

WSTF focuses its efforts in building capacity of WSPs as main implementers of UBSUP activities at their level. In each field of activity, WSTF provides specific trainings to the WSP staff (technical and social team) with the objective to train the trainers whose knowledge will trickle down to the actors on the ground involved in the activities related to UBSUP. The strategy of building the capacity of the WSPs is geared to ensure that supervision and monitoring of all activities is done properly at ground level.

THE UBSUP PROGRAMME IS A NEW CONCEPT THAT INTRODUCES TECHNOLOGIES THAT ARE NEW TO THE KENYAN CONTEXT, THEREFORE, CAPACITY DEVELOPMENT OF THE PROGRAMME STAKEHOLDERS IS PARAMOUNT

Training in toilet promotion and construction, emptying and transport of sludge, and construction and operation of a DTF is provided. The target audiences are social animators, tradespeople, vacuum truck drivers, sanitation teams, DTF contractors and DTF operators. Where possible, UBSUP is taking measures to promote gender balance through capacity building. For instance, participation of women was encouraged in promotion and sensitization activities, given that their position in society plays an important role in the acceptance of the programme by the community.

DRIVERS OF CHANGE

The indicators for the SDGs for sanitation require evidence of access to sanitation and of the percentage of population using safely managed sanitation services. This means that all interventions must address the entire sanitation service chain. **The WSTF has identified an opportunity to contribute to this indicator** by framing a national urban sanitation concept built on the principle of the complete sanitation service chain and anchored in sector institutions.

The development of the decentralised and medium-range sludge management technologies has ensured that services that previously needed large urban populations in order to achieve economies of scale are now affordable to medium and small towns. Backed by a sound business model along the sanitation service chain, many WSPs are now interested in implementing the FSM concept. The business orientation of the DTFs, the SaniGo and SludgeGo are already promising sustainability in sludge management operations in these towns.

The regulator, WASREB, recognises the opportunity for the WSPs to increase and expand services in their service areas even in the absence of conventional sewerage systems. Likewise, the private sector, which had initially had shied away from engaging in emptying and transportation of faecal sludge due to lack of interest as well as a lack of treatment/disposal facilities in small towns, is now more engaged.

CHALLENGES

Getting to the up-scaling phase of the programme has not been easy. The barriers and challenges that have had to be overcome include:

A lack of standards for toilet facilities and use that permit adequate containment of the sludge and emptying when full. Most of the existing toilets are pit latrines, often located at difficult corners of small plots and constructed with no provision for emptying access. Furthermore, there were no guidelines for proper use, making those toilets which are accessible difficult to empty. Most of the toilets contained a wide variety of solid waste, including old shoes, clothes and plastics. This prompted the design teams to set design standards for toilets that would enable proper containment and make emptying easier. The design of the UBSUP thus considered all these design and positioning limitations for the new toilets. A module for proper use of toilets for ease of emptying was developed and shared with the sanitation marketers to educate users.

The institutional perspective has always been that one day, sewerage systems will be built in all towns. This made it **difficult to convince institutional stakeholders to accept and adopt the intermediate response to sanitation that UBSUP introduced**. The programme had to embark on awareness raising and marketing of the concept among the key stakeholders, who held a strong belief that conventional sewerage was the sole solution for sanitation. Today, encouraged by the UBSUP, most of the counties and WSPs have embarked on on-site systems.

UBSUP introduced new designs and structures which, given the complexity of implementing sound FSM, **needed a testing process that integrates customer-aided-design**. This is an iterative process that takes time to allow for the involvement of all stakeholders in the design and learning process before up-scaling.

LESSONS LEARNED

Because the sanitation upscaling concept was new to Kenya, the UBSUP programme was implemented in stages that allowed systematic inclusion of lessons learned in successive stages. This ensured that there was no waste of resources from implementing unviable concepts for scaling up. To start with, a qualitative study and a detailed quantitative preparatory study were carried out in 2012. These studies established the existing sanitation situation, willingness and ability to pay, and the technologies applied across the sanitation service chain. The results of the study informed the development of the upscaling concept that was

tested and piloted in 2013 and 2014. Up-scaling of the UBSUP programme was carried out from 2015, after testing and piloting. The phases helped in identifying lessons that could support the sustainability of the up-scaling concept. Many lessons were learnt during the implementation of these two phases of the UBSUP programme, including the following:

National up-scaling works best with sector structures
Sector structures are designed to reach every corner of the country, which provides ideal ground for proven concepts to be simultaneously replicated in different areas. In the context of the UBSUP programme, WSPs are mandated by law to provide water and sanitation services, which has made the WSPs and other sector players more aware of sanitation needs and the opportunities that come with up-scaling programmes. This awareness helps drive the integration of up-scaling concepts into government strategies, policies and budgets.

Tried and tested concepts influence policy
While it is widely believed that policies inform interventions, it is also possible that properly tried and tested concepts can influence policy. From lessons learned, UBSUP made a significant contribution to several chapters of Kenya's Environmental Sanitation and Hygiene Policy (KESH) including giving shape to the chapters on urban sanitation, sludge management, sanitation types and financing. Before UBSUP, urban sanitation and FSM were absent from KESH. After successfully testing and piloting the UBSUP concept, the programme team drew vital lessons about how urban dynamics influence implementation of the programme, including technology preferences, policy and regulatory gaps, and capacity gaps at various levels including Ministry of Health, WSPs and the county governments. These lessons became the cornerstone of the national concept which was used to influence the urban sanitation chapters of the KESH.

A range of technology options is needed
In the beginning, UDDTs were exclusively promoted by UBSUP because of their relatively low capital costs and the ease of managing the dry material they produce. The programme did not promote the construction of pit latrines due to the absence of local safe emptying technologies. This changed, however, when the sanitation marketers engaged with LIA residents to market the technology. It turned out that UDDTs were not a popular choice, which proved that providing consumer choice is important for acceptance. Proper use of UDDTs is possible only if they are constructed within one household compound; use and maintenance is difficult if they are constructed on a plot with multiple households. In 2015, the programme allowed the construction of flush toilets connected to septic or conservancy tanks and sewer lines. As a result, the demand for toilets rose dramatically. Currently the UDDTs constitute less than two percent of the more than 8,000 toilets constructed under the UBSUP programme.

There is a willingness to pay for sanitation services
Contrary to the common belief that the poor do not prioritize paying for sanitation services, UBSUP has shown that, with enforcement of the Public Health Act by the public health department, appropriate sanitation options, and organised FSM systems in place, residents of urban LIAs are willing to pay for quality services.

Developing sustainable demand for sanitation services takes time
From piloting of the programme in three towns to the implementation of the first phase of the programme, demand for sanitation services was not always obvious and picked up very slowly, thus calling for patience during sanitation marketing. However, after vigorous marketing, construction of improved toilets by households and the first payment of post-construction incentives to the landlords and households by the WSPs, demand picked up dramatically. This suggests that with the provision of affordable technologies and sanitation incentives, poor households are willing to improve their sanitation.

Awareness creation is a necessity for up-scaling
As awareness has grown, demand for improved sanitation services has grown in many towns in Kenya. Local governments are already planning to finance improvement of sanitation services in various towns based on the up-scaling model. With the successes gained in the areas where the programme has been implemented, it is also expected that convincing potential clients will be easier.

OUTSTANDING CHALLENGES, NEXT STEPS AND GOING TO SCALE

During implementation, challenges arose that impeded progress. Outstanding challenges include:

Internal procedures in all implementing partners (for example, the project application process, appraisal and disbursement of funds) that delayed the response in areas where demand for improved sanitation had been created, slowed down uptake. In many cases the **clients adopted a wait and see approach**. In some places people became sceptical because of delayed post-construction incentive payments.

Delay in use of the DTFs to full capacity, due to lack of awareness of the collection and treatment services offered by the WSPs and private operators after the construction and commissioning of the DTFs.

Lack of resources to meet demand for these facilities in many small and medium towns across the country.

From a study carried out in 2012 on reuse of human waste as processed manure, it emerged that **selling the end-products of processed sludge is not an easy task**, as the WSPs lack the capacity to market them. This slows down maximising revenue from these recycled products.

Training and equipping intermediate entrepreneurs to offer services in places where there are no exhausters.

Standardisation and compliance with toilet standards that guarantee sustainable containment and emptying of sludge. However, this **requires the combined efforts of all key sanitation players** (donors, politicians, implementing agencies, and enforcement agencies) **to offer affordable technologies, incentives and enforcement**.

The programme has incorporated the lessons learned into the scaling up concept, and will take them fully into consideration when implementing the second phase. A robust social marketing strategy based on best practices in the first phase will shorten the lead time.

To sustain the momentum towards meeting universal sanitation needs, the programme is already lobbying the government for funding for scaling up. Other funding sources will also be approached.

To others that are planning to go to scale, the programme recommends they consider making use of existing sector structures and engage teams that have already gone to scale in order to learn lessons.

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ABBREVIATIONS AND ACRONYMS

DTF	Decentralised treatment facility
FSM	Faecal sludge management
LIA	Low-income area
KESH	Kenya's Environmental Sanitation and Hygiene Policy
MoWI	Ministry of Water and Irrigation
UBSUP	Up-scaling Basic Sanitation for the Urban Poor
UDDT	Urine diversion dry toilets
WSP	Water service provider
WSTF	Water Services Trust Fund

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Sanitation and Sewerage Management: The Malaysian Experience

Dorai Narayana

EXECUTIVE SUMMARY

Malaysia stands out in South East Asia as having made significant improvements in sanitation and sewerage management. The top-down strategy by the federal government, effectively over-riding the local governments, has produced quick results. The holistic approach adopted to manage centralised, community and on-site sanitation systems, put in place strong regulatory frameworks and a strong driver with a clearly defined role, and tasked the private sector to do what it does effectively. The national level policy, regulation and single service provider resulted in accelerated capacity building, creating a large pool of expertise in the country as well as a robust support industry.

The country has learned lessons from regulation, scheduled desludging, tariffs and cost recovery, and the incremental introduction of technology, all of which has produced mixed results. This has provided lessons for other places aiming to improve sanitation and sewerage management. Malaysia intends to forge ahead in this sector, charting the most appropriate and sustainable path for itself – providing another reference for cities that are developing their own sanitation and sewerage strategies.

Here, examples are provided of how septage management services are managed differently in two cities. First is Penang Island, which was part of the move towards privatisation and federalisation and where sanitation is manged by the national wastewater company, Indah Water; second is Kota Bharu, where sewerage and septage services are is managed by a state government owned company Majaari Services.

CONTEXT

Malaysia is a country in South-East Asia. Most of its urban centres are small, except for the Kuala Lumpur conurbation. The country is rich in natural resources such as oil, tin and other minerals. There is a large manufacturing sector, and a substantial tourism industry.

Over the last 50 years, Malaysia has made tremendous economic progress and has invested in quality infrastructure. Poverty has been drastically reduced, and stands at 0.6 percent overall, and 1.6 percent for rural areas (Malaysian Economic Planning Unit, 2014). Sanitation and sewerage management, although still perceived to be lagging behind other sectors, has also seen dramatic improvements. Almost 100 percent of the population has access to

Area: 330,000 km2
Population 30 million people
Urbanization 75%
Capital: Kuala Lumpur area 7 million people
GDP/person USD 10,000 (2016)

Box 1: Malaysia profile

toilets and safe sanitation. Nearly 70 percent of the population now has access to sewerage services that drain into off-site treatment facilities. Close to 20 percent use proper septic tanks (following standard design), while the remainder use modified septic tanks, pour flush or pit latrines. About 20–30 percent of the on-site facilities are regularly emptied and treated before disposal, while the rest are emptied on request.

HISTORICAL CONTEXT

Historically, Malaysia was an agricultural community, blessed with a good climate and fertile soils, and free from natural disasters. The local population lived in villages, coastal and riverine settlements, answering the call of nature in rudimentary toilets or in the open, and letting nature do the rest. The land attracted large numbers of immigrants from the region, and this led to economic activity and urbanisation. The arrival of European colonialists from the 1600s accelerated urbanisation. Rubber and tin were the commodities that drove the economy. Major urban centres arose around these production centres and ports. And with the urban sprawl came the attendant problems of waste disposal.

The incidence of waterborne diseases such as cholera, dysentery and typhoid was widespread, causing much suffering and death. By the late nineteenth century, local sanitation boards came up with mitigating strategies. Faecal matter was contained in pits or buckets, and carried away for safe disposal.

AFTER INDEPENDENCE IN 1957... WELL-CONSTRUCTED MULTI COMPARTMENT SEPTIC TANKS WITH FILTERS, SOAKAWAYS OR SOAK PITS WERE INTRODUCED

By the early twentieth century, the colonial authorities laid out piped sewerage in some of the larger towns, notably Georgetown (circa. 1930) and Kuala Lumpur (circa. 1940). The sewerage was limited to the inner core of the town, while the outer areas used bucket latrines and pit latrines, and practised direct discharge of waste. Most collected sewage and untreated night soil was discharged to a nearby river, or the sea. In rare cases, oxidation ponds were built to treat the sewage. The bucket toilets were emptied by night soil carriers, who sold the human faeces to farmers for agricultural use. When full, pits were usually abandoned, and new pits dug. Where emptied, faecal matter was dumped in rivers, the sea or on garbage dump sites. Pit latrines often contaminated wells. The diseases continued.

Definitive actions after independence

After independence in 1957, the sanitation challenge was approached in a more systematic manner. In the larger towns, bucket latrines and other such systems were gradually phased out. Well-constructed two compartment watertight septic tanks, with a capacity of at least 2 m^3 and the effluent either soaked away or passed through a filter, were introduced. Piped water supply became available in most towns, and flush toilets were common. A rural sanitation improvement programme provided proper flush toilets with pit latrines, located away from wells. All these steps effectively addressed the public health hazards of faecal matter at household level.

THE APPROACH WAS NOT A HOLISTIC ONE, AND SEVERAL SERIOUS SHORTCOMINGS EMERGED

Rapid development and emerging shortcomings

The 1970s and 1980s saw rapid economic development, driven by petroleum and oil palm. In most urban areas, housing estates and commercial complexes mushroomed, putting severe strain on the capabilities of local authorities. The federal government advised a policy requiring housing developers to build internal sewerage infrastructure to serve their developments. Small developments had to provide individual septic tanks, built to specifications, while larger developments exceeding 30 houses were required to provide a piped sewerage system, with their own sewage treatment plant. Grey water was also required to be included in the sewerage systems. This was a logical move, because it ensured sewerage infrastructure was provided for all developments, and it relieved the burden on the local government. However, the approach was not a holistic one, and several serious shortcomings emerged:

- **A logistical operational nightmare arose for local authorities**, resulting from the large number of sewerage systems being built by developers, with a wide variety of designs, systems, equipment and arrangements, and with little standardisation.
- **Local authorities generally lacked technical personnel with adequate knowledge of sewerage systems**, and the private sector was no better.

Moreover, there were no regulations or guidelines in place. Some systems were inherently defective in design, and the quality of the designs and the built infrastructure was sorely deficient.

- **Whole life costs and operability considerations were ignored.** Developers were driven to a large extent by commercial considerations. The options selected were therefore difficult to operate and maintain, or had high operational and maintenance costs. These facilities often developed serious defects soon after commissioning.
- **Neighbourhoods suffered overflows, odours, and nuisances** from these community treatment plants, which were located in close proximity to residential areas, especially when the treatment plants malfunctioned, which was often.
- **Serious issues of personnel, expertise and financial resources in the local authorities** resulted in large scale operational shortcomings, with most sewerage systems falling into neglect and disrepair. Theft and vandalism added to the problems, and as a result the sewerage infrastructure soon began to crumble. Discharges and overflows of raw or poorly treated sewage were widespread.
- **Enforcement of regulations was weak.** The Environmental Quality Act 1974 established the discharge standards for sewage effluent discharges to inland waters, but these were seldom applied. The fact that the offenders were local authorities may have been a factor.
- **Septic tanks numbers began to grow**, especially in small towns, because development was small scale.
- **Septic tanks began to malfunction, and sludge overflows were a major source of pollution**, because accumulated sludge was not emptied regularly. Septic tanks were generally well designed and built to specifications, but were desludged only on request, and there was no proper treatment of the sludge. It was often applied on land or discharged into the sea or rivers.

A few of the larger local authorities such as Kuala Lumpur and Penang obtained funding from the World Bank or the federal government, and implemented sewerage improvements. But most local authorities paid scant attention to sanitation, and any improvements that took place were driven by private developers. Local authorities generally neglected planning for this sector, and management was lacking too.

As a result, problems with the regulatory framework, institutional arrangements, capacity, awareness, financial and other resources, and overall management led to the deterioration of the physical infrastructure provided by developers.

In the meantime, a substantial percentage of the population continued to use poorly managed septic tanks, or even less satisfactory systems such as sub-standard septic tanks, pits or direct discharge, polluting ground and surface waters.

The result was a serious pollution of water bodies, including rivers, lakes and coastal areas. Water supply sources were being affected. Sewage was polluting recreational and tourism areas. The number of polluted rivers was increasing. The problem became very visible, forcing the federal government to take notice.

Federalisation and privatisation

The ineffective sewerage and sanitation management seemed incongruent with the rest of the country's infrastructure development. Save for a few major local authorities, most were not inclined to pay the attention that the sector needed. The obvious conclusion seemed to be that local authorities were ill-equipped to make the quantum shift that was called for.

Partly stemming from a private initiative by a group of entrepreneurs (which later became Indah Water Konsortium (IWK), the federal government decided to federalise sewerage services in 1994, through the 1993 Sewerage Services Act. Provisions in the Malaysian Constitution allowed the Federal Government to legislate the transfer of jurisdiction. A regulatory department was set up at the federal level called the Sewerage Services Department. The operations were privatised under a 28-year concession agreement with Indah Water Konsortium (IWK). Indah Water (meaning Beautiful Water in Malaysian) Konsortium comprised local and foreign partners, including North West Water, a British water and sewerage operator.

INEFFECTIVE SEWERAGE AND SANITATION MANAGEMENT SEEMED INCONGRUENT WITH THE REST OF THE COUNTRY'S INFRASTRUCTURE DEVELOPMENT

The concessionaire operated in urban areas and its responsibilities included:

- Operation and maintenance of public sewerage systems
- Scheduled emptying of septic tanks
- Safe treatment and disposal of sludge
- Refurbishment of all sewerage infrastructure
- Planning and construction of new sewerage infrastructure.

Figure 1: Indah Water service area

IMPROVEMENTS

This federal government strategy took a top down approach, but most local authorities and states were happy to give up what they saw as a problematic role. All states, with the notable exception of the East Malaysian states of Sabah and Sarawak, the opposition-led Kelantan state and the city of Johor Bahru opted to handover these responsibilities to the federal government.

The initiative resulted in spectacular improvements in the sewerage sector, with substantial funds invested for the refurbishment, upgrading and operation of the dilapidated sewage treatment plants. Regulatory control was tightened. Sewerage catchment planning, incorporating land acquisition and reservation, was carried out. Developer guidelines were published, designs were scrutinised before approval, and construction was supervised, resulting in better quality developer built systems. Intensive capacity building programmes were carried out, and over the years thousands of technical and professional experts were created. Indah Water set up a Technical Training Centre, offering a full-range of specialised training programs, both classroom based and hands-on, from planning, engineering design, right up to operator and skills training and safety. As a result, operation and maintenance of facilities became systematic and effective.

Improvements at city level

The approach adopted in Malaysia was one of uniform policy, regulation and service delivery across the area of coverage, which was almost entirely urban in Peninsular Malaysia. This section looks at the city level improvements that took place taking an example of a typical medium size city (Penang) which was part of the federalisation and privatisation drive, and contrasts it with developments in Kota Bharu, which was not included in the national privatisation exercise.

Penang Island

Penang is an island city in the northern part of Malaysia, with an area of 1050 sq. km and a population of about 700,000 (2016). It is highly urbanised and

has a strong tourism industry besides manufacturing and service industries. The population equivalent considering commercial, industrial and tourism contribution is about 1.4 million.

DEVELOPMENT OF THE TOURIST INDUSTRY CENTRED AROUND THE AREA'S BEAUTIFUL BEACHES AND NATURAL ENVIRONMENT CALLED FOR URGENT IMPROVEMENTS IN SEWERAGE MANAGEMENT

Sewerage development in Penang, started in the early 20th century under the British colonialists. Georgetown city centre was the first place to be sewered, and the raw sewage conveyed to the sea via a sea outfall. Septic tanks were emptied only on request, and sludge was also disposed in the sea through the sea outfall. By the 1990s this was causing gross pollution of the coastal areas. The aging sewerage system experienced frequent collapses and overflows. At this time, rapid urbanisation, industrialisation and the development of the tourist industry centred on the area's beautiful beaches and the natural environment, called for urgent improvements in sewerage management. Despite lacking funds, the local authority carried out these urgent improvements, using loans from the federal government. Planning was also carried out, for improved management of sewerage and sludge, and the land allocated for this purpose.

As part of the federalisation and privatisation drive, large budget allocations were made to refurbish and upgrade the sewerage infrastructure, including aging sewers and pump stations. A new centralised sewage treatment plant with a capacity of 800,000 people equivalent was built to replace the sea outfall at Jelutong. A second sewage treatment plant with a capacity of 650,000 people equivalent was also built to replace the old overloaded one in Bayan Baru in the south east of the island. Both incorporated sludge reception facilities to treat tankered sludge. An existing sewage treatment facility serving the tourist belt at Batu Ferringhi in the north coast of the island was refurbished and upgraded.

These massive projects, coupled with better management, and an awareness program, facilitated vast improvements in service delivery. Sewage overflows which had been a common occurrence, were eliminated. Desludging was done regularly and sludge was properly treated before disposal. Treatment plants performed much better, with compliancy exceeding 90 percent.

Sewerage and septage services in Penang Island
The sewerage profile of Penang in 1994 and 2016 is shown Figure 3.[1] A large proportion of the population

Figure 2: Map of Penang Island

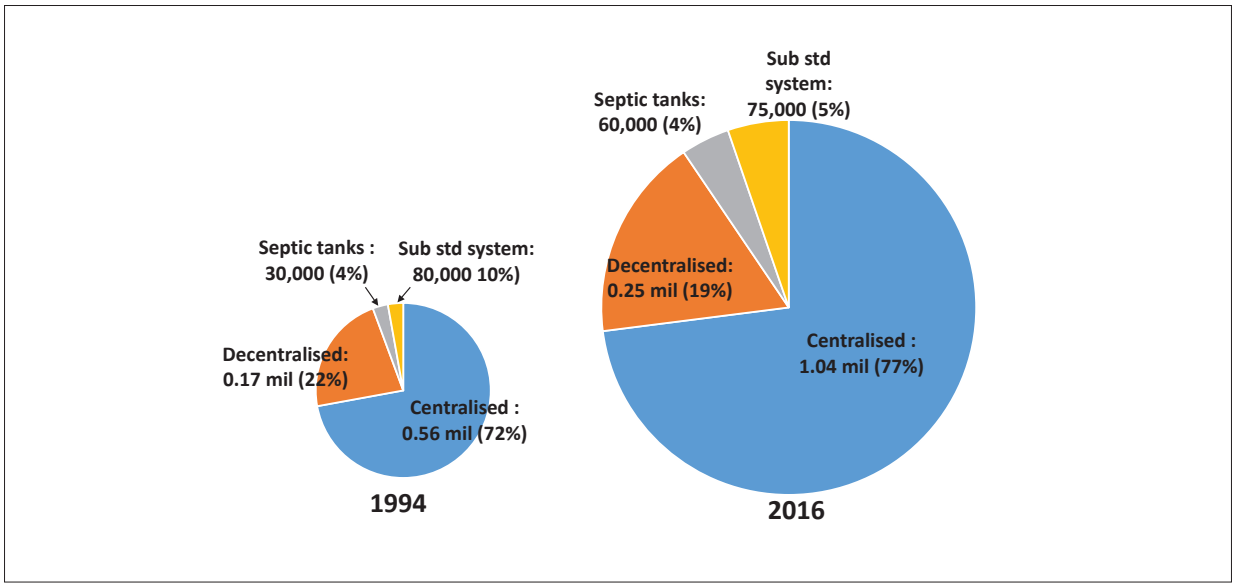

Figure 3: Penang sanitation/sewerage access profile

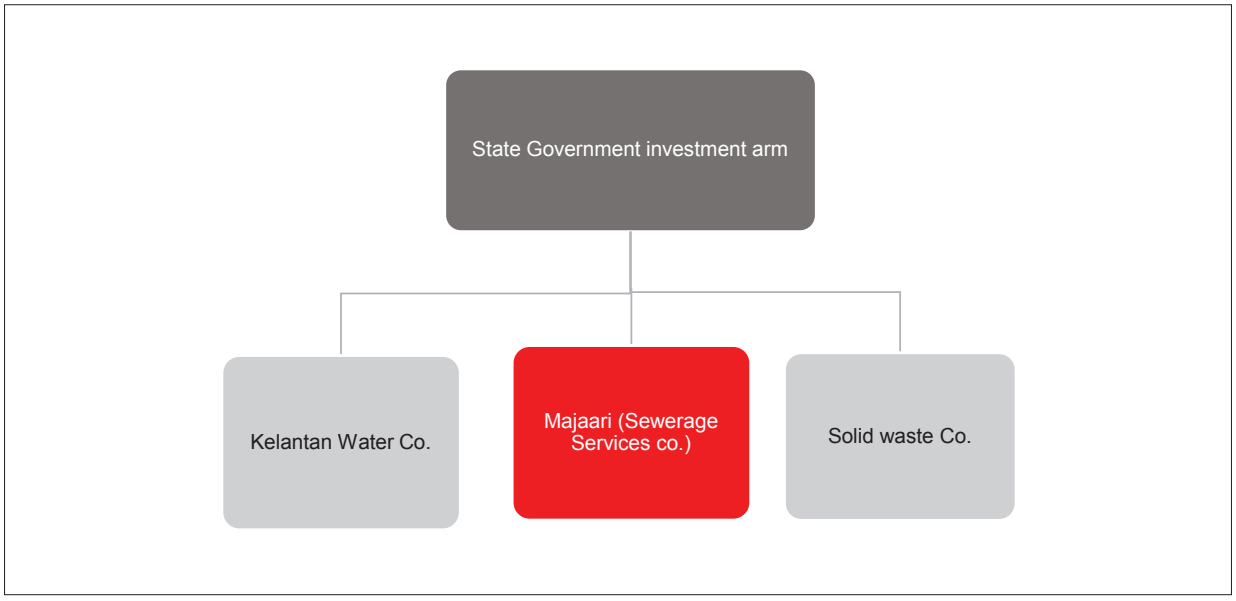

Figure 4: Structure of water and sanitation services in Kelantan State

is served by centralised sewerage, and the percentage of households using septic tanks and other systems is small. Three large centralised sewage treatment plants in Jelutong, Bayan Baru and Batu Ferringhi now serve more than 77 percent of the population. Indah Water Konsortium manages the sewerage in Penang, with a total staff of 149, including 15 in the sludge management section. The unit operates seven tankers, and most of the sludge is disposed in the reception facility at the Jelotong Sewage Treatment Plant where it is dewatered and the filtrate co-treated with the sewage. The Bayan Baru Sewage treatment plant also has sludge reception facilities.

Kota Bharu, Kelantan State

Kota Bharu is the capital city of Kelantan State in the North East of Peninsular Malaysia. It is the capital of the medium sized, largely rural state. The city, with the adjoining peri-urban areas is around 400 sq. km, and has a population of close to 500,000.

When federalisation and privatisation of sewerage took place in 1994, Kelantan State opted not to participate. Sewerage management continued under the jurisdiction of local authorities until 2007, when the state government set up a company, Majaari Services, wholly owned by the state government's investment arm. The state's water supply company and solid waste management company is also owned by the state government, and are sister companies to Majaari, as shown in Figure 4.

Sludge services in Kota Bharu

Majaari operates throughout the state, across 12 local authorities. It has a small workforce of 38.

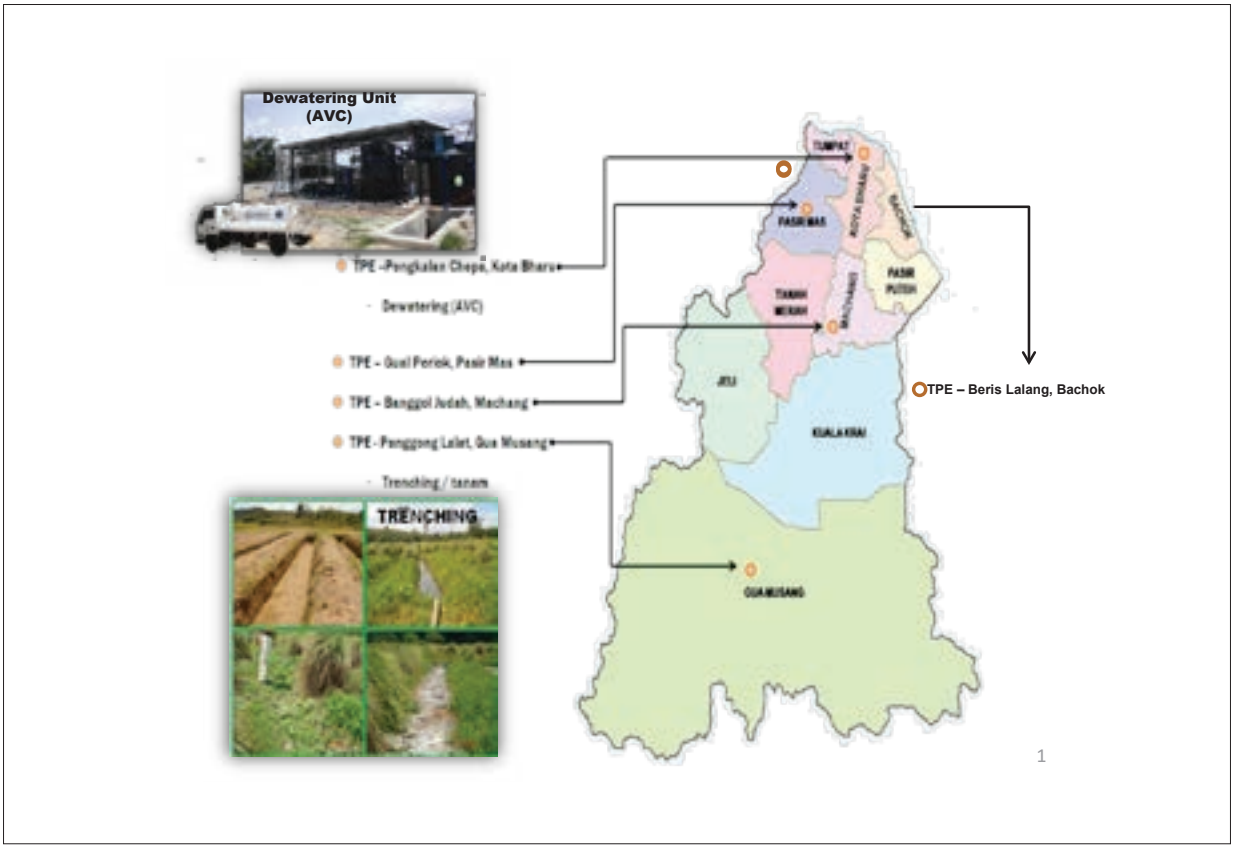

Figure 5: Kelantan sludge treatment and disposal facilities

The state has a total of 45,000 septic tanks and close to 70,000 pour flush or sub-standard septic tanks. About 10 percent are being desludged on schedule. The average monthly number of desludgings is about 290. Desludging demand has been increasing at the rate of almost 4 percent per year.

Sludge collected from Kota Bharu is sent to a semi mechanised dewatering unit where the filtrate is co-treated in an oxidation pond. In addition, there are four trenching sites in the state, in the more distant districts. Majaari has plans to increase its tanker fleet. It is also exploring reuse possibilities, especially composting and bio-char production. Being under state management, Majaari enjoys several advantages:

- Land issues are easily handled as land is a state matter. The company is able to obtain consent from state government to use sewerage sites for subsidiary purposes (such as siting of bill boards and telecommunication towers) and generate revenue
- Being the sister company of the water supply company, joint billing and collection synergies can be leveraged
- Being the sister company of the solid waste company, co-management of sludge solids and potential of co-composting opportunities exist
- Local authorities are also under state government, so the company is able to work with local authorities to link scheduled desludging to licensing of commercial premises, and potentially use local government regulations to enforce desludging

Disadvantages:

- As a small state based entity, it lacks the resources and capacity of a large centrally managed entity such as Indah Water
- The company faces financial and operational constraints, and operates on a low tech, low cost basis, subject to affordability.

LESSONS LEARNED FROM THE SEWERAGE AND SANITATION SECTOR IN MALAYSIA

Co-existence of sanitation systems is essential. The de-facto policies and philosophies of sewerage development accept the reality that a whole range of sanitation / sewerage systems are needed. These will continue to co-exist, and through specific demand drivers, the range will evolve, shedding the simpler and less effective systems and upgrading to better systems up the sanitation ladder. The concession agreement stipulates the targets for the eventual mix of sewered and on-site (septic tank) systems for different categories of urban areas. Also required is the gradual phasing out of pits and pour flush systems in urban areas, and refurbishment of all sewerage systems to meet regulatory standards.

Perceived value of sewerage and septage services is important. The nature of sanitation and sewerage as public goods means that after a certain point (usually outside the immediate vicinity of the household), the user does not perceive any added value, and the benefit is more to the community or larger environment. This was a key factor, which constituted a flaw in the model of full cost recovery from tariffs. The concession agreement intended to pass on full responsibility for capital and operating expenditure to the concession company, which in turn had to recover these costs from tariff revenue. In hindsight, a "user & beneficiary pays" model would have been more appropriate.

Information and awareness raising are crucial. The model of charging users directly was introduced abruptly without adequate information and awareness raising. Most local authorities had never imposed direct charges for sewerage, and for septage emptying services, the charge was minimal and on provision of service. Also, there was no scheduled emptying, and the charges were very low, because septage was not treated, but simply dumped.

Willingness to pay must be established. Most people considered sanitation and sewerage the responsibility of local authority, already paid for by the local property tax. With federalisation and privatisation, users had to pay a separate monthly sewerage/septic tank charge, which was perceived as double charging. Sanitation and sewerage services are generally invisible to the user, which made the charging of tariffs even more unacceptable. The tariff of MYR 8.00 (USD 2.00) per month per house (introduced in 1994 and unchanged since then) was and is very low, and is certainly affordable for almost all Malaysians. But the above factors, and the fact that payment could not be easily enforced, resulted in a very low willingness to pay. In addition, the tariff was heavily skewed with high tariffs for commercial customers. This caused a political backlash resulting in downward revision of the commercial tariff.

Scheduled septic tank emptying (1994–2008) is a must. A major responsibility of the concessionaire was the scheduled emptying of close to 800,000 septic tanks (now 1.2 million). The users were billed MYR 6.00 (USD 1.50) per month per house (1994–2008) and their septic tanks would be desludged once every two years.

The immediate challenges were:

- **Creating a database of the locations of all the septic tanks**, starting with trawling through local authority records and later through painstaking house by house ground surveys
- **Scheduling emptying and issuing advance notice** to the householder, using this database
- **Acquiring new tankers**. Some tankers were transferred to IWK from local authorities, but many of these were decrepit and had to be scrapped and new tankers acquired.
- **Drawing up a sludge strategy** with immediate, short, medium and long term plans was required. Because there were almost no existing sludge treatment or disposal facilities, a sludge strategy with was drawn up. The immediate strategy involved co-treatment in oxidation ponds and other treatment plants. In the meantime, sites were identified for treatment/disposal, and approvals obtained from the environmental authorities.

Figure 6: Incremental improvements in sludge treatment technology

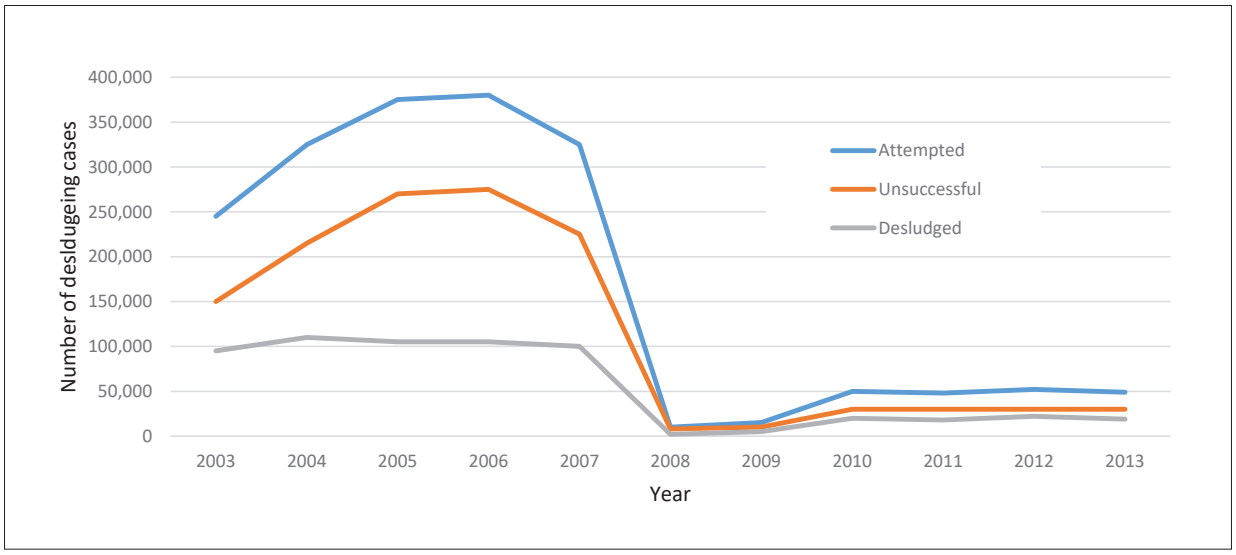

Figure 7: Septic tank desludging trend

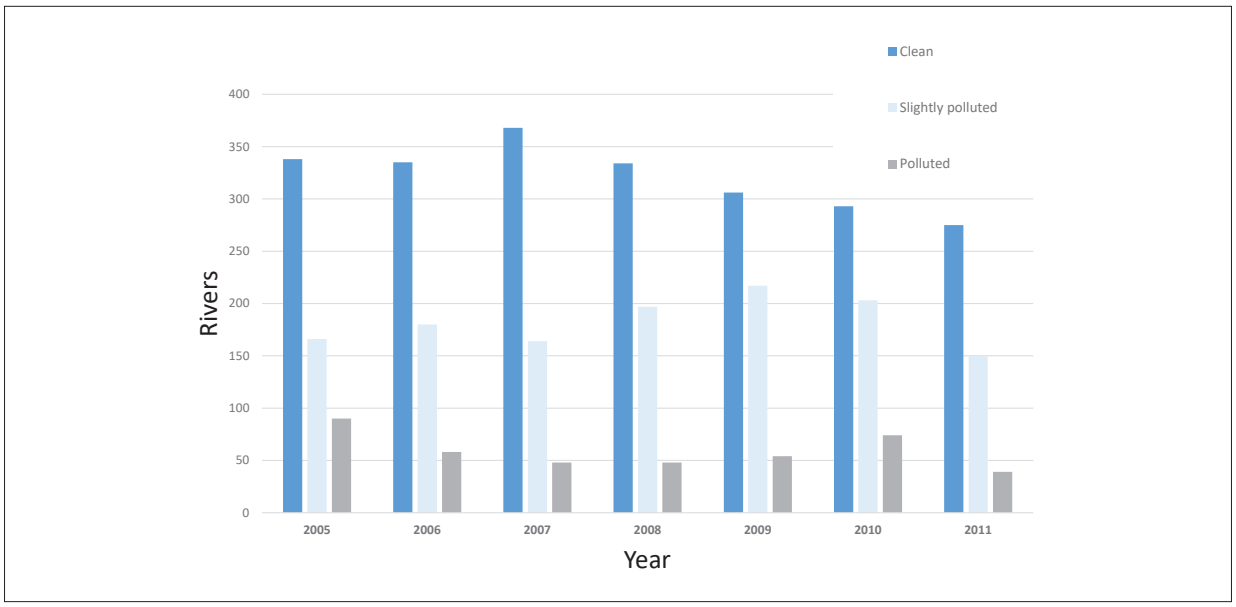

Figure 8: River water quality trend

- **Gradually upgrading systems.** Initially basic systems such as trenching were used, and gradually these were upgraded to drying beds, mechanical dewatering and full scale regional sludge treatment plants. The liquid portion was usually co-treated with sewage.
- **Focusing on removal, treatment and disposal,** rather than on reuse and resource recovery.

The considerable efforts of IWK resulted in a success rate of desludging of around 30 percent, which although low, was by no means a small achievement considering the lack of enforcement by the regulators. The reasons for the low success rate of scheduled desludging were:

- Owners refusal: a lack of awareness of how the septic tank functioned and why it had to be desludged
- Owner not present at time of scheduled emptying and therefore being unable to empty
- Inaccessible premises or septic tanks
- A total lack of enforcement

In 2006, the government passed the Water Services Industry Act, which came into force in 2008. This law shifted the responsibility of desludging to the house owner. House owners were obliged to get IWK or any licenced tanker operator, to desludge their septic tanks once every three years. However, sludge had to be brought to an approved facility. As a result, in 2008 scheduled emptying by IWK was stopped, leading to a huge drop in sludge removal and a significant decrease in river water quality.

The latest proposal being considered by the regulator is a volumetric tariff, which will be the same as the tariff for connected services (sewerage). Scheduled

Figure 9: Sludge treatment facilities

desludging will be reintroduced with septic tanks being desludged once every three years. IWK will manage the scheduled desludging, and contract out part of this task to licenced tanker operators. With the volumetric tariff, improved awareness and more stringent enforcement, the proposal promises to be effective.

Today, IWK provides sewerage and sludge services to almost 24 million people nationwide. Its workforce of 3,336 is highly specialised, and consists of professionals and technical experts. Women play a prominent role, comprising 25 percent of the workforce, and 40 percent at the managerial and technical executive level, in this traditionally male dominated industry. The company operates through 21 unit offices (and 51 operating centres) covering 87 local authorities. It manages 6,488 sewage treatment plants (STPs), 62 dedicated sludge treatment facilities and 18,000 km of sewers.

While tariffs have remained stagnant, business costs have soared. Although operating costs and resources have increased in tandem, performance levels measured in terms of compliance to effluent standards (97 percent in 2015) and customer service (97.6 percent in 2015) have improved vastly.

CHALLENGES

IWK had a rough journey from the beginning, and several serious issues arose.

- Massive default on payment of sewerage bills followed the abrupt introduction of a commercial model that charged customer tariffs. Although the tariff was quite low (USD 2.00 per month/household) and affordable to most, the bulk of consumers believed sewerage services should be part of municipal services, for which they were already paying local taxes. The fact that sewerage services are generally not visible did not help.
- Massive refusals meant that only 30 percent of septic tanks were emptied, despite being scheduled. This was in part due to poor enforcement by the regulators, coupled with a lack of sludge treatment facilities and difficulty obtaining suitable sites.
- The financial model of the concession was faulty, and the scale of the physical infrastructure, work required, costs and other factors had been underestimated. The tariff was inadequate.
- Lack of political will to review the tariff, enforce collection and make the concession viable.
- With federalisation, the role of state and local governments shrank to almost negligible levels, causing them to be left out of the process.

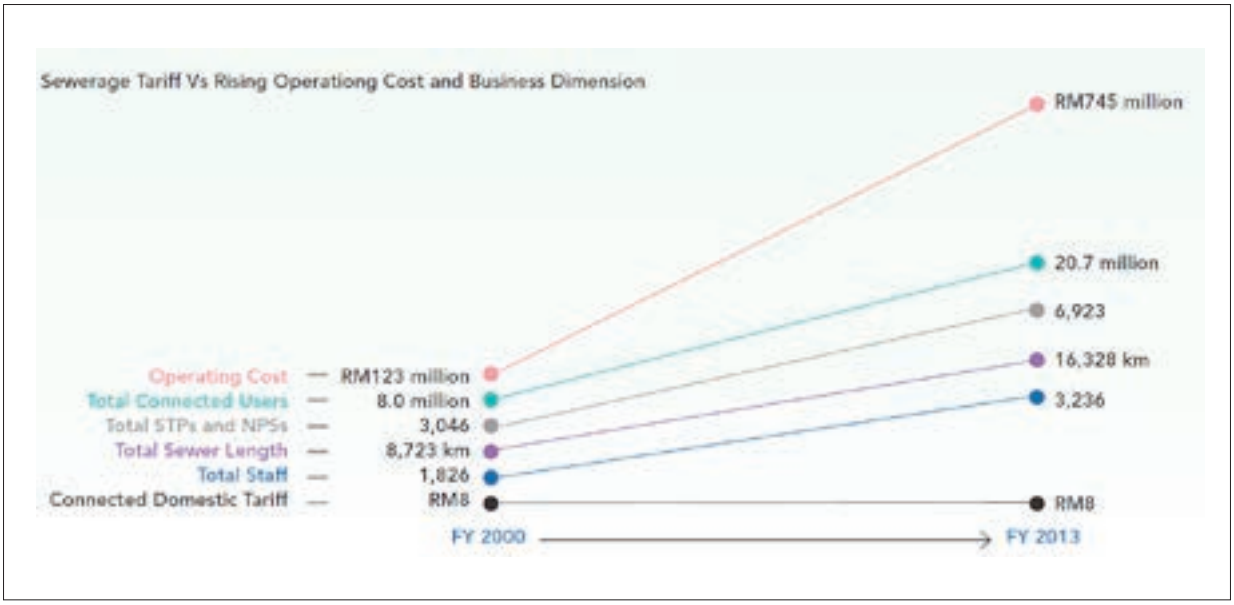

Figure 10: Indah Water business dimensions

Figure 11: Success factors

- Water and sewerage management were separated, with water supply remaining in the hands of state government.

As a result, Indah Water (IWK) ran into serious sustainability problems. While a lot of physical and management improvements took place, community acceptance was poor and financial viability was seriously lacking. This resulted in the federal government acquiring the entire equity of Indah Water Konsortium in 2000, and it continues to operate today as a government owned company. Public acceptance has improved, but tariffs remain low. The company regularly records an annual deficit of several hundred million ringgits, which is covered by the government in the form of a subsidy. As a government owned company, commercial considerations have generally taken a backseat.

In 2008, the government decided to decentralise sewerage management by integrating it with the state water supply companies. The Water Services Industry Act (WSIA) intends to gradually bring about the integrated management of water and sewerage under separate state entities, eventually resulting in a single volumetric water/sewerage tariff. The Act also envisages an asset-light model for the service licensees (operators), with the assets held by a separate entity, the facility licensee. This process is ongoing, but progress is very slow.

ACHIEVEMENTS

In spite of these problems that caused the government to reverse the privatisation, the sector has achieved great traction and momentum. This has been a resounding win. What are the achievements?

- **A very strong regulatory framework**, supported by institutional arrangements with clear roles for funding, asset provision, regulation, operation and management, as well as for various support roles.
- **Focused investment**, resulting in excellent infrastructure improvements, making many of them world class. Dilapidated treatment systems and sewers were rehabilitated and refurbished to good operating condition.
- In spite of its limited success, **the scheduled desludging regime has proven its value**. Sludge transport and treatment/disposal in a safe and orderly manner has been established.
- **The regulatory and institutional framework helped control developer investment**, with good quality infrastructure being provided by developers, which on completion was managed by IWK.
- **Systematic planning of sewerage and sludge management** ensured that the required infrastructure was provided in stages.
- **Development of systems and procedures for operation and management** of sewage and sludge management infrastructure.
- **Pervasive awareness was created** of the importance of good sanitation and sewerage management.

- **Training, skills development and capacity building has been largely successful** in creating industry capability.

What were the factors that contributed to the success?

- There was a very strong **driver** (the federal government) and political push for the whole process.
- While there was no written **policy** governing sanitation/sewerage, de-facto policies were recognised and institutionalised in laws, guidelines and procedures.
- Strong **legislative** arrangements gave legal basis to the initiatives. The Sewerage Services Act and its successor, the Water Services Industry Act and its various derivative legislation, provided a strong framework for the improvements.
- **Roles** and responsibilities of government, the regulator, operators, developers and others were clearly defined
- Federalisation resulted in **focused funding allocation** and massive investment in infrastructure improvements.
- **Private sector participation** helped develop guidelines, operating instructions and systems to bring the whole range of related activities, from planning, design, construction, operation and maintenance and overall management, to levels of excellence.
- **Appropriate technologies** were adopted with gradual upgrading, giving time and space for learning and adaptation
- Internal **monitoring and control** together with stringent regulatory oversight ensured everything was well controlled and weaknesses were identified and addressed
- Strong efforts by IWK in particular created **awareness and enhanced communications** among the community.
- **Training and capacity building** efforts, again spearheaded by IWK, created a large pool of people with the expertise and skill to support the industry.

On the downside, however:

- Although the federalisation approach brought quick gains, state and local governments despite being **key stakeholders were left out of the process**, giving rise to various issues.
- Sanitation and sewerage became federal government matters, while water supply remained a state government responsibility. This **broke the synergy** between water supply and sewerage management.
- The financial model of CAPEX / OPEX recovery from the tariff was seriously flawed, and there was a wide gap between revenue and costs. Even after CAPEX responsibilities had been assumed by the federal government, IWK needed a **huge shareholder subsidy** to continue to operate.

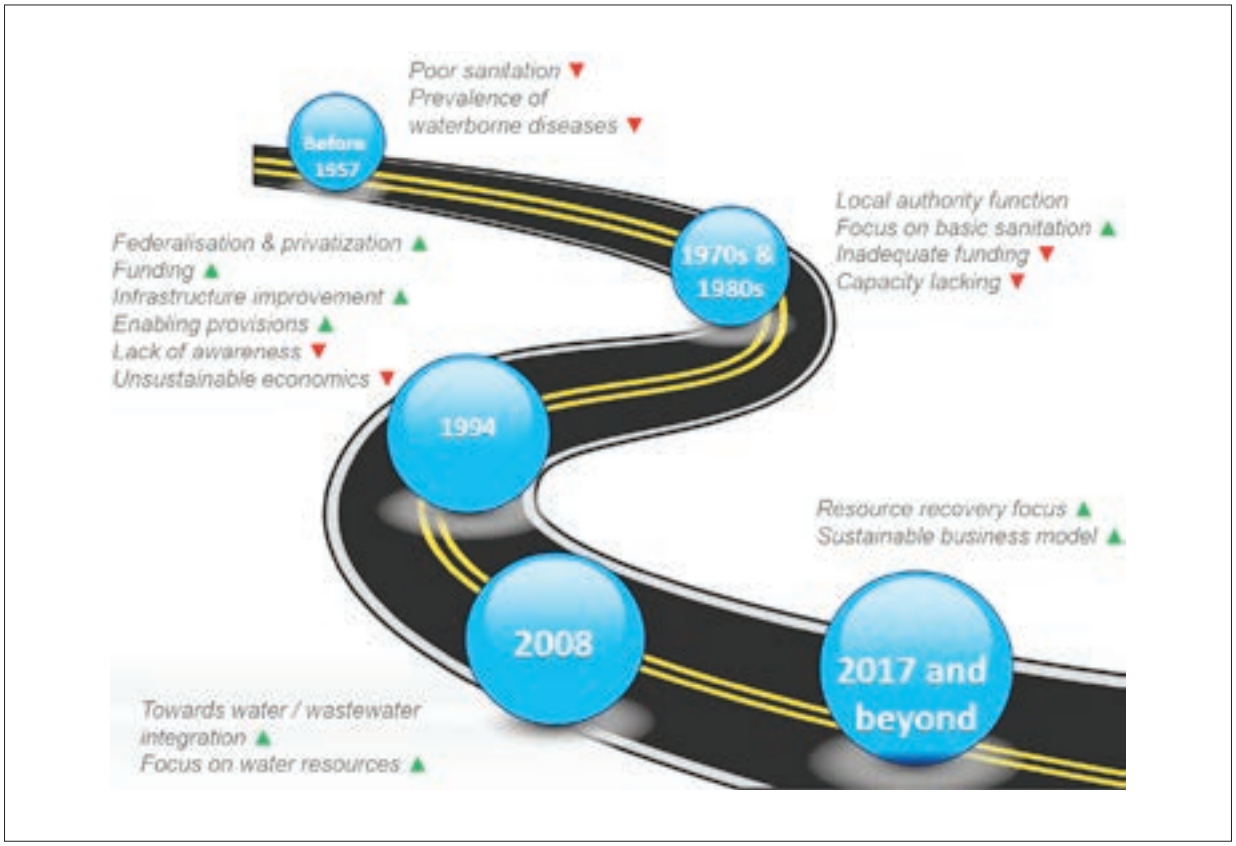

Figure 12: Malaysia's sanitation and sewerage journey

- **Public acceptance** of the tariffs was low and collection rates were poor.
- Developer investment in sewerage infrastructure far outstripped government investment. Coordination issues resulted in **wasteful investment** in many cases. Developer built infrastructure often suffered from **quality issues**.
- The policy of developer built sewerage infrastructure caused an increasing number of sewage treatment plants (STPs) to be built, most of them small and of various design, resulting in **logistical nightmares** for the operator.
- In the whole process, **opportunities for resource recovery** (effluent reuse, sludge biosolids reuse and energy recovery) were completely left out.
- The **well-intentioned scheduled desludging regime** met with failure due to lack of follow though enforcement.
- **Sub-standard systems and grey water** continue to be a major issue in many parts of the country.

OUTSTANDING CHALLENGES AND NEXT STEPS

Malaysia has come a long way in the last few decades in sanitation and sewerage management. Much has been achieved in terms of physical infrastructure, regulatory and institutional structures, capacity, education and awareness. However, shortcomings remain. Looking back over the last few decades, the way forward is clear: Malaysia intends to forge ahead in this sector by charting the most appropriate and sustainable path for itself.

THE WAY FORWARD IS CLEAR: MALAYSIA INTENDS TO FORGE AHEAD IN THIS SECTOR BY CHARTING THE MOST APPROPRIATE AND SUSTAINABLE PATH FOR ITSELF

- The coming years will see the sector **consolidating its primary roles** to continue to protect public health and protect water resources, while striving to provide nuisance free living space for the enhanced quality of life for the people.
- Priority will be given to **resource optimisation, reuse and recovery**.
- Attempts will be made to **define and coordinate** the roles played by various agencies in line with national goals.
- Public and private investment in the sector will be coordinated and **innovative funding** sourced, both for CAPEX and OPEX.
- **Appropriate waste management strategies** based on local needs will be formulated.
- Elements of **whole life cost, low-energy systems, standardisation and low carbon footprint** will be incorporated.

All these considerations have been incorporated into in the National Sewerage Planning Policy and Strategy, which will form the basis of the National Sewerage Development Plan. This is expected to take the sector in Malaysia to even greater heights.

NOTES

[1] Estimated by author based on information frrom IWK

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ACRONYMS

CAPEX	capital expenses
IWK	Indah Water Konsortium
OPEX	operational expenses
STP	sewage treatment plant
WSIA	Water Services Industry Act

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Emerging Lessons on FSM from Maputo, Mozambique

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EXECUTIVE SUMMARY

This case study describes the process of establishing faecal sludge management (FSM) services across an entire municipal district (population 150,000) in Maputo. Small-scale solid waste collection enterprises have successfully moved into the FSM business, where they have become economically viable. Key enabling factors were a systematic sanitation diagnostic, the problem-based approach of the municipal council, the enactment of by-laws recognising and regulating FSM services, and the existence of the solid waste micro-enterprises, supported by seed funding and a dedicated technical assistance team. Outstanding challenges include the development of funding and payment mechanisms to make the services affordable to the poorest residents, and development of improved technology for emptying pit latrines. There is also a need for a degree of consolidation in the FSM market to create larger and more robust enterprises capable of providing a full range of faecal sludge emptying and transport services. Looking further ahead, improvement of, and linkages with the upstream (on-site facilities) and downstream (treatment and re-use) parts of the sanitation service chain merit further applied research.

CONTEXT

Maputo, with a population of about 1.2 million, is the capital city of Mozambique, and forms part of the largest conurbation in the country, with a population fast approaching two million. About a third of Mozambique's population (of 27 million people) is urban, which is close to the average for Sub-Saharan Africa. But of these, a high proportion (about 80 percent) lives in informal settlements, a proportion that is not decreasing as urban migration continues, with an annual urban growth rate of 3.6 percent. Although the Greater Maputo area is richer than the rest of the country, that must be taken in the context of a national GDP per capita of less than USD 600, which places the country amongst the poorest five percent, and growing (though hard to quantify) urban poverty.

About ten percent of Maputo residents are connected to sewerage, about 35 percent use a septic tank (though many are quite crude) and 55 percent use a pit latrine. Open defecation is uncommon, practised by only around one percent of the urban population. As the water supply network expands into the unplanned areas and water availability increases, residents are rapidly switching from pit latrines to septic tanks. Between 2011 and 2013, in the area where the work presented here was undertaken, household water connections rose from 36 percent to 79 percent, the use of septic tanks increased from 15 percent to 46 percent, and the use of pit latrines decreased from 85 percent to 54 percent. Despite the overwhelming prevalence of on-site sanitation, FSM services are limited, especially in the unplanned peri-urban areas, where the majority of the sanitation facilities are emptied manually by traditional pit emptiers (43 percent) and family members (20 percent). The faecal sludge is dumped into open drains, open spaces, solid waste collection points, or buried it in backyards, which are now becoming full due to repeated sludge burial and the densification of housing.

Recognising that on-site sanitation is too important to be left to individuals and an unregulated informal sector, Maputo Municipal Council (MMC), in partnership with the World Bank's Water and Sanitation Program (WSP) and the NGO Water and Sanitation for the Urban Poor (WSUP) undertook a project to improve sanitation across the entire district of Nhlamankulo, an unplanned area with a population of about 150,000 (figure 1). In this context, eight FSM service providers were set up in April 2014, based on pre-existing primary solid waste collection micro-enterprises. They were trained and equipped with manual and mechanical emptying equipment, with the objective of understanding the business logic of small-scale pit emptying enterprises for subsequent scaling-up across the four other peri-urban districts of Maputo.

Although sanitation is the responsibility of the municipal councils in Mozambique, on-site systems,

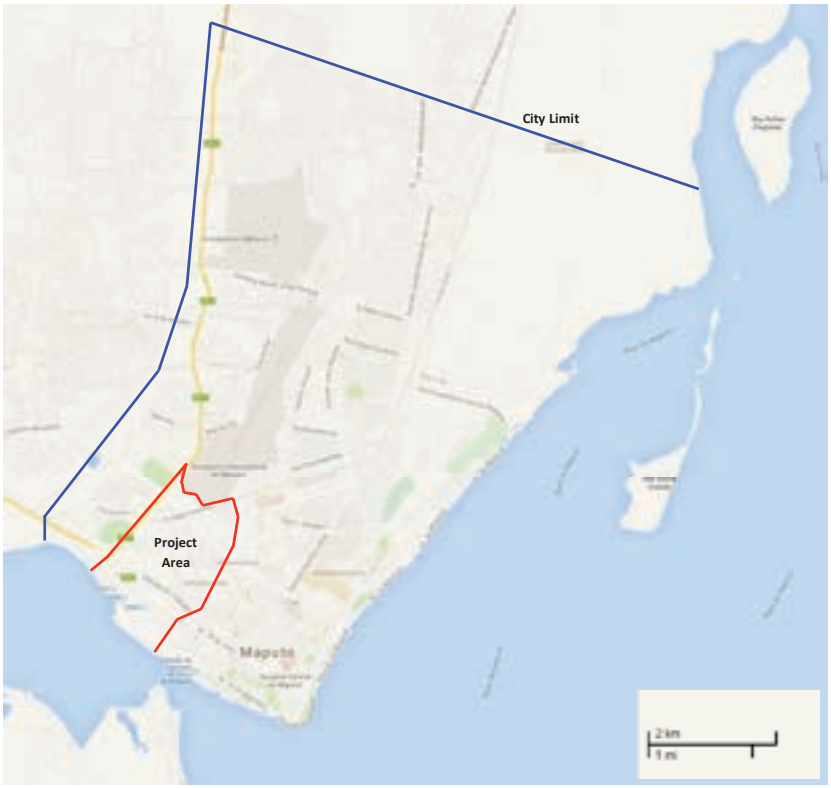

Figure 1: Map of Maputo and the Nhlamankulo project area

while recognised as an option in national policy, have been left largely to individual initiative. Residents build facilities that are not subject to building inspection in the unplanned areas, and emptying services were unregulated until the enactment of new sanitary by-laws in 2016.

NATIONAL AND CITY LEVEL POLICY

Following the promulgation of a national water sector policy in 2007, and a subsequent wide-ranging stakeholder consultation process, in 2011 the Government of Mozambique approved the National Urban Water and Sanitation Strategy (NUWSS), laying out the general principles for urban water and sanitation services planning and delivery. However, the development of implementation tools and plans for sanitation was limited by a lack of investment in the subsector, although investment and expansion of water supply services in urban areas continued.

In a related process, a new sector institution, the Water and Sanitation Infrastructure Board (AIAS, by its Portuguese acronym) was established in 2009 to lead investment and planning for water supply in secondary towns and public sanitation systems in all urban areas, and the remit of the water supply regulator (CRA) was expanded to include public urban sanitation systems.

However, the legal mandate for onsite sanitation remains with the municipal councils.

THE DEPUTY MINISTER FOR WORKS AND HOUSING INITIATED A PROCESS WHICH RESULTED IN AN INTEGRATED PLAN FOR URBAN SANITATION

In parallel, following the AfricaSan-3 conference in 2011, the Deputy Minister for Works and Housing became aware of the growing problem of urban sanitation, and initiated a process involving 12 ministries and agencies with an interest in sanitation, which resulted in an integrated plan for urban sanitation. Importantly, this was supported by the Planning Ministry, which enabled the establishment of a specific line for sanitation in the national budget and thus the tracking of expenditure on sanitation, as well as triggering the much-delayed promulgation of the NUWSS.

The NUWSS charges municipal councils with managing all parts of the sanitation service chain

under a comprehensive approach covering both planned and unplanned areas. It envisages the establishment of autonomous sanitation agencies in the larger cities, funded by a surcharge on water bills. However, general legislation allowing local governments to set up such entities is yet to be enacted and would also fall foul of government guidelines on municipal financial management. The situation is further complicated by the fact that CRA regulates the water tariff – and, by extension, water bills – but, having been designed to regulate independent utilities, does not have legal standing to regulate municipal councils. This led to an impasse whereby the surcharge could not be implemented. After much discussion at a high political level it was agreed that a modest surcharge could be collected as an interim measure.

Following considerable preparatory work collecting information on the sanitation situation and defining the scope of basic sanitation services, MMC decided to pilot improved FSM services at the level of a Municipal District, as a first step towards developing a city-wide approach. In support of this, MMC developed a Municipal Sanitation By-law (the first of its kind in the country)[1], which recognizes and regulates FSM service provision in peri-urban areas, based on the lessons learnt from this pilot. The by-law creates incentives for the private sector to expand services in peri-urban areas, and for residents to be more vigilant in protecting their health and environment. It also allows for MMC to develop service models and payment mechanisms to facilitate the access of poor households to FSM services.

The pilot and municipal capacity development activities were shared with other municipal councils during a National Urban Sanitation Workshop in 2014. This brought together senior national, provincial and municipal leaders with technical specialists from line ministries and agencies and development partners and brought urban sanitation into the political frame.

Figure 2: National urban sanitation workshop

Subsequently, Beira Municipal Council (the second largest city in Mozambique) decided to regulate sanitation services and expand service provision (previously monopolized by the Municipal Council) to the private sector[2]. Other cities are also embracing the initiative, engaging the private sector and developing municipal sanitation byelaws.

MOST OF THE EXISTING INSTITUTIONS ARE NOT DISCHARGING THEIR RESPONSIBILITIES EFFECTIVELY, AND SERVICE PROVISION IS HIGHLY FRAGMENTED AND POORLY COORDINATED

FAECAL SLUDGE MANAGEMENT PRIOR TO THE INTERVENTION

Replacement of pits when full is still quite common, practised by about 50 percent of households in the less densely settled peripheral areas of the city, and 30 percent in the inner-city slums, where population density reaches about 200 people/hectare, and of which Nhlamankulo is an example. About a quarter of the facilities are inaccessible by road for emptying by vacuum tankers, and many that are accessible still have to be emptied by other methods. About one third are unlined or lined with tyres or oil drums, and would collapse if emptied by vacuum truck. Across the city, 37 percent of emptying is done by vacuum tankers, 43 percent by informal manual service providers, and the rest by the householders themselves. Only the faecal sludge emptied by vacuum tankers is taken to the municipal treatment plant (a pond system in an advanced state of disrepair), while the rest is buried or discharged locally.

Responsibility for sanitation in peri-urban Maputo is not clearly defined. AIAS (under the Ministry of Public Works and Housing) is the national agency in charge of sanitation in urban areas, whilst CRA regulates sanitation services. MMC has ultimate legal responsibility for providing sanitation services to its citizens, but is not delivering very effectively on this mandate, due to weak institutional capacity and unclear definition of the services required.

While there are reasonably clear policies and strategies and a defined institutional framework for sanitation service delivery, implementation at

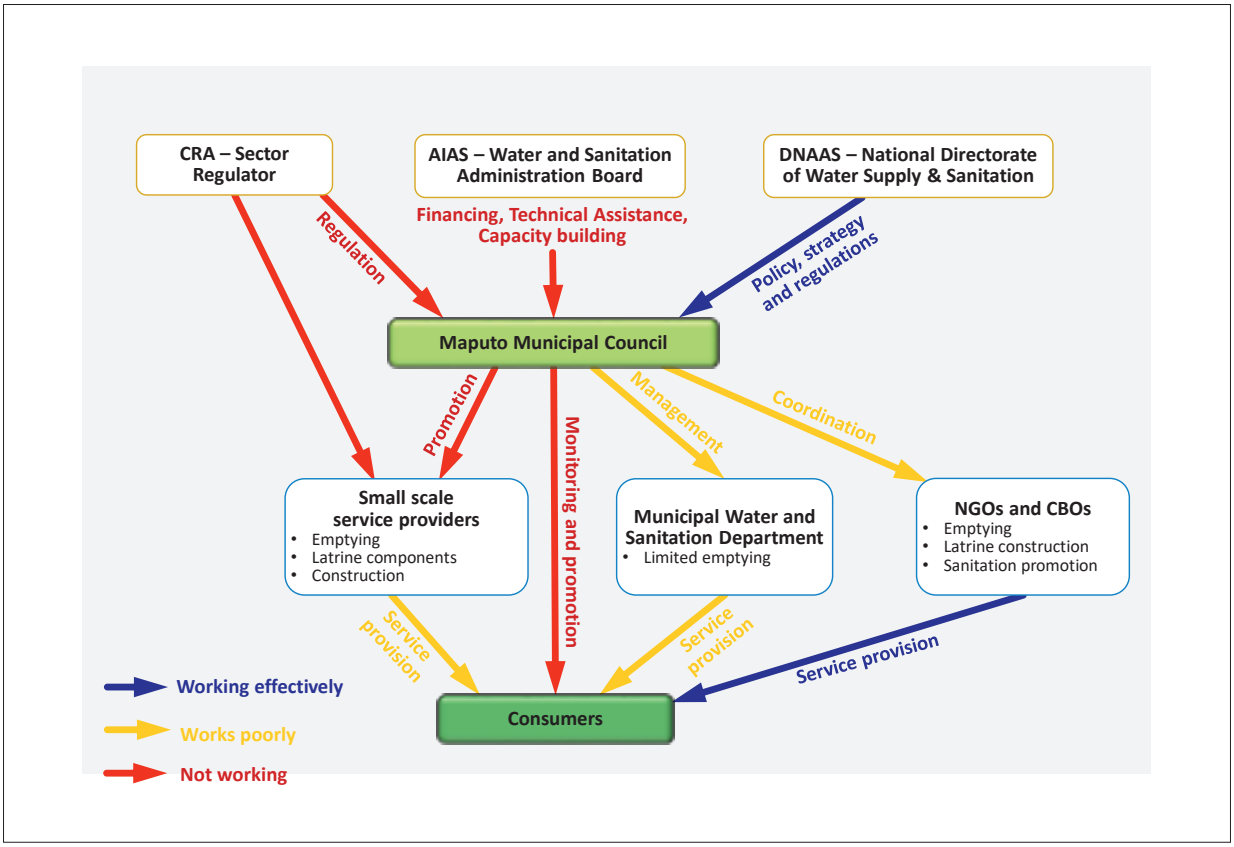

Figure 3: Institutional framework for urban sanitation

municipal level leaves a great deal to be desired. Most of the existing institutions are not discharging their responsibilities effectively, and service provision is highly fragmented and poorly coordinated. The main constraints are in financing, regulation and monitoring, all of which are key elements in effective sanitation delivery. Both CRA and AIAS have only recently been assigned responsibility for sanitation, and still have a long way to go in developing their capacity so that they are able to support local governments to tackle the sanitation agenda. CRA has the mandate to regulate private sector service providers and the autonomous sanitation departments envisaged for the larger cities under current legislation, whilst AIAS is responsible for investing in infrastructure and capacity-building for municipal sanitation entities.

MMC is currently developing a framework to improve sanitation services in Maputo, including the introduction of a sanitation tariff, enacting a new sanitation by-law that directly addresses FSM, and planning – on the basis of the work described here – the roll-out of FSM service provision by private operators across the rest of the city.

- Based on an analysis of the situation, principal FSM needs emerged as:
- Recognising and regulating FSM services;
- Phasing out (or displacing) unhygienic manual emptying practices;
- Upgrading the treatment facility; and
- Developing services capable of emptying on-site sanitation facilities that are difficult to empty or inaccessible by road.

PRINCIPAL COMPONENTS OF THE INTERVENTION

Although this was a pilot, it was designed to be at a scale and under a management structure that could be replicated, and so was designed to cover one of the four peri-urban districts of Maputo. The design of the pilot was based on a sanitation survey from 2011, when the ratio of pit latrines to septic tanks in the district was about 3:1. The FSM service model was consequently designed around transfer stations (simple underground storage tanks) to allow for primary collection of relatively small volumes from pit latrines using small equipment capable of moving through narrow alleyways, and secondary transport using larger equipment. The data quoted in this study refer to the period between April 2014 and April 2016, by which time the majority of residents were using septic tanks, following major water supply improvements in the area.

Eight pilot operators were selected through a competitive process, organised through AMMEPS, the association of MMC's existing peri-urban solid waste management contractors. Although the FSM business was new to all of them, all had intimate knowledge of

Figure 4: Operator and pump

the challenges of working in the peri-urban areas of Maputo. Five "primary" operators were equipped to provide services from collection to the transfer station, using a 0.5m^3 plastic tank mounted on a handcart. Three "secondary" operators additionally received a 2m^3 plastic tank that could be transported the longer distances to the treatment facility on a small truck. All operators were also equipped with buckets, appropriate hand tools, personal protection equipment for the workers, a Gulper for use on pit latrines, and a diesel-powered trash pump for use on the more liquid sludge from septic tanks.

Despite the support of the MMC, local resistance rendered the construction of transfer stations impossible, so each secondary operator was equipped with a 6m^3 vacuum tanker trailer instead. This gave the secondary operators excessive power over the primary operators, and by the end of the project, both primary and secondary operators were using the much cheaper option of the 2m^3 plastic tank for transport to the treatment plant on any suitable truck (easily available for hire in Maputo). Additionally, the handcarts proved difficult to operate on the rough, muddy and narrow alleyways in the area, and were abandoned in favour of direct transfer to the 2m^3 tanks for delivery to the treatment facility. A further reason for the abandonment of the 0.5m^3 handcarts was the large-scale shift away from pit latrines to septic tanks, which greatly reduced the number of emptyings of less than 2m^3 (Figure 5).

Customer feedback showed that the new service was appreciated for its improved hygiene, and the operators noted that the stigma associated with manual emptiers did not extend to them. However, almost 40 percent of those contacting an operator reverted to alternative methods, primarily due to price.

A MAJOR SPIKE IN EMPTYING AFTER THE TV CAMPAIGN CLEARLY DEMONSTRATED THE POWER OF SUCH ADVERTISING, AND THE POTENTIAL OF A FRANCHISING APPROACH FOR MARKETING FSM SERVICES

Initially, the plan was to charge the pilot operators commercial interest rates for the equipment. But the interest rates were too high to allow for repayment while keeping the service affordable to Nhlamankulo residents. Furthermore, it seemed reasonable not to charge for the equipment for a service model that

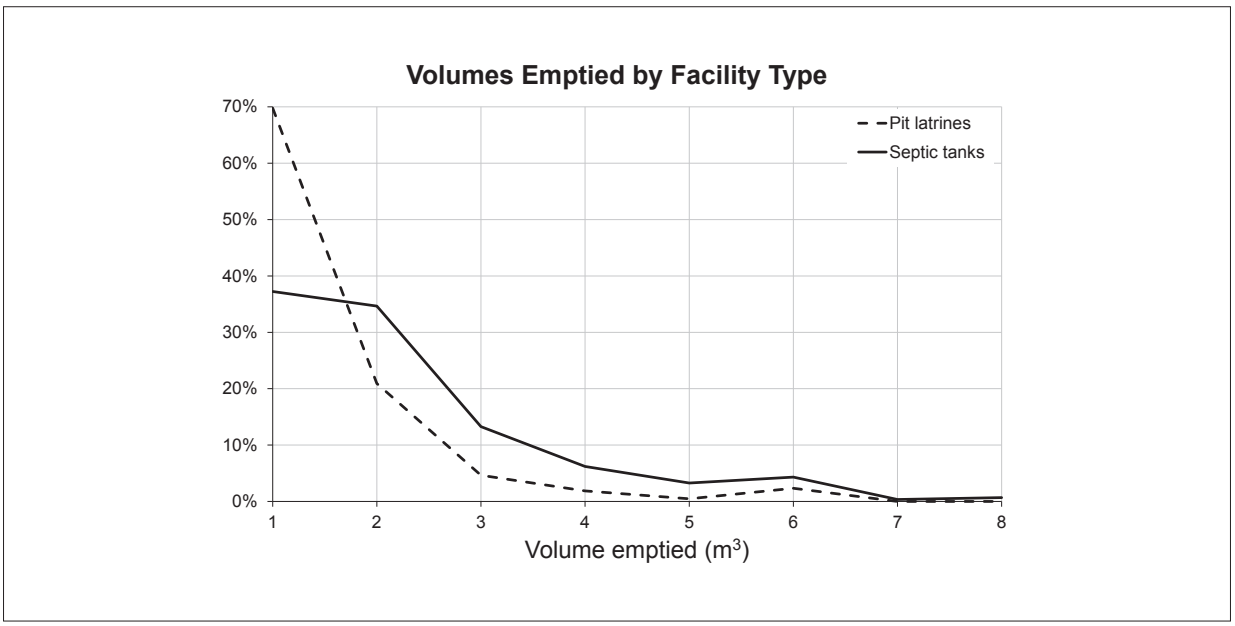

Figure 5: Volumes emptied by facility type

Operator	No. of emptyings:		Revenue	Cost	Operating profit	Depre-ciation	Net profit (loss)
	Pits	Septic tanks	(USD)	(USD)	(USD)	(USD)	(USD)
Primary Operators							
Acadec	52	61	7,645	4,975	**2,670**	2,832	**(162)**
Bejoel	3	63	4,307	1,800	**2,507**	2,832	**(325)**
Magoanine	76	79	7,589	2,963	**4,626**	2,832	**1,794**
Modac	0	41	1,675	1,293	**383**	2,832	**(2,449)**
*(Phatima)**	*1*	*7*	*661*	*470*	***191***	*2,832*	***(2,641)***
Secondary Operators							
Mbonga Mbilo	49	185	10,996	6,488	**4,509**	11,495	**(6,896)**
Siema	77	69	8,635	4,107	**4,528**	11,495	**(6,967)**
Oliveira	0	42	4,976	1,119	**3,857**	11,495	**(7,638)**
Total	258	547	46,485	23,213	**23,271**	48,645	**(25,374)**

** ceased operating*

Table 1: FSM operating costs and revenues for pilot operators

was still under development. The pilot operators were originally charged three percent of receipts, which was paid to a fund held by AMMEPS. This was later replaced by fixed monthly payments of USD 10.00 or USD 12.00 for primary and secondary operators respectively. In addition to the equipment, the pilot operators received technical and business management support.

The service was promoted in the media and through two local sports tournaments. A major spike in emptying after the TV campaign clearly demonstrated the power of such advertising, and the potential of a franchising approach for marketing FSM services. The logo and slogan ("clean toilet" in the local language) were taken up by the service providers and used in flyers. The local authorities were also frequently mentioned by users as a source of knowledge about the services. It was also clear that micro-enterprises, which were also community-based organisations with strong community roots, were easily able to garner customers. Interestingly, the mere occurrence of emptying operations during daylight hours (traditional emptiers tend to work at night, due to the social stigma) also attracted a significant number of customers who would otherwise have been unaware of the services.

FINANCIAL ASPECTS

It should be noted that because the operators were paying three percent of their receipts towards the equipment, the number of jobs and the operating profits are probably significantly under-reported.

Despite this, the primary operators essentially covered their full costs over the first 24 months (Table 1), and are now operating at a profit after refining their business model. The deficit of the secondary operators after subtracting depreciation reflects the high cost of the vacuum trailer tanks, which have turned out to be inappropriate compared with the cheaper option of plastic tanks that can be carried by a light truck.

Prices charged are negotiated with clients, taking into account both the costs of the job (for example, distance to the treatment plant, or the amount of compacted sludge to be dug out) and the perceived ability of the client to pay. The average price per emptying is USD 58.00. As already mentioned, this is too much for some poor households, even with the option of paying in two or three instalments, which some of the operators are offering.

THESE FACTS CLEARLY SHOW THAT THE BUSINESS IS PROFITABLE AT THE PRICES THEY ARE CHARGING

By comparison, vacuum trucks charge USD 30.00–USD 80.00 per service (average USD 53.00), whilst the informal manual emptiers typically charge USD 7.00–USD 13.00 for latrines (often a partial emptying only, depending to the user's ability to pay) and USD 30.00–USD 70.00 for septic tanks. The manual emptiers also require the user to buy creosote to reduce odours

and, usually, home-brewed spirit to be drunk before starting the job.

The demand for FSM services is very variable, rising in the wet season but also due to other factors, such as preparing to receive visitors in the holiday season, or in response to marketing activities. Because of this variability it is important to control fixed costs. A strategy adopted by nearly all of the operators was to contract their trained workers on a daily basis, maintaining only the foreman on a regular salary. Magoanine, a primary operator, arranges to carry out emptyings in coordinated batches, and in this way has managed to reach the same levels of operating profitability as the secondary operators. A specific advantage of the Maputo operators is that they all have primary solid waste collection contracts with MMC, which provides a modest but stable basic income which can be supplemented by FSM work (perceived by them as more profitable) when work is available.

Seven of the eight operators entering the FSM business are still operating and covering costs after two years, several have invested in additional equipment, and two that were community-based associations have now registered as companies in order to access bank credit. These facts clearly show that the business is profitable at the prices they are charging. However, these prices are similar to those charged by vacuum tankers, and well above those charged by traditional manual emptiers – and beyond the willingness to pay of poor customers. This reflects a basic fact of the FSM business, which is that much of the cost resides in transporting the faecal sludge to the treatment plant, and that it will therefore always be difficult for improved emptying with transport to compete on price with traditional emptying and local disposal.

BUSINESS MODELS

One of the factors leading to the high survival rate of these new FSM businesses was that all of them were already established in the solid waste business, under contract to the municipal council. As mentioned above, this made it easier for them to manage the highly variable demand for FSM services, and it also meant that they were already connected to their customer base and knew many of their future FSM clients. Given the linkages between sanitation and solid waste management, there are also technical advantages in having a single operator provide both services.

Some of the operators were formally established as businesses, whilst others were registered community organizations (CBOs). In the latter case, this gave them extra credibility and linkages to their clients, but two of the CBOs registered themselves as companies in order to be able to borrow money for investing in equipment to expand their businesses. This strong degree of orientation of the operators as businesses despite their respective histories suggests that it could also have been a factor in ensuring their survival.

SESSIONS TO INTRODUCE SANITATION MONITORING TO LOCAL COMMUNITY LEADERS HAD THE UNEXPECTED EFFECT OF DYNAMIZING THE LOCAL LEADERSHIP

The operators' association, AMMEPS, was instrumental in setting up the pilot in the first place. They approached the World Bank (which had supported the establishment of primary solid waste collection by micro-enterprises in Maputo) looking for ways to boost their income. In the ensuing discussion, FSM emerged as a promising business area, which formed the basis for the pilot project. Building FSM into pre-existing solid waste collection businesses was successful due to a number of factors: (i) the operators were already established in the target communities and familiar with their potential customer base; (ii) the nature of FSM is similar to solid waste collection and was therefore relatively easy for them to manage; and (iii) the fact that they were already providing solid waste collection services facilitated FSM, in that less solid waste, which is a serious complicating factor in pit emptying, ends up in latrine pits.

CAPACITY DEVELOPMENT

Capacity building was an important factor in building commitment to improved FSM, and sanitation in general, amongst many of the stakeholders. The active involvement of the municipal sanitation department was an important result of their on-going partnership with the World Bank's Water and Sanitation Program (WSP), which focused on the development and implementation of the new decentralized service structure for sanitation services, and revitalizing the department itself, which had been rather neglected. WSP also facilitated several tightly designed knowledge exchange events for the municipal team to learn from other experiences at national, regional and international level.

At community level, sessions to introduce sanitation monitoring to local community leaders on the lowest tier of the municipal administration had the

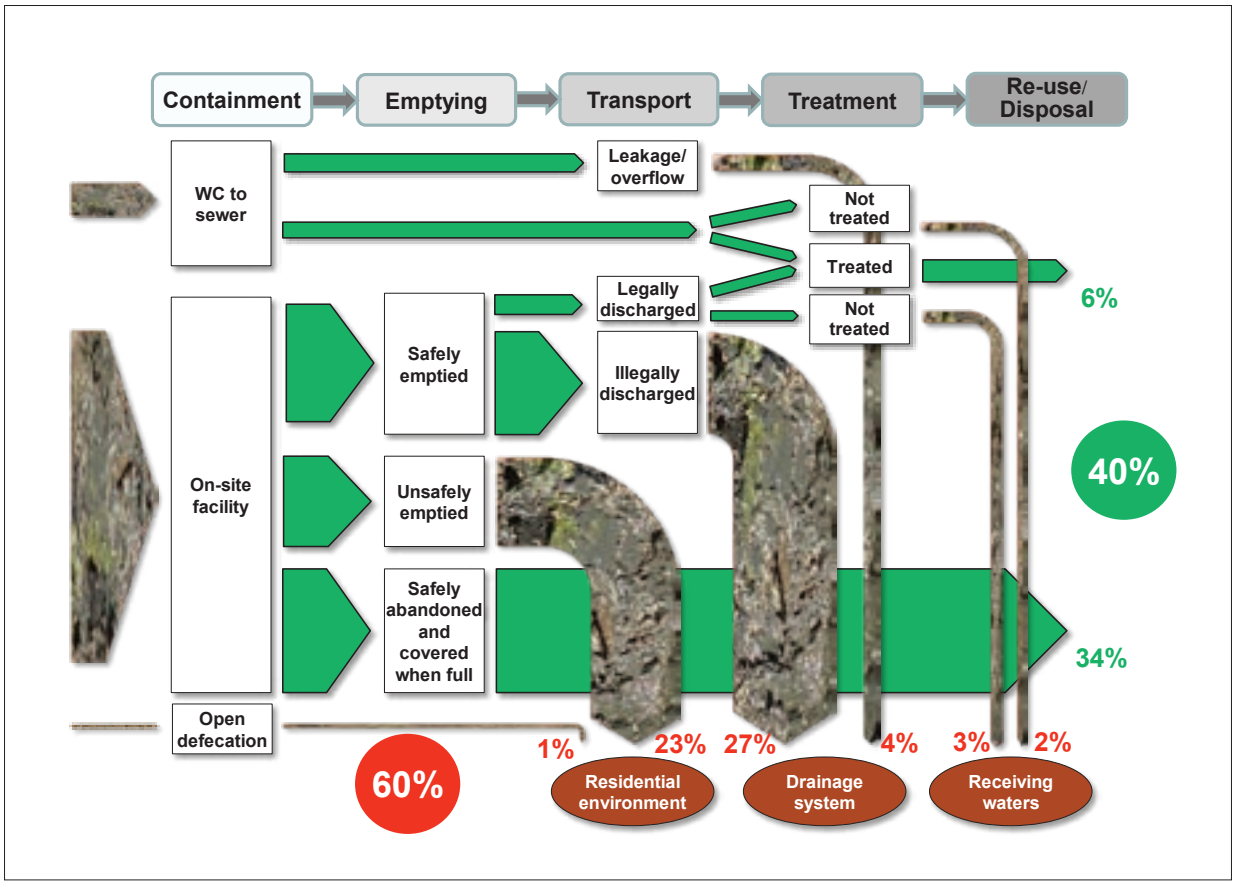

Figure 6: Faecal waste flow diagram for Maputo

unexpected effect of dynamizing the local leadership, when they were forced to confront the reality of the poor sanitation conditions prevailing in their neighborhoods. This followed on into continued support for the FSM improvement program.

An intensive program of technical assistance was provided to the FSM operators involved in the pilot, with three specialists each working about half time providing support on technical, business development and communication aspects respectively. AMMEPS provided the platform for this support, and it is expected to continue playing a key role in building its members' capacity. The operators only repaid a small part of the full costs of the equipment they received, but the equipment has proved adequate as seed capital and they are now able to invest for themselves.

DRIVERS OF CHANGE

The Maputo Municipal Council had, in common with many other cities around the developing world, a decade-old sanitation master plan with detailed and unfunded plans for sewerage, and some vague remarks about on-site sanitation for the non-sewered areas. Around the city there were a number of uncoordinated small-scale NGO-funded sanitation initiatives in progress. Realising that neither of these approaches would lead to city-wide improvement, MMC decided to undertake a city-wide sanitation diagnostic, assisted by WSP. From this it became clear that faecal sludge management in the peri-urban areas was the most pressing sanitation issue (see figure 6), and this informed the design of the project described here, which aimed to develop appropriate FSM services for the peri-urban areas and understand how they might be scaled up city wide.

To overcome various challenges to consolidating and sustaining FSM services, MMC has developed a city-level legal and regulatory framework to guide service provision and private sector engagement. Among the regulatory tools, MMC has drafted the Municipal Sanitation By-law, which allows for and regulates FSM service provision in peri-urban areas, based on the lessons learnt from this pilot. It also includes a set of regulations and guidelines for setting up FSM businesses, technical specifications for service provision and financial and administrative requirements for service delegation by the Municipal Department of Water and Sanitation. Although the by-law itself does not solve the challenges outlined in this study, it creates incentives for service expansion into the peri-urban areas, promotes service models that improve access for the poorest households, and establishes tools to help citizens be more vigilant in protecting their health and environment.

KEY LESSONS LEARNED

The enabling environment

As the chart below shows, progress in the enabling environment was critical in moving FSM improvement forward. In 2011, a senior politician was convinced through advocacy efforts of the need for improvement, and this led directly into the preparation of a national strategy and a plan. In parallel, at city level, advocacy by the WSP was instrumental in convincing the Mayor and his closest advisors of the importance of improving sanitation in the densely inhabited informal areas. The subsequent diagnostic studies formed the basis for a preliminary intervention in 2014, feeding back into further advocacy and the establishment of a legal framework for FSM in Maputo and the start of a city-wide roll-out of the approach developed. This demonstrates how policy and practice reinforce each other, facilitated by advocacy and the collection, analysis and presentation of evidence as progress is made.

Marketing and consumer acceptance

A television campaign incorporating a strong brand image had a major impact on uptake of the improved emptying services, and individual operators made use of the brand in flyers, which they found quite effective in generating business. Some of the operators were part of community-based organisations, and were able to use their strong community networks to promote sales.

Consumers appreciated the cleanliness and positive environmental impact of the new services, which were definite selling points. However, a sizeable minority (24 percent) found the service too expensive and continued to use traditional manual emptiers. This is perhaps to be expected, since a major added element is transport away from the local area to the treatment plant, which is the most expensive component of the service. How to subsidise this effectively and sustainably should be the subject of future work.

Technical factors

Manual emptying cannot be completely abandoned, but better tools are needed in order to improve hygiene and reduce the cost of emptying. There are technical limitations on the mechanised emptying of thicker sludge from dry pits and dense bottom sludge from both pits and septic tanks. This makes pit latrines – on which the poorest people depend – relatively more expensive to empty than septic tanks.

Substantial improvements in piped water supply over the project period resulted in a large number of pit latrines being replaced by septic tanks, which require larger volumes of more liquid sludge to be removed. This had profound implications for the equipment used, and it is important when designing a FSM service to ensure that pumps and tank volumes are aligned with the nature and volume of sludge to be removed.

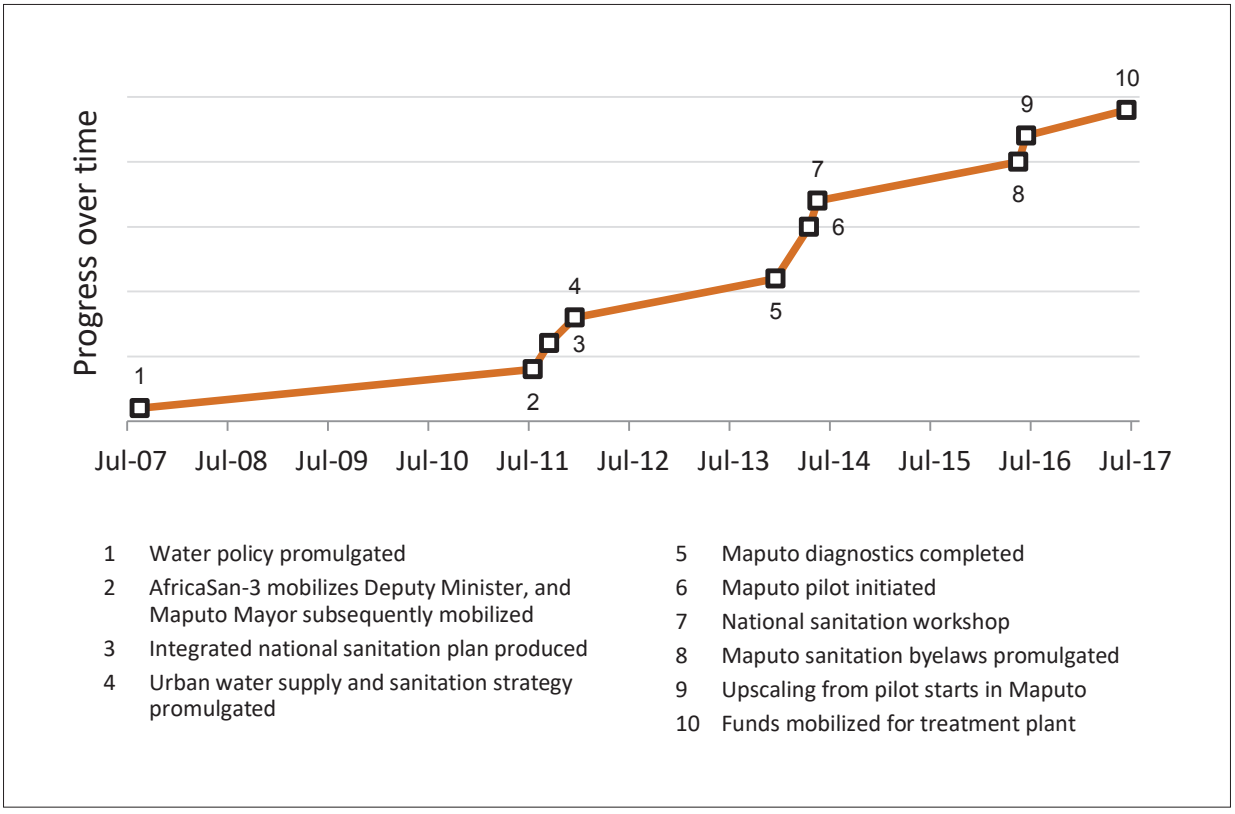

Figure 7: Progress towards improved FSM in Maputo

The FSM business is highly seasonal, peaking in the wet season. Therefore, a micro-enterprise needs complementary sources of income to survive – provided in this case by year-round solid waste collection. Alternatively, it may be possible to spread demand over the year with scheduled emptying. Operators quickly moved to a casual labour system, calling on their trained labourers only when required, retaining only the foreman full time.

Outstanding challenges and next steps

This work has demonstrated that small-scale FSM businesses can serve dense, unplanned peri-urban areas inaccessible to large vacuum tankers. However, the poorest households are not willing to pay an economic price when traditional manual emptying services, which are intrinsically cheaper as they do not involve transporting the faecal sludge away from the neighbourhood, are available. Experimentation is required to work out the best way of applying potential resources from the sanitation fee soon to be applied to water bills, and of maximising user contributions through flexible payment mechanisms, so as to make FSM services affordable to all and to phase out unhygienic manual emptying.

The experience shows that a mix of emptying equipment types and transport options could be more profitable than the current model. It would allow operators to serve a greater variety of clients and compensate for equipment downtime. This consolidation could occur in a number of different ways, ranging from outright mergers to the formation of looser groupings such as franchises or cooperatives. Well-organised groups of FSM operators could invest in a wider variety of equipment, make more effective use of available equipment, and combine their marketing effort. Whatever the option chosen, transport will remain the principal cost factor and technical constraint. All available vehicles should be used as economically as possible, and for this the efficient coordination of emptying crews is crucial, irrespective of the way it is institutionally organised.

Factors such as inaccessible location, lack of access covers, consolidation of sludge, and the ingress of solid waste, contribute greatly to the cost of emptying on-site facilities. Better technology for dealing with consolidated sludge will always be needed, and should be developed. However, all of the factors mentioned are susceptible to better design and construction of latrines and septic tanks. Over the longer term, improved toilets with reduced emptying costs could have a lifetime cost less than the current poorly designed toilets, which are difficult to empty. This could best be delivered as a complete service package including the toilet and regular emptying, similar to the way mobile phone contracts are structured, with all or part the capital cost and all normal operational expenses covered by a fixed monthly service fee. The keys to making such a concept work would be adequate scale and a means of funding the up-front investment costs.

On the downstream side, the opportunity should be taken when funds become available to rehabilitate the municipal sewage treatment plant, to build facilities specifically for processing faecal sludge. This would avoid damage by faecal sludge to the sewage treatment process, and reduce the cost of producing usable products such as solid fuel or compost. The choice of end product should be made carefully, taking into account local markets for potential products and the costs of producing them.

Services similar to those described here are being rolled out across the rest of Maputo and in other cities. They should incorporate the learning already gained, and seek to develop solutions to the many remaining issues.

NOTES

[1] Maputo Municipal Assembly. Resolution No. 68/AMM/2016

[2] Beira Municipal Assembly, Resolution No. 33/AMB/2016

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ACRONYMS AND ABBREVIATIONS

AIAS	[Mozambique National] Water and Sanitation Infrastructure Board
AMMEPS	Mozambican Association of Small-scale Service Providers
CBO	Community-based organization
CRA	Water Regulatory Council
FSM	Faecal sludge management
GDP	Gross domestic product
MMC	Maputo Municipal Council
NGO	Non-governmental organization
NUWSS	National Urban Water and Sanitation Strategy
USD	United States Dollars
WSP	The World Bank Water and Sanitation Program
WSUP	Water and Sanitation for the Urban Poor

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City-Wide Fecal Sludge Management Programs in the Philippines

David Robbins

EXECUTIVE SUMMARY

The concept of organized, city-wide septage management programs in the Philippines was introduced in the 2004 Clean Water Act (CWA). The metro Manila region and Dumaguete City were both early adopters and developed functional programs. In addition to the requirement that cities establish septage management programs, the CWA mandated the development of a National Sewerage and Septage Management Plan (NSSPM) as a mechanism for scaling up, with a focus on highly urbanized cities. Problems with the NSSMP roll out coupled with issues related to the cost share mechanism, and the limited capacity of the implementing agencies translated into little action, and no funds dispersed to date. Recognizing this, the national government is working to fix the problems while also supporting local government units (LGUs) to improve sanitation through technical assistance from the Department of the Interior and Local Government. Combined efforts are poised to usher in an era of progress in improving sanitation. The current focus is on enabling septage management at the local level, either through local government management as a municipal service, or water district led programs that provide septic tank pumping services to water customers, or a combination of the two.

This case study provides examples of two septage management programs that illustrate two different approaches. The greater metropolitan area of Manila is an example of water utility run service that uses a concessionaire service delivery model in a city of over 15 million. Dumaguete City provides a more "typical" example of cities and municipalities in the Philippines. Its septage management program was initiated in 2008, and has developed into a program that is co-owned and managed by the Dumaguete City Water District (the utility) and the local government. It demonstrates how a city of 130,000 can provide sustainable septage management services to its citizens for an average tariff of less than USD 1.00 per family per month. The Dumaguete program represents a model that can be replicated throughout the Philippines, while the concessionaire model from metro Manila may be replicable in other mega cities around Asia and beyond.

CONTEXT

The Philippines has a total population of 103,570,000, as of May 2017.[1] It is a middle-income country with a gross domestic product of USD 2,819 per capita and an annual growth rate of around 6.5 percent.[2] Despite achieving some progress as measured by the Millennium Development Goals, limited access to safe drinking water and sanitation remains both a burden to the economy and to public health.

According to the National Sewerage and Septage Management Plan, an estimated 55 people die each day in the Philippines due to poor sanitation, the estimated cost of which was approximately 1.5 percent of GDP in 2005. While there have been improvements in access to basic sanitation since then, only 10 percent of the population currently has access to sewerage.[3] In 2015, 78 percent of urban households had access to improved sanitation, up from 69 percent in 1990 (Table 1), while 59 percent have piped water to their premises (up from 43 percent in 1990).[4] One out of every three children suffers from childhood stunting (33.4 percent), which is an indicator of poor nutrition and inadequate sanitation, and has a direct correlation to poverty.[5] 12 Million children in the Philippines and Indonesia are affected – three quarters of the affected children in all of South East Asia.[6]

Estimated coverage 2015 update				
Year	Improved	Shared	Other unimproved	Open defecation
1990	69%	17%	7%	7%
1995	71%	17%	5%	7%
2000	72%	17%	5%	6%
2005	74%	18%	3%	5%
2010	76%	18%	2%	4%
2015	78%	19%	0%	3%

Table 1: Urban sanitation access in the Philippines

Figure 1: Percentage of female headed households over time

The urban population in the Philippines makes up 44 percent of the total, with an annual growth rate of 1.32 percent.[7] Government services are not keeping up with demand of the country's poor and extremely poor urban residents living in underserved slums or unserved informal settlements. Approximately 26.3 percent of the Philippine population lives below the poverty line, with 12.1 percent living in extreme poverty.

The impacts of poverty on men and women are often disproportionate. There is a rapidly increasing trend in the percentage of female headed households (Figure 1), often assumed to be more vulnerable than male headed households.[8] Evidence from Chance (1997) suggests however that by examining the intra and extra-household characteristics, a more accurate picture of economic vulnerability can be formed. Indeed, women often attain high status and stature in Philippine households and work environments.

A POSITIVE CORRELATION EXISTS BETWEEN INVESTMENTS IN SANITATION AND SPECIFIC BENEFITS TO WOMEN

Traditionally, in poor families, women and girls often have the responsibility for securing water for drinking, bathing and cooking. Therefore, when sanitation improvements are made, they provide more benefits to women, as less time will be taken to collecting water and caring for the sick. While these benefits are difficult to monetize, a positive correlation exists between investments in sanitation and specific benefits to women.[9]

The 1991 Local Government Act ushered in an era of decentralization in the Philippines, where local government units (LGUs) were transformed into self-reliant and relatively autonomous communities. Unfortunately, decentralization did little to improve sanitation. While the statistics on poor sanitation are alarming, there is room for hope as the national government becomes more engaged at the local level around this issue. As the National Sewerage and Septage Management Plan is strengthened and capacities at the national and local governments increase, it is expected that more local governments will begin to act to reduce the amount of fecal waste that ends up in the environment. Their tool for achieving this change will be through organized septage management programs.

SEPTAGE MANAGEMENT SERVICES

Historically, septic tanks in the Philippines were designed with two chambers: a digestive chamber and a leaching chamber. After passing through the digestive chamber, the effluent leaches into the soils through the open bottom of the second chamber. In urban settings, septic tanks were typically constructed underneath buildings to minimize space requirements. Leaching chambers were often connected to the drainage ditch to minimize the need for desludging. This applied in both metro Manila and Dumaguete, and persists today to some extent. Septic tanks are the main on-site method of sanitation, with 70 percent of the general population connected to one, and 85 percent of urban residents using this technology.[10] Updated building codes require triple compartment septic tanks, and that septic tanks be fully sealed on the bottom and no connection to the drainage system.

CUSTOMERS PAY FOR THE SERVICE THROUGH AN ENVIRONMENTAL FEE OF 20 PERCENT OF THEIR WATER BILL, WHICH COVERS ONE DESLUDGING EVERY 5–7 YEARS

When septic tanks required desludging, local desludging firms (Malabanan) were contracted with to excavate the waste. Today, many Malabanan firms still operate and where there are no septage treatment facilities, waste is often discharged in to open fields, drainage ditches or surface waters. In locations with formal desludging programs and treatment facilities, Malabanan firms work in conjunction with local programs through public-private-partnerships or as independent contractors that engage directly with their customers.

In Metro Manila, water and sanitation services are provided by two concessionaires; Manila Water Company (MWC), which operates in the Eastern Zone, and Maynilad Water Services, Inc. (MWSI), which operates in the Western Zone (see Figure 2).[11] Both companies operate under a concession agreement with the Metropolitan Waterworks and Sewerage System (MWSS), which was formed as a governmental organization in 1971, and privatized in 1997 as a result of the Water Crisis Act (Republic Act 8041). Both MWC and MWSI are responsible for providing piped water service, sewerage, and septage management services for a combined population of 15 million people, which includes the metro Manila area along with some outlying cities and municipalities. They achieve the desludging mandate using a combined fleet of almost 200 desludging trucks and five mechanized fecal sludge treatment plants, including a new MWC waste to energy septage treatment plant that came on line in 2017.

Operations are carried out by a mix of subcontracted service providers and staff. Tariffs are set to achieve full cost recovery plus a profit set by law. Currently, scheduled desludging services are provided for some customers (MWSI estimate is 30 percent), while on-demand services are available for all customers. The companies plan to be able to provide scheduled septic tank desludging services for all customers by 2037.

Metro Manila includes 16 cities and municipalities. LGUs work together with the concessionaires as key stakeholders, performing promotional activities, and traffic control during desludging. Customers pay for the service through an environmental fee of 20 percent of their water bill, which covers one desludging every 5–7 years.

In contrast, Dumaguete City's septic tank desludging services are provided through a program jointly managed by the city government (LGU) and Dumaguete City Water District (DCWD). DCWD maintains and operates a fleet of eight desludging vehicles while the LGU maintains and operates the septage treatment plant. The treatment plant uses waste stabilization pond technology and was designed with an operational capacity of 85 cubic meters of septage per day (Figure 4). Tariffs are collected to cover the operational costs (OPEX) while achieving full cost recovery for the capital expenditures (CAPEX) within 5 to 7 years. The system has been in operation since 2010 and reached its full cost recovery targets in 2016. The program initially started as a scheduled

Figure 2: MWSS service coverage map. The East Zone is under the management of Manila Water Company, and the West Zone is managed by Maynilad Water Services, Inc. Image courtesy of Asian Development Bank.

Figure 3: Waste Stabilization Ponds at the Dumaguete City Septage Treatment plant. Josephine Antonio, Chief Urban Planner at the time of construction.

Figure 4: The septage treatment plant at Mactan Island Cebu. Owned and operated by EnviroKonsult Equipment & Services Inc. Desludging and treatment services are procured through a 5-year partnership agreement with Metro Cebu Water District.

desludging service, with trucks going house-to-house throughout the city on a five-year cycle. Participation was voluntary, but since households were paying for the service through their monthly water bills, the percentage of participating households was initially high. It is believed that the promotions campaign, initially launched to coincide with the initiation of city-wide services drove this initial success. However, following a drop in the participation rate about two years later, it was no longer economically feasible to continue the scheduled desludging model. Today, the program operates strictly as a demand based service.

There are theoretical advantages to scheduled desludging, including economies of scale and greater septic tank and program efficiency. In practice, these were not adequately demonstrated in Dumaguete City in part due to a lack of real-time data. When the demand-based model started, the opportunities for demonstrating these advantages were lost. However, the current on-demand program in Dumaguete City is still effective as a clear majority of septic tank owners use the service, calling to request that their tanks be desludged within their 5-year cycle.

The Dumaguete City septage management program is regulated through a local ordinance passed in 2008. The ordinance provides the local regulatory framework for septic tank construction, desludging frequency, and the tariff, which can be adjusted from time to time to cover the cost of the services. Initially, the tariff was set at PHP 2.00 (USD 0.05) per cubic meter of water consumed, which resulted in an average bill of PHP 48.00 (USD 1.00) per household per month. This is where the rate remains today. According to the Water District general manager, the funds from the tariffs are also used to improve conditions in the community that hosts the treatment plant, including a health center, improved roads, and a local scholarship fund, all of which were negotiated during the initial stages of the program. The Dumaguete Septage Management program continues to provide services to customers and is keeping up with demand, with most customers receiving the service within 24 hours of the department receiving the call.

THE CITY COUNCIL BEGAN TO DISCUSS REDUCING THE TARIFF, REFLECTING THE FACT THAT CAPITAL COSTS FOR THE TREATMENT PLANT AND TRUCKS HAVE BEEN FULLY RECOVERED

FSM IN NATIONAL AND CITY URBAN SANITATION POLICY

Septic tanks and septage are referred to in several national laws in the Philippines, including the Clean Water Act (CWA), the National Building Code of the Philippines, Revised National Plumbing Code, Code on Sanitation, and the Subdivision and Condominium

Laws. The CWA and the National Sewerage and Septage Management Plan define national septage management policy. It was the introduction of the CWA that initially had the greatest impact in prompting some local governments to act. To date, there are seven new septage treatment plants in the Southern Philippines with more on the way. At least seven water districts are in different stages of septage management project planning/development, including Dumaguete, Metro Cebu, Cabanatuan, Baliwag, San Pablo, Davao, and Zamboanga. Also, the private sector is starting to invest in septage management with fully functional systems in Bay Laguna (a cluster facility serving four neighboring municipalities), the two cities in Mactan Island, Cebu (Figure 4). As of May 2017, a further 61 municipalities have begun developing local ordinances to start the process of implementing septage management programs.

TO DATE, THERE ARE SEVEN NEW SEPTAGE TREATMENT PLANTS IN THE SOUTHERN PHILIPPINES WITH MORE ON THE WAY

The main influencing legislation and policies on septage management are:

The Clean Water Act is the defining legislation that provides direction to local governments in implementing septage management programs.[12] The CWA requires: first that the government establish a National Sewerage and Septage Management Plan to oversee the scaling up of septage management throughout the country. Second, that each LGU shall appropriate the land required to install the treatment system, and to levy taxes to pay for the service.

The NSSMP is part of the National Sustainable Sanitation Plan (NSSP) and Philippine Sustainable Sanitation Roadmap (PSSR), which are broader, overarching frameworks that include the full spectrum of sanitation challenges.[13] The NSSMP focuses on the larger infrastructure projects that LGUs will implement to manage wastewater and septage in urbanized areas in the Philippines. The plan provides cost sharing for sewerage programs, in which the national government funds up to 50 percent of the total cost of the program. For septage programs, the NSSMP provides technical support and support for **feasibility studies.**

Local ordinances on septage management. Local governments, and to some extent, local water districts are encouraged to promote septic tank desludging and effective management of fecal sludge. At the local government level, ordinances on sanitation, and specifically on septage management are implemented to "prevent and control water pollution and to promote health and ensure a balanced ecology."[14] To promote this, a model local ordinance was created by the Department of Interior and Local Government (DILG) to help facilitate uptake. The model ordinance includes sections on:

- Scope and application (the types of buildings the ordinance applies to);
- Principles of sewerage and septage management;
- Proper sewage treatment and disposal systems (typically on-site septic tanks and leach fields, including their design, construction and operation;
- Desludging requirements, including the collection, transportation and treatment of septage; and,
- Penalties for non-compliance.

Although there are other laws, policies and implementing rules and regulations that set the stage for modern septage management, perhaps most significant for scaling up septage management in the Metro Manila area was the 2008 Supreme Court ruling, which directed 13 government agencies to clean up, rehabilitate and preserve Manila Bay within 10 years of the ruling.[15] Progress to date includes the cleaning up of the Pasig River, a major tributary into Manila Bay, as well as a push by the Laguna Lake Development Authority (LLDA) to promote septage management for all of the cities and municipalities within the watershed. The Laguna Lake watershed is home to over 18 million people and serves as an important water source for the region.[16] The current intervention is to help local governments within the watershed to implement their own local ordinances on septage management as the initial step in establishing city-wide programs.

The regulator for septage management services in the Philippines The Department of Environment and Natural Resources (DENR) and the Philippines Department of Health (DOH) are national agencies with a regulatory role for new septage management programs. While the DENR, DOH and the Department of Public Works and Highways in theory have regulatory power over local governments in requiring compliance with the CWA and other national laws, these powers have not been used to date.

OVERVIEW OF PROGRESS

In Manila, the story of water and sanitation service provision dates to 1873 (see Figure 5) with the founding of the Manila Waterworks Authority, but it was not

Treatment plant	Company	Sewerage cubic meters per day	Septage cubic meters per day with 16 hours operation per day
Dagat Dagatan	MWSI	13,000	450
Project 7	MWSI	2,400	240
Pamplona Las Pinas	MWSI	None	500
North septage treatment	MWC	None	586
South septage treatment	MWC	None	814 – Waste to energy plant is combined with the South STP

Table 2: Septage treatment plants in the Metro Manila area

until 2002 that septage management began in earnest. A loan from the World Bank, the Manila Second Sewerage Project (USD 35 million), enabled the construction of the Dagat Dagatan septage treatment facility, which has a current septage treatment capacity of 450 cubic meters of septage per day (based on a 16 hour per day operating period). A follow-up loan, the Manila Third Sewerage Project (US 64 million) in 2005 paved the way for the construction of two more septage treatment plants: Manila Water's North Septage Treatment Plant in the north east of their coverage area, with a capacity of 586 cubic meters per day, and the South Septage Treatment Plant, which has a total septage capacity of 814 cubic meters of septage per day (Table 1).

More recently, MWSI constructed its own 350 cubic meters per day septage treatment plant in Las Pinas. The Dagat Dagatan plant together with the facility in Quezon City enables MWSI to provide on-demand desludging services to all its customers.

Figure 5 shows key events in septage management development in the Philippines.

In Dumaguete City, 2006 was a pivotal year, when City Ordinance 18, Series 2006 was adopted by the city council, thereby establishing the Septage Management System. The ordinance:

- Requires that all homes and buildings have an approved excreta disposal system (septic tank or other approved structure);
- Prohibits discharge of septage anywhere other than the city-owned and operated licensed treatment facility;
- Provides model septic tank design criteria;
- Provides permit requirements for new construction;
- Requires that septic tanks should be desludged every 3–5 years, or when 1/3 full of sludge;
- Requires the creation of a City Septage Management Authority (CSMA) to oversee the program;

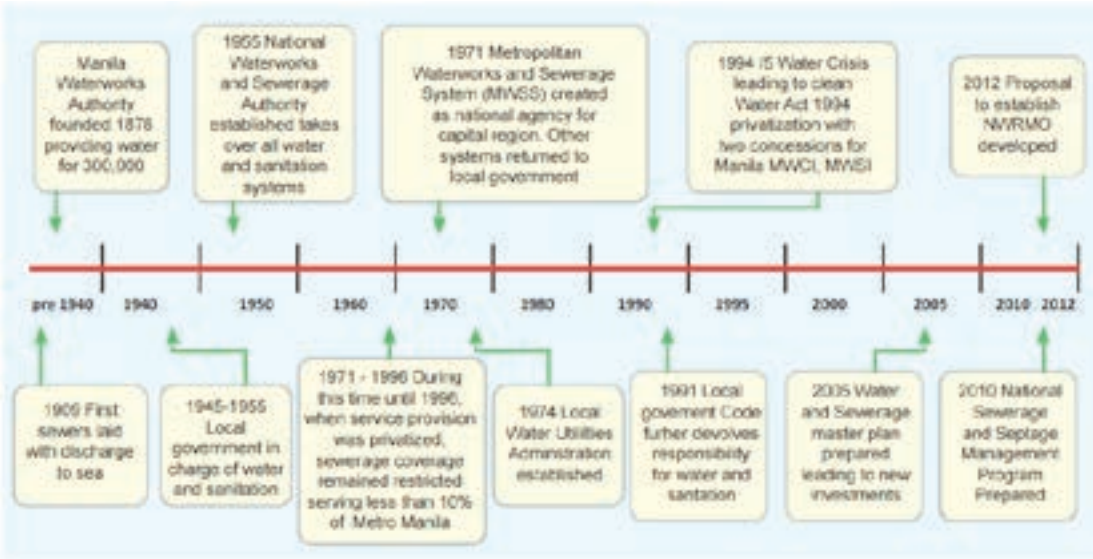

Figure 5: Key events in septage management development in the Philippines

- Provides a tariff structure to sustain the septage program;
- Provides penalties for non-compliance.

FINANCIAL ASPECTS AND BUSINESS MODEL

Organized septage management programs in the Philippines are funded by user fees and tariffs, which are based on the concept of full cost recovery. In Manila, the two concessionaires charge their customers 20 percent of the water bill as an "environmental fee", which includes watershed management, water source protection, conservation related expenses, and sanitation including desludging. Customers are entitled to have their septic tanks desludged once every 5 years for no additional charge. Additional desludging services are available, at a cost of PHP 3,000 (USD 60.00) for residential customers, and PHP 6,000 (USD 120.00) for commercial customers (for a 10-cubic meter load).

In Dumaguete, a tariff of PHP 2.00 (around US 0.05) is charged for each cubic meter of water consumed. With an average household consumption of 24 cubic meters per month, this results in an average monthly septage charge PHP 48.00 (USD 1.00). In return, all customers are entitled to one septic tank desludging service every 5 years. This tariff was set at the inception of the program in 2009, and was based on the idea of achieving full cost recovery in between 5–7 years.

The 2012 balance sheet from the Dumaguete City Septage Management program is illuminating (Table 3). It shows that the program generates net income, even after covering the cost of depreciation

Item	Pesos	Pesos
Septage "User Fee" Revenue from 24,000 households x 25cum/month x 12 months x P2.00/cum		14,700,000.00
Assessment/Production Meter		640,000.00
Less: Billing adjustment memo Senior Citizen Discount	24,000.00 1,200.00	25,200.00
Net "User Fees" revenue		15,355,200.00
Other Income (Charges) Bank Interest Bank Charges	 7,200.00 (4,200.00)	 3,000.00
Total Income		**15,358,400.00**
Operation and maintenance		
a. Salaries, honoraria and wages		4,306,488.00
b. Fuel and oil		2,182,600.00
c. Depreciation		1,500,000.00
d. Financial assistance to host barangay		1,002,300.00
e. Maintenance		838,000.00
f. Security Services		360,480.00
g. Travelling and training		200,000.00
h. Representation		
i. Taxes, insurance, and licenses		131,400.00
j. Truck and plant supplies		108,400.00
k. Utilities		75,600.00
l. Medical and vaccine		65,000.00
m. GSIS, Philhealth, contributions		54,793.52
n. Office supplies expenses		50,000.00
o. Miscellaneous and general		218,000.00
Total operating and maintenance expenses		**11,243,111.52**
Net Income		**4,115,288.48**

Table 3: 2012 Balance sheet for the Dumaguete City Septage Management Program. Source: Dumaguete City Planning Department, 2013

Item	2014	2015	2016
Total Income	15,836,817	16,311,972	18,679,231
Depreciation	2,361,051	2,411,694	2,349,696
Operating expenses (includes deprecation)	13,370,514	14,181,870	13,460,173
Net Income	**2,466,303**	**2,130,102**	**5,219,058**

Table 4: Net income after expenses and depreciation in Dumaguete

Year	Number of septic tanks desludged per year
2012	52,514
2013	65,936
2014	65,855
2015	67,252
2016	82,143
TOTAL	**333,700**

Table 5: Number of septic tanks desludged per year by Manila Water Company

and paying financial assistance (investments) to the host community. Profitability has been maintained, with record net income recorded in 2016 (Table 4).

BUSINESS MODELS

The concessionaire business model for septage management that has its roots in the 1971 law (Republic Act 6234) which created the Metropolitan Waterworks and Sewerage System (MWSS), then a government agency. Then, the 1997 "Water Crisis Act" (RA 8041) paved the way for privatization of MWSS by transferring water system operations to the private sector, with the goal of significantly improving services.

According to Ryan Orillo, Senior Wastewater specialist, MWSI applies two desludging business models.[17] The first is a regular desludging scheme, which provides scheduled desludging in selected communities, where trucks and crews work neighborhood by neighborhood to achieve desludging on a scheduled 5-year cycle. MWSI contracts third parties to provide these services. For communities where on-demand services are provided, or for customers that require additional desludging services, MWSI staff perform the work. The rationale is that scheduled desludging is more routine, resulting in fewer customer complaints, whereas customer satisfaction with on-demand services is potentially lower. Orillo (May 8, 2017) believes that desludging services are best provided by highly trained in-house staff.

MWC adopts a different approach. It owns all the desludging vehicles, but subcontracts the driving and desludging operations to a third party. Its program has been quite successful, although still well below their goal of servicing every septic tank every 5 years (Table 5). However, given the rate of growth in desludging services, MWC is well on its way to achieving full coverage by the end of the concession agreement in 2037.

CAPACITY DEVELOPMENT

Septage management capacity refers to: i) how much septage can be collected, and treated (in cubic meters per day), and ii) the capacity of staff and service providers to carry out the required activities.

In Manila, septage collection and treatment capacity is determined in the Concessionaire Agreement, which provides the specific sanitation coverage targets by year for each of the cities and municipalities within the coverage zone. This in turn influences the infrastructure requirements for both treatment and collection capacity. The targets for MWSI are regular desludging for 80 percent of customers by 2021, and sewerage coverage for all customers by 2037.

To achieve the septage capacity targets, MSWI operates a fleet of 63 septage desludging trucks: 57 of which have a volumetric capacity of ten cubic meters, and six that have a volumetric capacity of four cubic meters. They also have three treatment plants that should meet the treatment capacity target the end of the current concessionaire agreements (2037). Manila Water has a fleet of more than 100 trucks, most of which have a tank volume of 10 cubic meters (Figure 6).

MWSI HAS A STAFF CAPACITY BUILDING PROGRAM THAT COULD SERVE AS A MODEL FOR REPLICATION THROUGHOUT THE PHILIPPINES AND BEYOND

MWSI has a staff capacity building program that could serve as a model for replication throughout the Philippines and beyond. It adopts a two-step program:

- Annual company-wide training on the core values and mission of MWSI; and

Figure 6: Part of Manila Water's desludging fleet. The trucks are owned by MWC but operated by EnviroKonsult, a third party contractor.

Figure 7: Rizal Boulevard today, an important part of Dumaguete City's identity, and a driver of tourism and economic development.

- Annual septage management training for two or three days for all septage program staff that includes:
  - Policies and procedures;
  - Customer service;
  - Safety; and
  - Traffic management.

In Dumaguete City the treatment plant has been designed to treat 85 cubic meters per day. Average flows in 2016 are between 55 and 60 cubic meters per day. While there is still some treatment capacity left in the existing plant, program managers should begin planning for the future when demand exceeds capacity. Similarly, while the number of trucks are adequate to meet current demand, as demand increases, additional desludging equipment training will be required. Costs for capital expenditures (CAPEX) are covered by the tariff.

Formal training programs are lacking in Dumaguete for staff and management. As new equipment comes on line, such as GIS tracking and automated receiving stations, staff training on the proper operation and maintenance of the equipment will be required.

DRIVERS OF CHANGE AND LESSONS LEARNED

Dumaguete

In Dumaguete City, the most significant driver of change was the drafting of a city ordinance establishing a septage management program and minimum criteria for on-site wastewater treatment systems. A promotions campaign was initiated to raise community interest in and willingness to pay for the program, as well to promote the new ordinance. At the same time, plans were developed for the city's septage treatment plant and the decentralized wastewater systems for key institutional buildings.

Other drivers of change include:

- The realization that improving sanitation, especially if it could restore the water quality of the bay along Rizal Boulevard, could stimulate economic development. This gave the mayor's governmental offices a clear focus and established motivation for collaboration (Figure 7).
- The Philippine Clean Water Act of 2004 and its mandate that local governments implement septage management programs if sewerage systems are not affordable. This was the primary reason cited for the promulgation of the local septage ordinance.
- The community, through stakeholder meetings, agreeing to the need for a septage management program. This was also driven by the multisector awareness campaigns.

- Showing that the program would be a money maker and not a burden to the city coffers.
- The City agreeing to support the host community of the septage treatment plant, and then forging a long-term agreement with them.
- The sustained awareness and multimedia promotions campaigns, which gained support for the program.
- Interest and technical assistance from USAID.

IN DUMAGUETE CITY, THE MOST SIGNIFICANT DRIVER OF CHANGE WAS THE DRAFTING OF A CITY ORDINANCE

The major challenges in Dumaguete include:

- Lack of real time data tallying the number of cubic meters of waste collected and costs of the treatment and collections programs.
- Re-developing and then launching targeted promotions campaigns to drive the willingness to participate in the program.

Metro Manila

Prior to 1995, it was recognized that Manila's water system was not working well as a public corporation. The system was "inefficient, debt-ridden, and overstaffed" with one of the highest non-revenue water (NRW) level in Asia.[18] NRW is water that is produced, and delivered but not sold due to leakage or theft and is indicative of a poorly operating utility. Today, both concessionairs operate award-winning utilities. The drivers of this change in Manila included:

- The Water Crisis Act (Republic Act 8041), which was signed in 1997 which paved the way for privatizing the concessionaires.
- The 1997 concession agreements with two private consortiums to manage the utility. The goals of privatization were to increase efficiency and improve service standards for water delivery and expanding services to the poor.
- Pursuit of excellence by both companies. Both have pursued and achieved ISO certifications for their treatment plants and overall programs.[19]

The 2008 Supreme Court Decision requiring the cleanup of Manila Bay was another significant driver of change. Progress by the affected government agencies in meeting the court ordered mandates has been slow, however appears to be stepping up pace in 2017 as key agencies have begun ramping up efforts. While the Supreme Court decision has been an important driver, change in leadership at both LLDA and DENR may also be driving the push for septage management.

Despite many challenges in the ensuing years, including the bankruptcy of Maynilad Water Services Inc in 2003 these targets have generally been achieved.

Figure 8: Manila Water's first Waste to Energy (WTE) septage treatment plant

Year	Number job orders	Volume	Volume collected per working day
2010	2,223	10,953	44
2011	2,964	14,604	58
2012	2,964	14,604	58
2013	2,964	14,604	58
2014	3,293	15,501	62
2015	3,921	17,884	72
2016	3,512	16,581	66

Table 6: Summary of desludging operations – Dumaguete City, May 2010–Dec 2016

Finally, the economics of septage management is a key driver of change towards highly efficient and energy positive septage treatment systems. One example is the new Waste to Energy (WTE) septage treatment facility that works in conjunction with Manila Water Company's South septage treatment plant (Figure 8). According to the company: "Once the WTE system operates at full-scale, it can fulfill more than 100 percent of the power requirements of the South Septage Treatment Plant, reducing greenhouse gas (GHG) emissions of the facility by 267 tons of carbon dioxide (CO2) in a year and generating to up to PHP 17 million (USD 340,000) in annual savings for the Company on power expenses."[20]

LESSONS LEARNED AND IMPACTS

Lessons learned in Dumaguete City are:

The current model of desludging operations appears to be meeting demand. The estimated total number of septic tanks is around 20,000, and the average number of desludging jobs is 3,500 per year, thus the estimated number of tanks desludged in a five-year cycle is 17,500. Although some septic tank owners do not request the service within the five-year cycle, most do, and the fact that most job orders are completed within 24 hours is an indication that the program is working for the majority of citizens and the city (see Table 4 for a summary of the desludging operations in Dumaguete City to 2016).

Table 4 Provides the annual number of tanks desludged (job orders) as well as the total annual volume collected, as well as the volume collected per working day (50 weeks a year, 5 days a week = 250 days/year. Some addition points:

- Data for year 2010 is for May – December;
- Data for years 2011, 2012, and 2013 are approximate
- Data shows a moderate drop in activity in 2016 compared with 2015, although no reason for the drop has been provided. Data from 2017 indicates desludging rates similar to 2016 indicating that 3,500 tanks may be an average for Dumaguete City, operating on a demand-based model with no promotional activities conducted.

There are theoretical advantages to a scheduled desludging model, including economies of scale and greater program efficiency. In practice, however, these were not realized when the program shifted to the demand based model. The current program in Dumaguete City is working, but not everyone calls even though they are paying for the service. The net result is that for the treatment plant, less septage being collected and treated than anticipated, resulting in lower operating expenses (Table 3) and higher profits than originally anticipated.

There appears to be a direct correlation between the community outreach and level of interest in the program. When the promotion campaigns tapered off, so did the participation rate.

A pro-poor tariff structure is widely accepted by the community. The LGU and Water District, in their formative memorandum of agreement included a provision requiring that both parties must agree on any future rate adjustments. This helps to maintain current funding levels at a time when there is political pressure to reduce the septage tariff.

Private desludgers can be encouraged to dispose of collected sludge into a city's treatment plant for a small fee.

Visits from local government units, private groups and international development agencies can promote innovative approaches to sanitation. The city's system is now a model to other local government units.

The Manila desludging experiences have also resulted in lessons learned:

Early land banking is beneficial. In a city like Manila where real estate is expensive, it is important to land bank as early as possible. Otherwise, acquiring land to construct septage treatment facilities will be difficult even if funds are available. Once acquired, the land must be fenced and regularly monitored to prevent informal settlers taking up residence because this could limit future development. Prior to actual construction, the land could be used for warehouses or planting crops.

Allow time for program preparatory work. When planning for FSM services, considerable time must be allotted for preparation or "upstream" work such as land acquisition and securing permits and endorsements. As these are mostly subject to personalities and opinion, it is important to be realistic when drafting the timeline for a project. In Manila, the whole process of acquiring land and securing endorsements is up to two years.

Continuous data gathering is essential. Other than updating assumptions made, data gathering is essential to help inform management decisions. It was crucial in determining the right service level agreement to be put in place when outsourcing desludging operations. It can be crucial in determining organizational composition, investments needed (repair, maintenance and replacement of vehicles, expansion of treatment plants), reporting performance and determining tariff. Data also helps when presenting a case to the public and helps to convince them to get their septic tanks desludged regularly.

Operational efficiencies must be in place. Outsourcing the desludging operations, including fleet maintenance, have proven to be more economical than carrying out the operations in-house. But to do this, a robust service level agreement that is fair to both the concessionaire and to its contractor, must be in place. For the East Zone, a service level agreement based on distance and volume is in place that offers incentives when they collect more. This must be countered with a good monitoring check, done through regular reporting and random measurement of tanks. On top of that, checks on the contractor itself helps ensure good performance.

Community partnership is preferable. At a minimum, community partnership is necessary to avoid complaints about very visible desludging operations. In Manila, this partnership has helped pave the way for scheduled desludging services.

OUTSTANDING CHALLENGES AND WAY FORWARD

Outstanding challenges for Manila's and Dumaguete's septage management programs include:

New standards for nutrient removal. In 2016, the Department of Environment and Natural Resources promulgated new regulations on effluent quality (DAO 2016–08), which sets more stringent requirements for nutrient reduction. Nutrients, especially nitrogen and phosphorus are difficult to remove from wastewater effluent and require tertiary treatment units. Even though existing wastewater and septage treatment facilities are granted a five-year grace period for compliance, meeting these standards on a consistent basis will be a challenge.

Increasing community acceptance of septic tank desludging. Acceptance levels or the percentage of customers that use the desludging services (even though they are paying for them through their bills) has been historically low. In 2016, around 50 percent of customers in communities where scheduled desludging is offered used the services when the trucks were in their neighborhood. Despite significant promotion by the concessionaires in Manila, more community outreach is needed.

Traffic congestion in the city is getting worse each year. This means that trucks need longer to reach the target neighborhood or building, and the treatment plant. As a result, more trucks and staff will be needed to meet the compliance targets set in the concessionaire agreements.

Accessibility of the septic tanks. Narrow roads and indiscriminate parking and road obstructions are a continuing challenge. Closer work and more coordination with barangay (individual communities with their own elected officials) officials is one way of alleviating this problem.

Implementing the Smart Scheduling System, wherein a customer's bill will include a reminder that their septic tank is due for regular desludging. This will also affect smart job order management. This applies to both Manila and Dumaguete and is likely to improve participation rates.

Reusing treated biosolids continues to be a challenge in both Dumaguete City and in Manila. Most of the treated biosolids are taken to a site some 36 kilometers away from Manila, which translates as significant transport operational cost. There is little agriculture and hence no market for treated biosolids within metro Manila, even when concessionaires give the sludge away. MWSI engages with a private sector

company that processes biosolids for reuse, although the volumes and values are not publicly available.

Real time management information data is needed. In Dumaguete City, data collection is the biggest current challenge. There is no effective data system for collecting statistics such as including i) how many tanks have been desludged, ii) volume of septage treated, and iii) revenue collected. Many data acquisition systems that provide real time monitoring are available, however. This will be especially important in Dumaguete as there are renewed calls for transparency and up-to-date information on which to base managerial decisions. Both concessionaires in Metro Manila are successfully using real time monitoring systems.

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ABBREVIATIONS AND ACRONYMS

CWA	Clean Water Act
DENR	Department of Environment and Natural Resources
DILG	Department of Interior and Local Government
DOH	Department of Health
LINAW	Local Initiative for Affordable Wastewater Treatment
LLDA	Laguna Lake Development Authority
MWC	Manila Water Company
MWSI	Maynilad Water Services Incorporated
MWSS	Metropolitan Waterworks and Sewerage Authority
NRW	Non-revenue water
NSSMP	National Sewerage and Septage Management Plan
USAID	United States Agency for International Development

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Dakar: Organising the Faecal Sludge Market

Becaye Sidy Diop and Mbaye Mbéguéré

EXECUTIVE SUMMARY

Sanitation in Senegal is managed by the National Sanitation Office (ONAS), which in 2011 initiated the Faecal Sludge Market Structuring Programme in the peri-urban areas of Dakar, as it started to assume greater responsibility for on-site sanitation, in addition to sewerage and drainage. The programme is wide-ranging and includes: rehabilitation and delegation of the management of Dakar's faecal sludge treatment plants to the private sector; upgrading of the dilapidated fleet of vacuum tankers owned by the private sector through the establishment of a guarantee fund to facilitate repairs and the purchase of newer vehicles; increasing service quality by certification and regulation of vacuum truck operators; and streamlining of the faecal sludge collection and transport market with a call centre, all backed by a promotion and marketing campaign.

The programme resulted in the transfer from using manual emptiers (who serviced almost half of the total market) to vacuum truck operators, and, by operating online bidding through the call centre, further resulting in reduced emptying prices by about 20 percent. The faecal sludge treatment plants (now managed by the private sector) are operating well and producing a profit for ONAS and the delegated private sector managers, as compared to their highly degraded status prior to the programme. They are also selling dried sludge to the agricultural market. The loan guarantee fund facilitated the purchase and import of 26 vacuum tankers, significantly improving service quality for the city. Current challenges include establishing a sustainable business model for the call centre after external funding is withdrawn. Important lessons from the experience include the importance of a strong partnership with the faecal sludge collection and transport service providers, and the need for continuous sanitation promotion and active dialogue with the service user communities.

CONTEXT

Dakar, the national capital, is home to almost half (49.6 percent) of Senegal's urban population. Dakar Region is 96.4 percent urban and has a population of 3,137,196. Senegal's gross national income per capita is estimated at USD 980[1], with one in four residents of Dakar falling below the poverty line. Much of the work reported here was focused on Pikine and Guédiawaye (marked with a dashed line on the map), two of Dakar region's four administrative subdivisions or departments, which have a combined population of 1,421,060 (Senegal National Census, 2013). To the west lies the department of Dakar, which includes the city centre, and to the east the department of Rufisque, consisting of the urban fringe and a few rural communities.

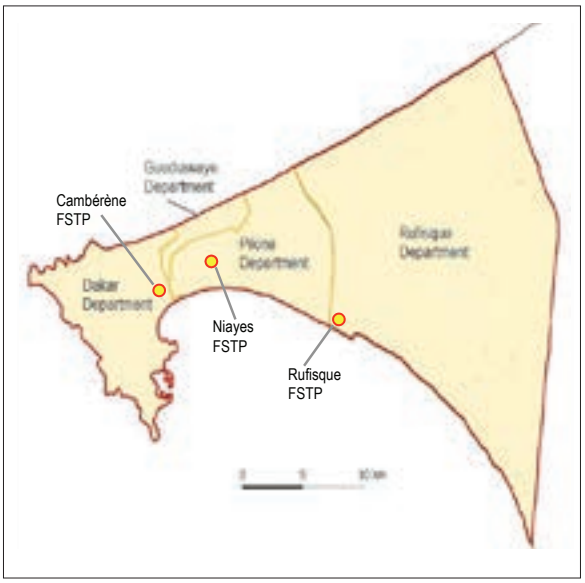

Figure 1: Faecal sludge treatment plants and departments in Dakar region

OVER 75 PERCENT OF DAKAR'S TOTAL POPULATION USES ON-SITE SANITATION FACILITIES FOR THE MANAGEMENT OF DOMESTIC WASTEWATER

Over 75 percent of Dakar's total population depends on on-site sanitation. In Pikine and Guédiawaye, 96 percent are served by on-site systems, while in

Figure 2: Manual emptying

the city centre, about 60 percent are connected to sewerage. The production of faecal sludge is estimated at 1,130 m^3/day for Pikine and Guédiawaye and about 1,500 m^3/day for the whole city (Tounkara, 2007).

Sanitation in Senegal is managed by the National Sanitation Office (ONAS). Its major focus was on sewerage and drainage, but it has gradually been taking on responsibility for on-site sanitation as well. In 2011, ONAS initiated the Faecal Sludge Market Structuring Programme (PSMBV) in Pikine and Guédiawaye, where the majority of poor people and on-site sanitation users are concentrated. This includes making the faecal sludge collection and transport market more efficient, improving service quality and upgrading faecal sludge treatment.

FSM SERVICES

Prior to the PSMBV, just over half of the faecal sludge was collected by about 150 ageing vacuum trucks in an unregulated market, and dumped at three poorly functioning treatment plants or directly into the environment. The rest (43 percent) was emptied by informal manual emptiers and buried or dumped nearby.

Due partly to the high water table, on-site household sanitation facilities in Dakar are typically emptied once or twice per year. Manual emptying remains the cheapest option and continues to be widely practiced despite serious health and environmental implications. The high prevalence of manual and informal emptying means that a substantial proportion of the faecal sludge produced is not safely treated and disposed of. It also reduces the potential for economies of scale in the re-use market. The manual emptying market is estimated to have an annual value of about USD 2.3 million[2]. The low affordability of mechanical emptying is aggravated by weak competition between emptiers in the market, and to the mismatch between the prices charged (about USD 50.00 per emptying) and the incomes of a large segment of the population (the majority earn less than USD 2.00/day). By comparison, manual emptying costs about USD 20.00.

Most (68 percent) of the vacuum truck operators have a single truck, mainly due to difficulties mobilising financial resources. Renewing their trucks, most of which are old (the average age is 25 years) and unfit for business, is not easy. Thus, in addition to the health and environmental hazards posed by these trucks, their operating costs are high, with repairs and maintenance accounting for 7–12 percent of operating costs, and fuel for 34–41 percent.

The operators have great difficulties accessing bank credit. Bank loans are subject to officially declared incomes adequately covering loan costs or a guarantee equivalent to at least twice the amount of the loan.

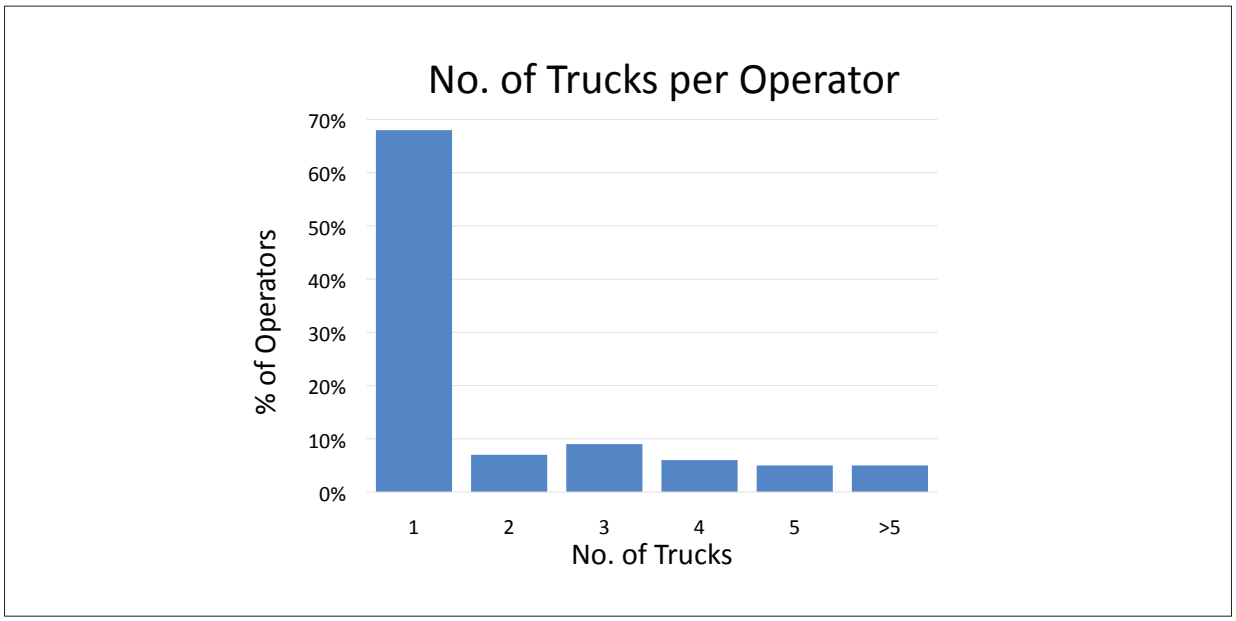

Figure 3: No. of trucks per operator

Figure 4: Damaged cover, Cambérène FSTP

Figure 5: Damaged drain, Rufisque FSTP

However, as most of the operators work in the informal sector, they cannot meet these criteria. About 91 percent of trucks are purchased using the operators' own resources, or through operations combining equity financing and borrowing from a third party (relative, friend, business associate) based on trust or debt agreements signed by both parties. Only three percent of trucks was purchased entirely with a bank loan, and six percent with a partial loan.

ONAS has three faecal sludge treatment plants (FSTPs) designed for a total aggregate flow of 220 m^3/day and built within the Cambérène, Niayes, and Rufisque wastewater treatment plants (see map). Prior to the PSMBV the three FSTPs were in a state of advanced deterioration (see figures 4 and 5), and seriously overloaded, receiving about 530m^3/day. Under the direct management of ONAS, the FSTPs had virtually no systematic management, little maintenance, a general lack of staff personal protective equipment (clothes, gloves, helmet, boots, masks, etc.), obsolete and broken down electromechanical equipment, and no offices and equipment for basic administrative tasks.

In 2013, prior to the introduction of delegated management by the private sector, receipts across the three FSTPs totalled USD 113,288. These were derived almost entirely from tipping fees, with a trivial USD 623 from the sale of dried sludge. Their net profit of USD 7,100 was relatively meaningless given the very poor state of the FSTPs.

INTERVENTIONS IN THE FSM MARKET

In 2000, the Government of Senegal set up an extensive programme to improve sanitation in the peri-urban districts of Dakar (PAQPUD). The CFA 20 billion (USD 35 million) programme financed by the World Bank covered 32 peri-urban communities, reaching 22 percent of households not served by the sewerage system. A total of 66,732 individual facilities, 16 public toilets, 76 school sanitary blocks, three FSTPs and 130 semi-collective systems were built.

Following on from PAQPUD, in June 2011 ONAS, which is responsible for all urban sanitation (both sewered and non-sewered sanitation), organised a workshop to define a project to achieve universal access to mechanical emptying services. The operators and other sector stakeholders at the workshop formulated priority actions to improve performance in this sector, which ultimately resulted in the PSMBV, managed by ONAS with financial support from the Bill and Melinda Gates Foundation. The project addressed all of the issues outlined above, focusing on the departments of Pikine and Guédiawaye, which account for most of the on-site sanitation in the city. It consists of a set of complementary actions contributing to two apparently incompatible (but actually mutually reinforcing) objectives: (i) to provide a good mechanical emptying service at the lowest possible cost to low-income urban residents; and (ii) to help increase the incomes of the mechanical emptiers. The structure of the program is presented in figure 6.

ONAS ORGANISED A WORKSHOP TO DEFINE A PROJECT TO ACHIEVE UNIVERSAL ACCESS TO MECHANICAL EMPTYING SERVICES

Call centre

The call centre is both an intervention and a research tool, with the dual purpose of streamlining the mechanical emptying market in Dakar and identifying effective strategies that can be replicated elsewhere. Specific objectives of the call centre are to:

- Establish healthy competition between the emptiers, thus reducing the cost of mechanical emptying
- Facilitate the relationship between the emptier and the household, and improve the quality of service

- Increase the mechanical emptiers' market share, so as to increase their incomes and reduce manual emptying
- Serve as an action research tool in support of the above objectives

The call centre was implemented in three stages as outlined below:

Preparatory activities
This phase lasted 20 months and included the following activities:

- Identifying emptying companies in the Dakar region, their staff, and their trucks. The emptiers have been fully involved in the process
- Registering the GPS coordinates of the on-site facilities of 60,000 premises in the target area
- Identifying (name, phone number) of people involved in making decisions on pit emptying in the 60,000 premises surveyed
- Geo-referencing primary and secondary reference points through their GPS coordinates. These points are used to help emptiers easily locate the household
- Designing and pre-testing the call centre platform
- Training of the vacuum truck operators to promote their effective participation in bids mediated by the call centre
- Physical establishment of the call centre (premises and equipment)
- Recruiting and training call centre supervisor and operators.

Operation of the call centre
The system links the customer and the emptier, and works via SMS on any mobile phone. Customers wishing to empty a septic tank or pit call the centre, provide key information about the household and the pit, and confirm the date and time it is to be emptied. The call centre then invites the emptiers by SMS to submit quotations for the job. At the end of the bidding period (typically about two hours), the centre notifies the customer the lowest bid, for the customer to accept (or not). After the service has been delivered, the call centre carries out quality monitoring by phone with the household and the emptier.

This bidding for emptying services through a call centre is highly innovative and has since been replicated in other countries. The service model – ordering a service using a mobile phone – is unfamiliar to the majority of Senegalese. To reduce the risk of failure, the call centre was put into operation in three successive phases: beta, pilot, and going to scale.

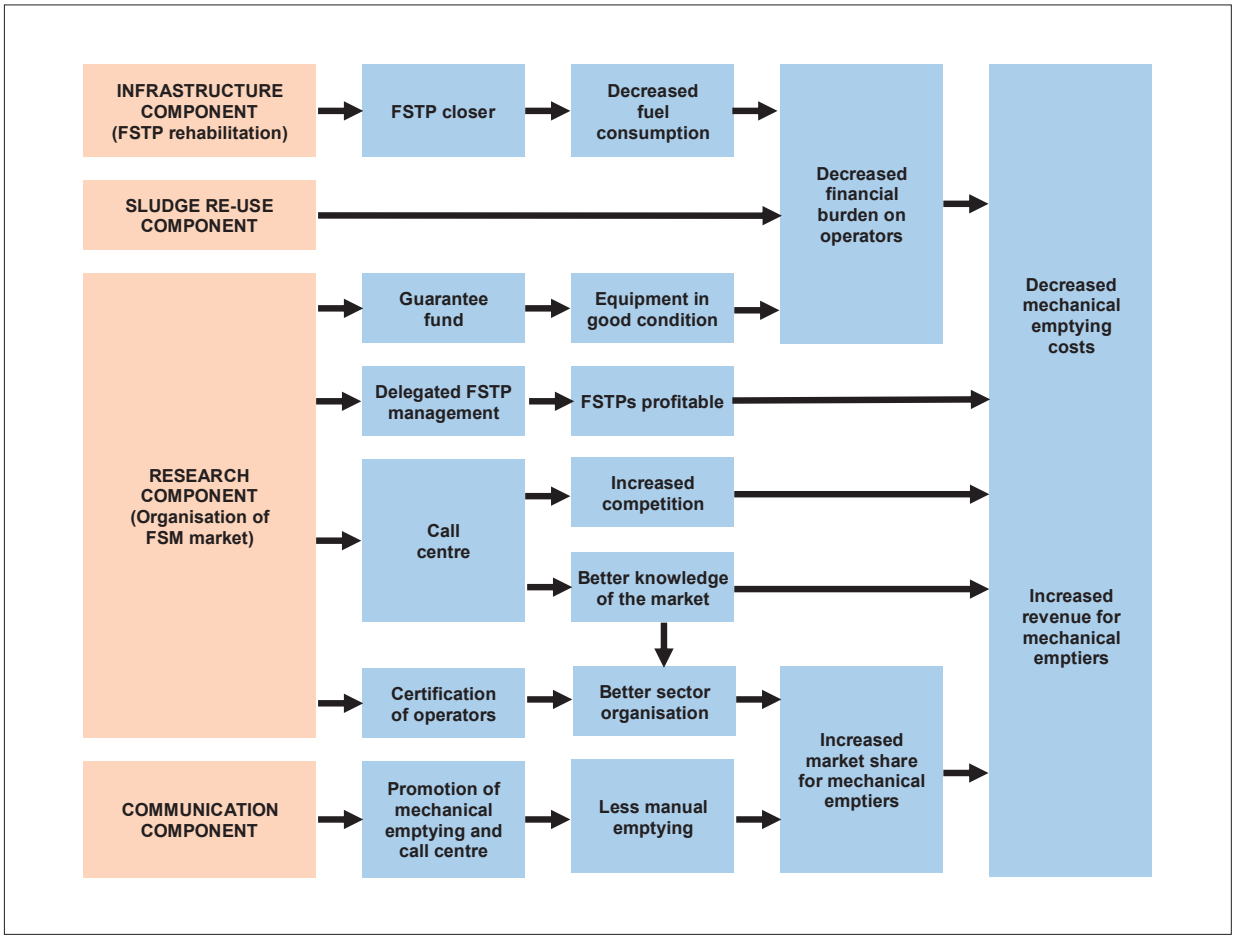

Figure 6: Components of the Faecal Sludge Market Structuring Programme (PSMBV)

Figure 7: Call centre

- **Beta phase:** This lasted approximately one month, and consisted of technical testing of the call centre tools on a small scale, and the initial training of the call centre staff. To generate demand for services, the centre was actively promoted in 150 households through posters, SMS and home visits.
- **Pilot phase** This was a five-month practical test of the operation of the call centre tools targeting a specific and favourable population, still on a small scale, but in a larger area than for the beta phase. Training of the call centre staff was completed, and preliminary information was collected on the impact of the call centre on emptying prices. During this phase, the call centre was actively promoted to 2,000 target households.
- **Going to scale:** This twenty-month stage expanded the call centre services throughout the program area (Pikine and Guédiawaye), with information and awareness campaigns actively promoting the call centre, and mechanical emptying in general. Lessons learned in the beta and pilot phases were used to improve the service and prepare for the at-scale operation.

THIS BIDDING FOR SANITATION SERVICES THROUGH A CALL CENTRE IS HIGHLY INNOVATIVE

In addition, daily monitoring of call centre activities was carried out, to inform the gradual improvement of its platform and procedures. A business model was developed at the end of the scaling stage in order to clarify, among others, issues related to the management of customers, emptiers, and customer/emptier relations, and the feasibility of covering the operating costs of the call centre.

Support activities

Support activities aimed at reinforcing the effectiveness of the call centre were carried out simultaneously through other components of the PSMBV, including:

- Gradual improvement of the call centre platform based on daily monitoring
- Communication campaigns to promote mechanical emptying and the call centre
- Establishment of a guarantee fund to promote the renewal of emptying equipment
- Real-time GPS tracking of emptying trucks
- Initiation of the certification process for emptying companies

These supporting activities acted as catalysts and contributed significantly to developing the emptiers' ownership of the call centre.

Preliminary impact of the call centre

The call centre has given a touch of modernity to the Senegalese faecal sludge sector. It has also enabled many households to access mechanical emptying services and established healthy competition among the emptiers. A rapid assessment shows a downward trend in the prices offered through the call centre. The average price of an emptying by an $8m^3$ truck has decreased from USD 50.00 before the programme started to USD 40.00 after three years' implementation.

In total, between 2013 and 2015, more than 3,537 auctions were held, of which 972 (31 percent) resulted in an emptying operation. The number of calls peaked in 2014 at 2,282, which is attributed to the communication campaign in 2014. It should also be noted that the 2014 rate of 21 percent of calls

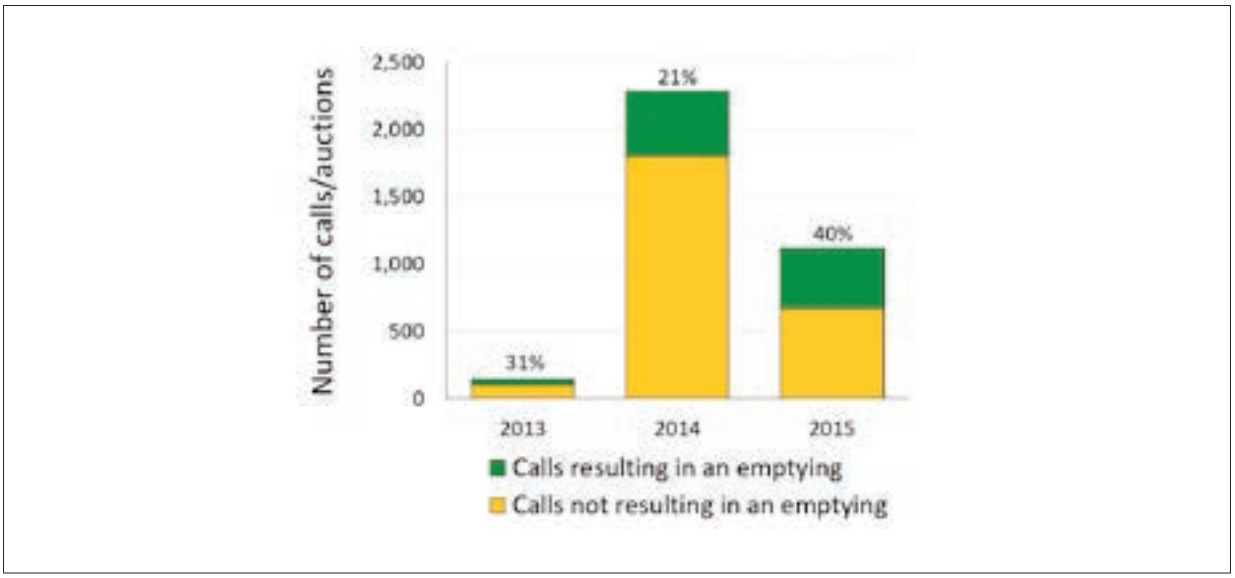

Figure 8: Calls leading to emptying

resulting in an emptying is low compared to the 2015 rate of 40 percent, when there was less promotion of the call centre. The target population appears to have adopted the call centre by 2015, but it is clearly important to continue with an active communication campaign to maintain their interest and increase the volume of calls.

The call centre database covers the 60,000 premises surveyed and 138 vacuum trucks. All registered trucks were invited to join the network and therefore available to bid for emptying services, and all actively adopted the system. Between October and December 2015, 449 tenders were offered through the call centre in 38 communes of Dakar, 186 (41 percent) of which resulted in an emptying in 31 communes, thus demonstrating the wide coverage of the call centre. Eighty-four percent of all activities were located in Pikine and Guédiawaye area.

It is also possible that customers might be using the call centre as leverage in their bargaining with vacuum truck operators in their area. A telephone poll of call centre clients for whom an auction was launched, but after which they did not accept the price, indicates that 60 percent end up contracting a vacuum tanker directly, independently of the call centre. Thus, although a customer may not end up contracting a desludging operation through the call centre, its influence is nevertheless beneficial.

Ninety-nine percent of customers gave a positive rating to the service provided by the call centre. Specifically, they appreciated the ease of contacting an emptier, compliance with commitments made by the call centre, the punctuality and quality of the emptiers' services, and the quality control follow-up calls made by the call centre after each emptying. Similarly, 94 percent of the emptiers expressed a positive opinion about the call centre. They especially appreciated the facilitation of contacts with customers and the simplicity of the procedure for invitation and bidding by SMS.

With the high rate of participation by emptiers, competition has increased and resulted in price reductions. The call centre has thus had a positive impact on both customers and emptiers – the former benefit from lower mechanical emptying prices and the latter from higher demand for their services.

THE CALL CENTRE HAS THUS HAD A POSITIVE IMPACT ON BOTH CUSTOMERS AND EMPTIERS

Guarantee fund

The Guarantee Fund aims to promote the development of emptying companies by facilitating access to credit for the renewal of emptying trucks and/or acquisition of spare parts to enable them to:

- Obtain an emptying licence, as required by the certification process
- Increase income by reducing operating expenses

The Guarantee Fund is based on the following principles:

- Risk sharing between the three parties concerned (Guarantee Fund, bank, borrower [emptier]) on the following basis:
  - The guarantee provided does not replace normal loan requirements (deposit, collateral, personal securities, transfer of income, etc.)

  - The security provided benefits the bank and the Guarantee Fund in proportion to their respective share of risk, because they share liability for any loss associated with a bad loan
  - The guarantee is a fixed percentage of any bad loan. This provision is intended to prevent the bank and/or borrower shirking its responsibilities;
- Use of the Guarantee Fund for compensation applies to bad loans only after all legal steps have been taken to recover the funds, according to normal bank practice
- A loan interest rate lower than usually applied by the bank

A commercial bank was selected by competitive bidding and the guarantee funds deposited with them. The negotiated terms and conditions of the Guarantee Fund are as follows:

- Guarantee rate equal to 25 percent of the loan amount. In other words, the amount made available for lending by the bank is four times the value of the Guarantee Fund
- Annual percentage rate (APR) lower than or equal to 12 percent, including a one percent charge
- Maximum loan of USD 33,000 for trucks and USD 8,000 for spare parts
- 60-month tenor with a six-month grace period for trucks
- 24-month tenor with no grace period for spare parts

IN TWO YEARS OF OPERATION, THE GUARANTEE FUND HAS FINANCED THE PURCHASE OF 26 SECOND-HAND VACUUM TANKERS FROM EUROPE

The Guarantee Fund is overseen by a Steering Committee comprising:

- The PSMBV project Coordinator, Financial Manager and Monitoring Specialist;
- Representative of the Ministry of Water and Sanitation;
- Representative of the ONAS Administration and Finance Directorate;
- Representative of the Association of Sanitation Actors in Senegal (AAAS);
- Two representatives of the bank.

The Steering Committee meets at least once per month and, in fulfilling its assignment, may call on any relevant person or organisation for advice. It is responsible for:

- Assessing the financial and economic viability of the borrowers
- Assisting the borrowers (most of whom are illiterate) to prepare their applications
- Assessing and selecting applications to be financed
- Ensuring compliance with the commitments made by borrowers to the bank
- Reporting to the ONAS Director General on the status of the Guarantee Fund
- Allowing the bank to use the guarantee in the event of unpaid debts, after all remedies provided for in the agreement are exhausted.

Further conditions for loans established by the Steering Committee are that:

- The bank puts a lien on the vacuum truck
- The borrower signs an agreement with the emptiers' association, whereby it may repossess the truck and hand over its operation to another emptier, if more than three repayments are in arrears.

Applications must include:

- Financial statements covering the last three years, audited if possible
- Projected trading account over the term of the loan
- Legal status of the operator
- Financing plan
- Opening an account at the lending bank and depositing its income there.

Legally established companies must also provide a 12-month cash flow plan and a presentation of the company's business.

In two years of operation, the Guarantee Fund has financed the purchase of 26 second-hand vacuum tankers from Europe.

Delegated management of the FSTPs

The objectives of this component were to make faecal sludge treatment profitable through the efficient management of the FSTPs, and to encourage the private sector to invest in them. A private sector operator was recruited by ONAS with the aim of introducing management methods to maximise:

- Technical efficiency
- Financial viability, including the sale of products from faecal sludge treatment as a significant component in making the FSTPs profitable
- Compliance with environmental legislation

The public private partnership (PPP) agreement with Delvic, the selected contractor, includes the provisions set out in table 1.

ONAS	Delvic
Rights • Receive information from the concessionaire (Delvic) • Monitor and control the operation • Apply sanctions or terminate the contract due to reasons of general interest, fault of the concessionaire or unforeseen circumstances	**Rights** • Exclusive rights to operate the service in the geographical area specified in the contract • Direct collection of tipping fees • Receive reasonable compensation from ONAS if unforeseen circumstances arise
Obligations • Plan and execute major investments in the renewal of facilities and equipment	**Obligations** • Pay ONAS for an annual operating licence • Pay 50 percent of net profits to ONAS • Ensure the cleanliness and proper functioning of the FSTP • Maximise value from by-products. • Make any small investments necessary for the continued effective operation of the facilities • Ensure the continuity and adaptability of the service and the equal treatment of users

Table 1: Essential provisions of the PPP for delegated management of the faecal sludge treatment plants

After three years' operation, the FSTPs have been rehabilitated in accordance with the mutual obligations specified in the contract, but with an extra USD 25,000/ year investment by Delvic in lieu of some of the profits to be shared with ONAS under the contract. For the 26 staff, salaries have been increased, working hours and holidays are properly observed and pension contributions and health insurance are paid for. As a result of these measures:

- The FSTPs are fully operational and their environments clean and healthy
- The dumping of sand removed alongside faecal sludge is now permitted
- Opening hours have been extended by 8.5 hours per week to facilitate tanker operations, thereby reducing illegal dumping and increasing tanker availability
- Dried sludge is being marketed
- Financial results have improved, with the annual operating surplus rising to USD 33,300 in 2016 (see graph below)

DRIVERS OF CHANGE AND LESSONS LEARNED

The PSMBV is a major applied research project which has gathered a lot of useful information as well as improving FSM in Dakar. Some of the principal lessons learned are highlighted below.

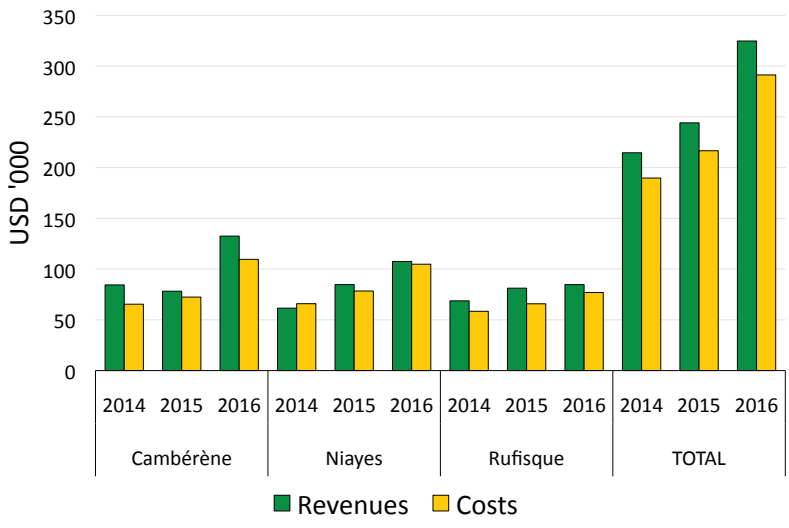

Figure 9: Financial performance of faecal sludge treatment plants

Call centre

Call centre operations
The gradual development of the call centre from test to pilot to city scale allowed for the development of a reliable service and the database on on-site facilities. Daily monitoring of the call centre by an experienced team was instrumental in delivering an effective scaling up process. The call centre requires robust technology in order to be able to process and follow up calls regardless of their volume.

Partnership with the emptiers
Involvement of emptiers in the process of establishing the call centre was crucial to their adopting it, and was facilitated by previous work to get them organised, formalised and committed to modernisation of their businesses. This also helped in ensuring the regular updating of the emptier database to take into account the constant changes in this highly dynamic sector. Training and ongoing supervision of the emptiers on their participation in the bidding process was necessary, especially as many of them are illiterate and are not at ease with the bidding process. Another important catalyst was the support provided through the Guarantee Fund, which promoted the emptiers' ownership of the program and, in particular, helped them to meet certification requirements.

Marketing and communication
The performance of the call centre clearly showed that effective and continuous communication to both households and emptiers on the available FSM services and their advantages is an essential ingredient for success.

Guarantee fund
The high capital cost of serviceable vacuum trucks and, to a lesser extent, spare parts, creates a huge business financing need. However, the informal nature of the sector (at least until the introduction of the PSMBV) and the fact that the banks are completely unfamiliar with the FSM business makes them very reluctant to lend. The establishment of the Guarantee Fund was therefore crucial in unlocking credit for the operators, in this case to the tune of four times the value of the Fund.

It was necessary to educate the banks on the nature and significant growth potential of the FSM business. By doing so it was possible for them to offer loans against the operators' future incomes, taking on the majority of the credit risk and offering attractive interest rates. Another key element of this trust building between the banks and the FSM business was the formal organisation of the emptiers themselves, also supported by the programme, which enabled the imposition of peer pressure on bad debtors, and, in the last resort, the opportunity for the bank to pass the equipment on to another operator who could run it profitably and pay the loan. The emptiers' organisation also facilitated information dissemination, training and support in the process of accessing funds.

Delegated management of the FSTPs
The introduction of delegated management by the private sector had an almost instantaneous effect on improving the management of the FSTPs. ONAS now has fully operational FSTPs as well as increased revenue, and is no longer seen by the private emptying operators as an obstacle, but rather as a partner, helping to organise the private sector and facilitate its work. Engagement of the private sector was clearly a win-win situation for both the private sector and the Government owned ONAS.

NEXT STEPS

Call centre
The call centre has been successful. However, work remains to be done on designing a business model for the sustainable operation of the call centre at an affordable cost which could be passed on to customers. Further simplification of the transactions, for both emptiers and customers would also be beneficial.

When replicating, it is important to consider the local situation taking into account the differences that exist in African markets. For example, even within the immediate region, Accra, Ghana is characterised by a more developed market with little manual emptying, whilst Ouagadougou, Burkina Faso has a less developed market, few trucks, and a lot of manual emptying.

Delegated management of the FSTPs
Technical and financial partners have shown considerable interest in this African experience on the delegation of FSTP management to the private sector, which is one of the first, and may support similar programs in other parts of Senegal or in other developing countries.

NOTES

[1] http://data.worldbank.org/country/senegal

[2] If 96 percent of a population of 1,421,060 inhabitants with an average household size of 10 has their pit emptied twice a year, there will be about 273,000 emptyings per year. If 43 percent of these are manual emptyings at a price of USD 20.00, the total value comes to 273,000 x 0.43 x 20 = USD 2,346,000.

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ABBREVIATIONS AND ACRONYMS

FSTP	faecal sludge treatment plant
ONAS	National Sanitation Office
PSMBV	Faecal Sludge Market Structuring Programme

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Sustainable FSM Services through Integrated Use of Resources and Innovative Technologies: A Case Study of the eThekwini Municipality (Durban) South Africa

T. Gounden and N. Alcock

EXECUTIVE SUMMARY

The vision of the EThekwini Water Services (EWS) is to ensure integrated use of resources through sustainable water management. This means providing water and sanitation services that are equitable as well as environmentally, socially and financially sustainable, and technically excellent.

EThekwini Municipality (City of Durban) has been forced to address sanitation challenges in a relatively short time span, due to a sudden increase in its geographic area of operation and a change from an infrastructure to a service delivery approach in the 2000s. This involved moving from 'first world' challenges of operating waste water treatment works and sewer networks to developing and applying a broader mix of technologies across the sanitation services chain.

During the sanitation development and scaling up process, the city has tested several innovative technologies and learned important lessons, including that 'one size does not fit all' for community sanitation. Sustained stakeholder engagement and education are critical for success and acceptance and continued academic research and assessment, will guide the implementation process and allow for re-imagining and re-development of the solutions.

The City places a high priority on gender equity including gender awareness within its own organization and in implementing sanitation programmes. Promoting gender equality is important for advancing the fundamental development goals of human rights and social justice, poverty reduction, economic development, and overall human development (UKZN Pollution Research Group, 2014).

Although gender is about men and women, the eThekwini Municipality's focus and is largely on issues concerned with women's development and empowerment. Many women have experienced triple oppression, based on their race, class and gender. These derived from past policies and laws which deliberately favoured men. EWS has integrated gender into its work based on the leadership of the Municipality and the National Sanitation Policy.

EThekwini Water Services (EWS) has also learned that partnerships with research institutes and collaboration with the private sector greatly assist with meeting the objective of providing adequate and acceptable sanitation for all.

Finally, eThekwini is looking at developing new approaches, such as social franchising system to meet operation and maintenance challenges and technologies, such as recycling water, generating valuable products and operating off the grid to meet current challenges.

CONTEXT

Background

EThekwini Municipality (Durban) is located on the eastern seaboard of South Africa in the province of KwaZulu Natal, and covers an area of 2,297 square kilometres. In 2015 the population estimated from the 2011 census was 3.5 million people, and the GDP per capita USD 13,000 (2014). Approximately 55 percent of the land is designated as urban (30 percent peri-urban, 25 percent urban), and 45 percent as rural. Since the dawn of the new democracy in 1994, there has been significant influx of people to the city from rural areas, from other cities and from other parts of Africa. Population growth between 2001 and 2011 increased 1.13 percent, putting pressure on sanitation service delivery and other services. Most newly arrived people live in peri-urban areas and in the informal

settlements that are scattered throughout the city, often near potential work opportunities. Most informal settlements are situated on steep land or flood plains, which are high risk areas and pose further challenges to service delivery and infrastructure development.

According to a survey in 2011, there were 912,000 households within the municipality, of which 54 percent were formal, 34 percent informal or backyard shacks, and 12 percent rural. The diverse nature of the topology, the mix of urban, peri-urban, informal and rural households, and the inward migration rate pose a significant challenge to the city in terms of service provision.

Shit Flow Diagram analysis

EThekwini FSM interventions can be summarised using a shit flow diagram (SFD). The offsite and onsite services provided by eThekwini can be broken down as follows:

Onsite

- Urine Diversion Toilets
  - Burial on site
  - To Black Soldier Fly (BSF) plant
- Ventilated Improved Pit (VIP) Toilets
  - Burial on site
  - To LaDePa (Latrine Dehydration and Pasteurisation treatment system)
- Ablution Blocks on site (VIP)
- Flush toilets to septic tank
- Flush toilets to conservancy tank

Offsite

- Flush toilets to central sewer network
- Ablution blocks to central sewer
- Flush toilets to decentralised package plants.

The tables below provides the breakdown of sanitation services by dwelling type as well as backlog figures, and was used to generate the SFD (UKZN Pollution Research Group, 2014). The data used was secondary data from a desktop study and has not all been verified in the field or by surveys.

The key issues depicted in the SFD are as follows:

- 74 percent of the excreta is safely treated before disposal or reuse
- 26 percent is released unsafely into the environment
- 16 percent of onsite sanitation is not contained due to the use of informal pits
- 7 percent of the waste going through the waste water treatment works is considered not treated to effluent quality standards
- 18 percent of the population have UD toilets, and it is assumed that the waste is buried or treated at the BSF plant
- 8 percent of the population have VIPs, septic tanks or conservancy tanks, and it is assumed waste is treated safely.

Dwelling type	Total number of dwellings	Sanitation type per dwelling: Serviced with Urine Diversion Toilets	Within 200m of Ablution Block	Serviced with VIPs	Serviced with Septic Tanks & PPs	Serviced with Waterborne Sanitation	Backlog in sanitation service
Informal Settlements	265542	5194	111868			15533	132947
Informal Settlements - Formal/informal	3096				3096		
Backyard Shacks	48975					48975	
Rural - Traditional	103715	77059					26656
Formal houses not in Rural area (A1)	409210			35000	99232	274928	
Flats (B1)	110225					110225	
Formal houses in Rural area	5147				5147		
Total	945910	82253	111868	35000	106525	449661	159603
Percentage	100%	9%	12%	4%	11%	48%	17%

Dwelling type	Occupancy Rate
Formal house	3.86
Formal Flat	2.0
Informal single	3.6
Informal Backyard	3.9
Rural	5
Rural formal house	4.05

Dwelling type	Population Proportion per dwelling type: People with UD	People with ablution	People with VIP	People with Septic or Package Plants	People with Waterborne to central	People Unserved
Informal Settlements	13698	402725			55919	476609
Informal Settlements - Formal/informal				11951		
Backyard Shacks					191003	
Rural - Traditional	385295					133280
Formal houses not in Rural area (A1)			135100	383229	1061222	
Flats (B1)					319553	
Formal houses in Rural area				22934		
Total	400993	402725	135100	409113	1627796	611889
Percentage	11%	11%	4%	11%	46%	17%

Table 1: Breakdown of sanitation services and backlogs by dwelling type

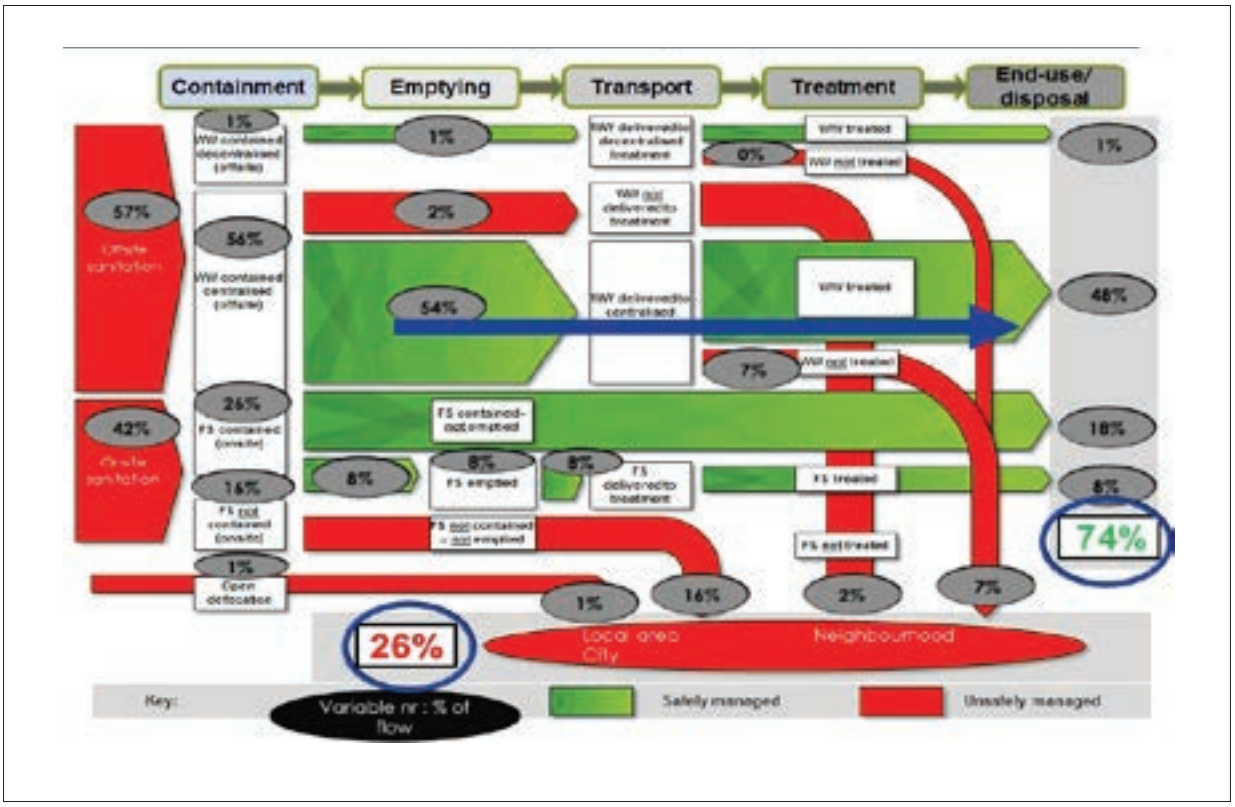

Figure 1: Shit flow diagram for Durban

FSM IN NATIONAL AND LOCAL URBAN SANITATION POLICY

History

Prior to the first democratic election in 1994, the City of Durban comprised several council areas servicing white, Indian and coloured areas under the former apartheid system. Black areas were governed by a combination of the provincial government and the KwaZulu homeland structures. Following the election, the former council areas were amalgamated with the former black township areas to form the eThekwini Unicity, which had one water and sanitation department. The boundary of the city was later expanded to include the sparsely populated rural areas, which had little or no services. Between 1994 and 2000, the municipality focussed on improving the operation of the waterborne sewer system in the former townships through upgrades and community education programmes.

The city also inherited approximately 35,000 VIPs in peri-urban areas where factors such as high density or topography prevented the construction of waterborne sewage.

In 2000/2001, a cholera epidemic broke out in the newly formed Metro region that affected more than 1,000 people and led to more than 15 deaths. The epidemic was particularly problematic in the rural areas, where no formal water and sanitation services were being provided. An extensive programme to roll out a basic water and sanitation service was developed and then implemented. The services consisted of a ground tank system providing six kilolitres of free water per month and a urine diversion toilet for each household.

AN EXTENSIVE PROGRAMME TO ROLL OUT A BASIC WATER AND SANITATION SERVICE WAS DEVELOPED AND THEN IMPLEMENTED

The city also realised that the provision of housing to new residents living in informal settlements could not keep up with demand. A programme to provide community ablution blocks (CABs) with showers, toilets and laundry areas was developed and rolled out. This would ensure that each household had access to basic sanitation within 200 metres of their homes.

Institutional mandate

National policies and legislation focused specifically on sanitation, to guide the delivery services in an equitable and fair manner including the policy of free basic services for all (Department of Water Affairs and Forestry, 1994).

While the right to access to adequate sanitation is not expressly provided for in the Constitution of South Africa, it does contain clauses that imply the right to basic sanitation. In addition, the 2001 white paper on Basic Household Sanitation explicitly acknowledges that "...government has a constitutional responsibility to ensure that all South Africans have access to adequate sanitation...", and the Water Services Act of 1992 the primary legislation relating to water and sanitation in South Africa also refer to a "right to basic sanitation."

South Africa has a three-tier system of governance: national, provincial and local. Local government has the constitutional responsibility to provide water and sanitation services, while provincial and national government have a constitutional responsibility to set policy and support local government in a spirit of co-operative governance (DWAF, 2001).

The Water Services Act sets out the regulatory framework for institutions tasked with the supply of water and sanitation services, and provides for different water institutions to be established as follows:

- The water services authority (WSA), which is the responsible municipality
- The water services provider (WSP), whose role is to physically provide water supply and sanitation services to consumers.

Thus the eThekwini Municipality is the WSA and EWS is the WSP for the EThekwini Municipal Authority. EWS has the responsibility of providing water and sanitation services to more than 3.6 million people within the municipal area, which includes both urban and rural areas. This has given rise to a number of challenges, such as provision of basic water and sanitation services to communities outside the waterborne edge, a lack of awareness about how to use water supply and sanitation services correctly, illegal connections, blockages and vandalism (EWS, 2011).

The challenges facing the WSP in the provision of water and sanitation services are to:

- Manage the conflict between different users in different catchments
- Provide a means of providing access to services to those who are still without
- Maintain and improve services already supplied in a sustainable manner
- Provide measures to assist those who do not have the economic means to pay normal service charges
- Provide water services in support of all forms of economic development
- Address gender equity issues and services for other vulnerable groups.

These challenges need to be addressed in a manner that supports the preservation of ecosystems and in conjunction with an education and awareness programme to ensure proper use and management of water and sanitation systems.

Government policy provides for free sanitation for indigent households (the minimum level of service being a VIP latrine) and access to free basic water. Specific funding streams are available to municipalities for these services; however the details of delivery are left up to the local service provider.

The main strategic planning instrument for local government is in the Integrated Development Plan (IDP). The IDP is a single, cross sectoral plan intended to integrate and co-ordinate all developmental activities and associated budgets within the municipality and which includes the development of a Water Services Development Plan (WSDP).

The new National Sanitation Policy of 2016 has also provided some new areas of focus. These include:

- Prioritising hygiene and sustained end user education
- Sanitation must be people centred and demand driven
- Sanitation has economic value in the form of reuse of bi-products
- Sanitation services need to reflect the growing scarcity of water in a manner that does not undermine long terms sustainability and economic growth
- Long term operation and management planning needs to take place in order to ensure long term sustainability of the services
- Differences in needs and priorities of women, girls and boys and inequalities in access are taken into account during implementation.

Role of the private sector

EWS provides most of the sanitation services throughout the sanitation chain although private sector entities are used to collect and transport of faecal sludge from septic tanks, VIPs and urine diversion (UD) toilets. A number of decentralised treatment plants are privately operated. The private sector is also utilised for the construction of new UD toilets and Community Ablution Blocks (CABs).

Active regulatory aspects or gaps

EThekwini Water Services has an active approach to policy when developing a new sanitation technology. The approach is to first pilot the technology based on the research findings. New policy is then developed before rollout at scale according to the approved policy. Recently developed is the policy on UD toilets, which will be emptied by the municipality every two

Figure 2: Photographs showing emptying and transport of waste from VIP toilets

years free of charge rather than the onus being on the resident to empty the toilet. Adopting the principle that 'good science makes good policy', this decision was based on research by PRG into viable pathogens in UD content that pose a risk to householders who emptied chambers. An example of a new policy area being explored is in relation to control of private septic tank emptiers. EWS is exploring the use of a GPS tracker system to monitor septic tank emptiers in order to prevent unofficial dumping of waste in the environment. Gaps in regulatory aspects relate mainly to by-laws that restrict onsite sanitation where sewer infrastructure has been provided. There are also significant regulatory gaps in the area of reuse of waste.

ABLUTION BLOCKS PROVIDE SEPARATE ACCESS AND SERVICES FOR WOMEN AND GIRLS WITH ADEQUATE LIGHTING AND FEMALE CARETAKERS TO IMPROVE SAFETY

Gender policy and approach

Although gender is about men and women, the eThekwini Municipality's focus is largely on issues concerned with women's development and empowerment. This is because women have experienced triple oppression, based on their race, class and gender. This is also derived from the impact of past policies and laws which deliberately favoured men, thereby historically disadvantaging women. *"eThekwini Municipality hereby deliberately focuses upon this vulnerable group in order to honour its commitment to reducing poverty and facilitating development."* (EThekwini Municipality, 2015)

EThekwini Water and Sanitation have directly applied gender requirements of the municipality and the National Sanitation Policy through the following actions:

- At least 75% of all local project employment opportunities must be for women
- Ablution blocks provide separate access and services for women and girls with adequate lighting and female caretakers to improve safety.

SUMMARY OF FSM INTERVENTIONS

VIP Programme and LaDePa

EWS inherited 35,000 Ventilated Improved Pit latrines (VIPs) in the mid to late 1990s. This was the basic level of sanitation service provided to areas that could not be included in the waterborne system, due to high population densities, lack of formal cadastrals and difficult topography. After ten years, many of the VIPs were full or overflowing, giving rise to extreme public health hazards. EWS piloted an emptying service that was later refined. Policy was then developed before full rollout took place. Under this policy, toilets would be emptied free of charge every five years. Residents would pay for emptying within that period, which would be on request. The sludge removal was carried out by a managing contractor that used local subcontractors who adhered to strict emptying protocol and high levels of health and safety standards. Disposal was burial on site or sludge was processed at a decentralised pelletizer plant called the LaDePa. This machine, developed in partnership with technology partners, first removes solid waste, then dehydrates and pasteurises the VIP sludge and finally produces

pellets which can be used as a soil conditioner or fertiliser. The machine uses heat and medium wave infrared technology to destroy the pathogens.

Urine diversion toilet programme using BSF processing plant

In early 2000, during the cholera epidemic, EWS began exploring other sanitation technologies that could be used in the vast, sparsely populated rural areas as well as the peri-urban areas to replace to the VIP toilet. The cost of emptying the VIP toilet was proving prohibitive due to difficult access to areas and the toilet itself. Following this research and prototype testing, the urine diversion double vault toilet (UDDT) was selected. As the sketch shows, the pedestal separates urine (a male urinal is also provided) from faecal matter. The urine is diverted to a soakaway, while

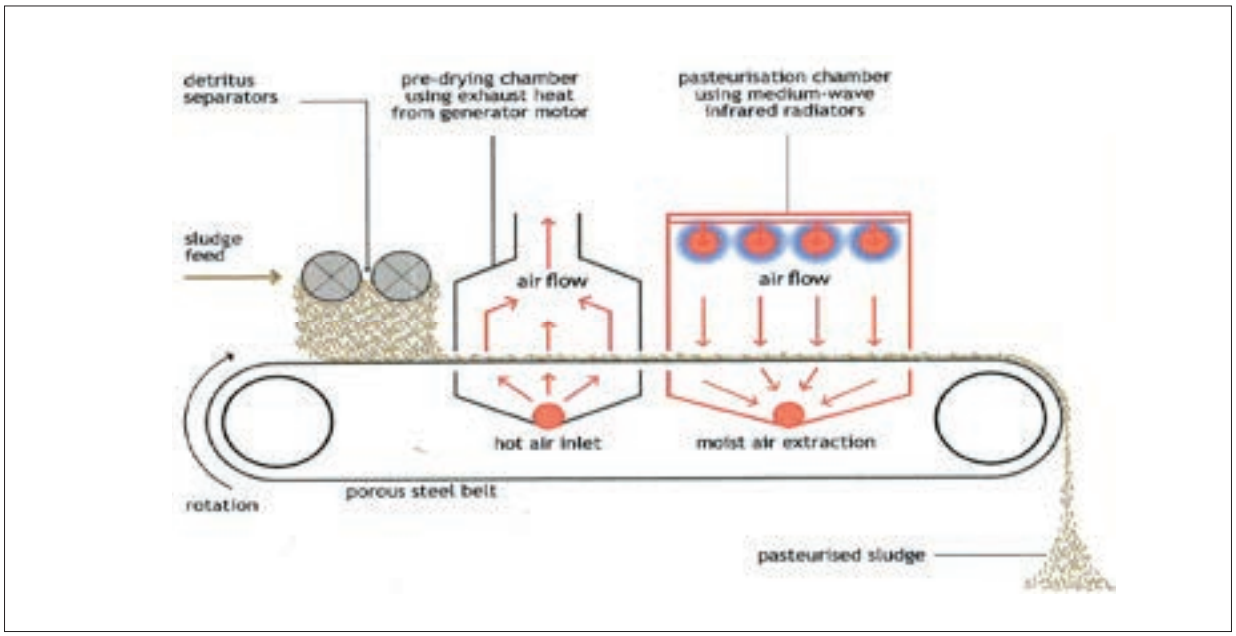

Figure 3: Schematic of LaDePa (Latrine Dehydration Pasteurisation) pelletiser which is used to process VIP waste at decentralised locations

Figure 4: Photographs of LaDePa components, inputs and products

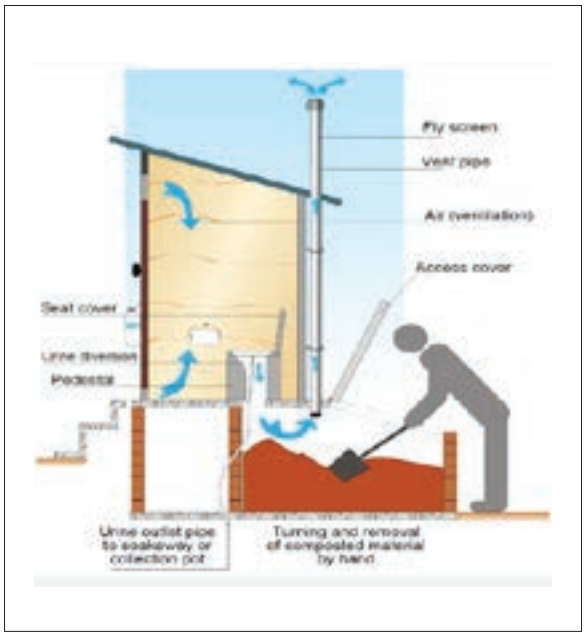

Figure 5: Schematic of a urine diversion toilet

the faecal matter collects in the chamber. When the chamber is full, the pedestal is moved to the second chamber giving time for the contents of the first chamber to decompose and for pathogens to die off. Residents are trained to empty and bury the contents of the chamber once fully decomposed. Access to the chamber is by means of two sliding back panels, which is much easier than breaking into a conventional VIP toilet. The UDDT is provided to the households at no cost but the householder is responsible for emptying. The delivery programme started in 2005, and some 85,000 toilets have been developed to date (DWAF, 2002).

EWS partner, the University of KwaZulu Natal Pollution Research Group (UKZN PRG), have undertaken several research activities linked to the implementation and operation of the UDDT over the past five years. A number of challenges were identified:

- Some households were not emptying full and overflowing chambers
- Households felt that EWS should provide a free emptying service as they did for VIP toilets
- Pathogens were not breaking down during the decomposition process, so households were being exposed to health hazards during uncontrolled emptying
- Some peri-urban areas have densified and there is limited space for burial onsite
- Disposal at hazardous waste sites is prohibitively expensive (USD 65.00/ton).

EWS made a decision in 2014 to provide one free emptying service every two years. The appropriate policy was approved by the council. An opportunity to test and develop an emptying and disposal model through a private sector partnership was made possible through a grant from the Bill and Melinda

Figure 6: Photographs showing the components of a urine diversion toilet and emptying activities

Figure 7: Photographs showing various aspects of a black soldier fly plant used to process urine diversion toilet faecal waste

Gates Foundation (BMGF) that aimed to promote business partnerships in the sanitation sector. The programme consisted of an emptying programme followed by burial on site or transport to a processing site. The emptying, burial and transport programme is funded by the municipality.

The technology selected for the processing plant is Black Soldier Fly (BSF). The plant, which was built at a municipal wastewater treatment works, consists of receiving area, grow-out sheds, nursery and processing equipment. This was funded by BMGF. The end products are oil from larvae, animal feed and biochar. As the project is a pilot, "downstream" sale of products are still being finalised by the operator. However, the operator has existing relationships with agricultural buyers for sale of feed and industrial buyers such Unilever for sale of oil. The plant was completed at the end of 2016 and is in the commissioning phase at present. It is being operated privately under a service level agreement (operating contract). The emptying contractor was appointed by tender and will start emptying toilets at the beginning of 2017.

Key institutional and regulatory issues are:

- The development of an innovative service level agreement between the municipality and the BSF plant operator
- Use of local labour and local contractor were made mandatory in the emptying tender document
- Detailed health, safety and environmental requirements were included in the emptying contract and in the BSF service level agreement.

Community Ablution Blocks (CABs)

A key third sanitation challenge faced by the municipality is the provision of services to residents of dense informal settlements while residents wait for provision of new formal housing. Waterborne sewage and urine diversion toilets at a household level are not possible due to densities and topography. EWS piloted and later rolled out community ablution blocks (CABs), which provide services to approximately 75 households within 200 metres of the facility. Housed within a converted shipping container, the CAB provide the following facilities:

- Separate male and female toilets
- Showers
- Laundry areas
- Lighting
- Connections to sewer mains.

Each container is allocated a local caretaker who manages the facility. Of the 1,500 caretakers employed to date, more than 1,300 are women. EWS provides consumables such as toilet paper and cleaning material on a regular basis. EWS also attends to faults such as water leaks, toilet blockages and vandalism. Robust, non-valuable materials were used to reduce incidents of theft and vandalism.

Through EWS partner UKZN PRG, a number of research activities on the installation and operation of CABs were undertaken between 2012 and 2016. Key findings from these research activities included:

- High running costs due to slow response by the municipality to leaks and faults
- Inconsistent service provided by caretakers due to low levels of monitoring
- Some pollution challenges due to leaks and blockages
- Access is difficult (in some cases) due to topography
- Greater acceptance of the technology
- Significant reduction in open defecation

Figure 8: Photographs showing components of a community ablution block in an informal settlement

- Greater social cohesion where communities embraced toilet blocks as their own
- Reduction in vandalism.

Other planned FSM Interventions

The EWS response to these findings was to develop a social franchising system to manage the CABs. This system involves the appointment of a private managing company (franchisor) that appoints local CAB operator companies (franchisees). Women owned businesses will be targeted for the majority of these franchisee opportunities. The system allows for rapid response to faults, and procurement requirements and cost management would be transferred to the franchise system. However, EWS has not yet been able to obtain approval from municipal management to implement this approach.

EWS is also investigating decentralised waste water treated options including DEWATS for use at new housing projects that cannot be connected to the sewer network. DEWATS is an anaerobic baffle reactor, which has been piloted by the municipality but approval for use at new housing projects is still being sought. The approval process, which includes conducting an environmental impact assessment (EIA) and obtaining a water use licence, has proved laborious and resulted in delays.

THE EMPTYING SERVICES ARE MADE POSSIBLE BY CROSS-SUBSIDISATION FROM WATER AND SEWERAGE SERVICE CHARGES FROM MORE AFFLUENT AREAS AND HOUSEHOLDS

FINANCIAL AND ECONOMIC ASPECTS

Both the VIP and the UD toilets were provided to residents free of charge. This was made possible by a municipal infrastructure grant provided by national government to municipalities, and the cost of installing

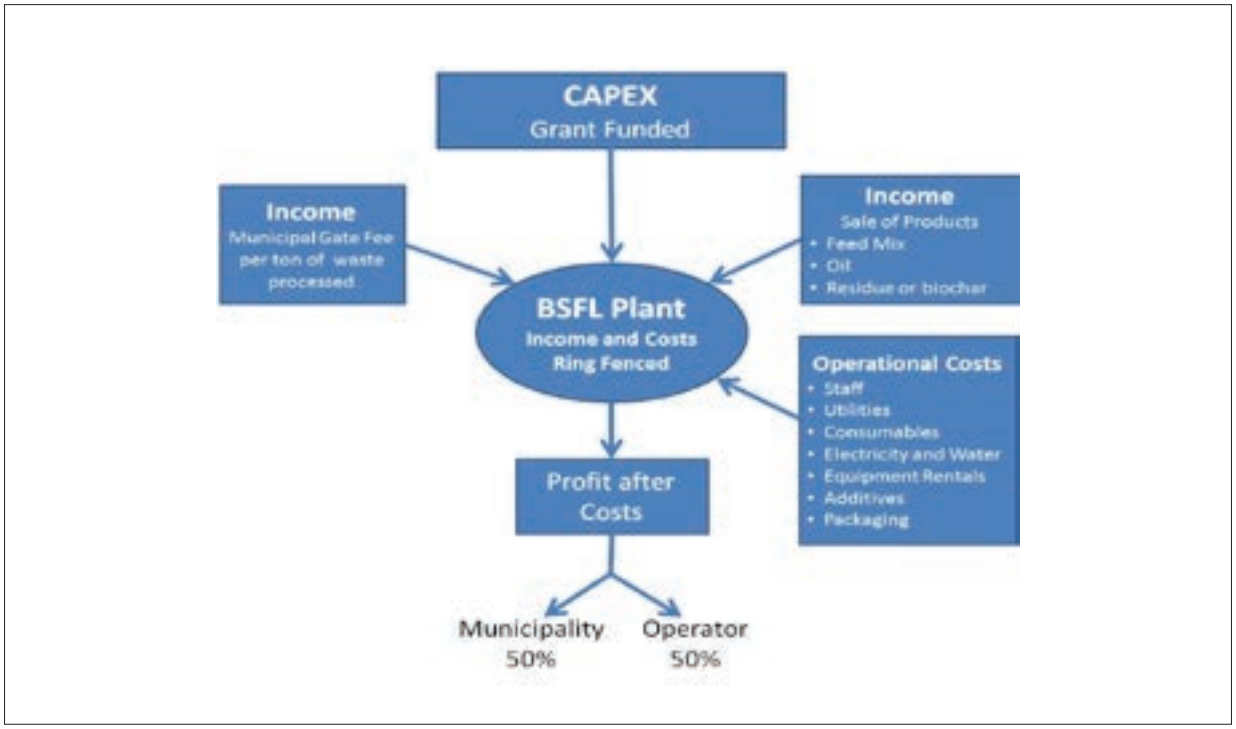

Figure 9: Schematic of the business model agreed on by the municipality and operator for the black soldier fly plant

Processing route	Cost/toilet USD
Removal, burial and tree planting	75.00/toilet
Removal, transport and disposal at hazardous waste site (average dist. 20kms)	97.00/toilet
Net cost of removal, transport and BSFL processing (assuming a profit share of USD 11.00 per toilet waste processed and a 100% capital cost subsidy)	51.00/toilet

Table 2: Costs of waste management from urine diverting toilets

Driver	Change
1994 new democratic dispensation 1996 new eThekwini unicity as amalgamation of townships, white and Indian council areas Free basic services policy	• Improve sewer network in former townships • Extensive education programmes in communities and schools on correct operation of sewer system • Rollout of VIPs
2000/2001 cholera epidemic 2000/2001 White paper – adequate sanitation for all	• Rollout of basic water and UDs in rural and peri-urban areas
2005 VIP – five-year emptying policy	• Rollout of VIP emptying programme and development of LaDePa for processing of waste
Rapid urbanisation after 1994	• Rollout of CABs in informal settlements
Political and social pressure for flush toilets in non-sewered areas	• Testing of DEWATS • Pour flush testing
Urine diversion research indicates health hazard when emptying	• Development of UD emptying programme and BSF technology for processing plant
2014 Research indicates operation and maintenance challenges at CABs	• Development of social franchise management system

Table 3: Drivers of change in the sanitation sector

a UD toilet through the municipal infrastructure grant is USD 860, and a VIP USD 461.

The emptying services (every two years for UDs and every five years for VIPs) are made possible by cross-subsidisation from water and sewerage service charges for in more affluent areas and households. Should households require emptying within the two and five years cycles, they can request this but must pay a removal fee. The cost of pit emptying a VIP toilet is an estimated USD 100, whilst UD emptying costs around USD 46.00 and is covered by the cross subsidy which is equivalent to the household pays if they need extra emptying.

Figure 9 illustrates the agreed business partnerships contained in the service level agreement for the processing of UD waste at the BSF plant (N Alcock et al., 2016)

The financial costing for the model for removal of UD waste and burial onsite, and transport and processing is shown in Table 2.

The costs for UD management are subsidized by the Municipality from the higher sewage and water charges in more affluent areas, meaning that there is no income through payment by users. The cost to the householder to desludge a septic tank and transport waste is approximately USD 65.00.

CAPACITY DEVELOPMENT

Capacity development is an integral component of EWS ethos both internally (staff) and externally (community and contractors). Internally, staff are mentored and coached on specialised areas of their work including being given opportunity for further education in their respective fields. Externally, work

opportunities on projects include members of local community (non- skilled) who are given on job training according to the Expanded Public Works guideline "to develop skills within communities through on-the-job and/or accredited training of workers and thereby developing sustainable capacity within communities" (EPWP,2016).

DRIVERS OF CHANGE

The drivers of change in the sanitation sector in eThekwini are summarised in Table 3 above.

LESSONS LEARNED

There have been many specific lessons learned from the implementation of the various sanitation technologies for target communities. However, several fundamental lessons have been learned across all programmes.

There is no 'one size fits all' approach. Different technologies are suitable for different situations and communities. Secondly, the attitudes and understanding of communities and political structures are instrumental in the success of any rollout. Without community engagement, support for and understanding of operation and maintenance will be lacking. Technologies need to be tested in laboratories and then piloted in communities before finalisation for rollout. Policy development based on the findings of the pilot must then be developed and approved. During rollout, ongoing research and evaluation must take place. Finally, based on any problems identified, the approach can be re-imagined and new approaches piloted.

The FSM sanitation model can thus be summarised in the cycle below. This development cycle is the key to achieving rollout.

A number of other key lessons learned are summarised below:

- **Rollout to city-wide services** needs to include comprehensive long-term community engagement and education
- **Need to shift from an infrastructure** to a service delivery approach
- **Need for safe management of excreta** throughout the sanitation chain
- **Need for facilitation of progressive realisation** built on what is already in place
- **It is important to consider operation and maintenance budgets** and not focus purely on building toilets
- **The role of the private sector** in bringing in innovation needs to be recognised
- **Policy makers and sector leaders** need to encourage calculated risk in order to continually improve service delivery.

OUTSTANDING CHALLENGES

Key outstanding challenges and the planned steps to address these challenges are:

New environmental policy is aimed at reducing or stopping burial of faecal waste on site. This means more waste from VIPs and UDs will need to be transported to decentralised processing plants. There is a plan to rollout three more LaDePa pelletizes at various locations in the municipality to process waste and derive income from sale of products. This potential income will reduce the costs associated with the transport of the waste.

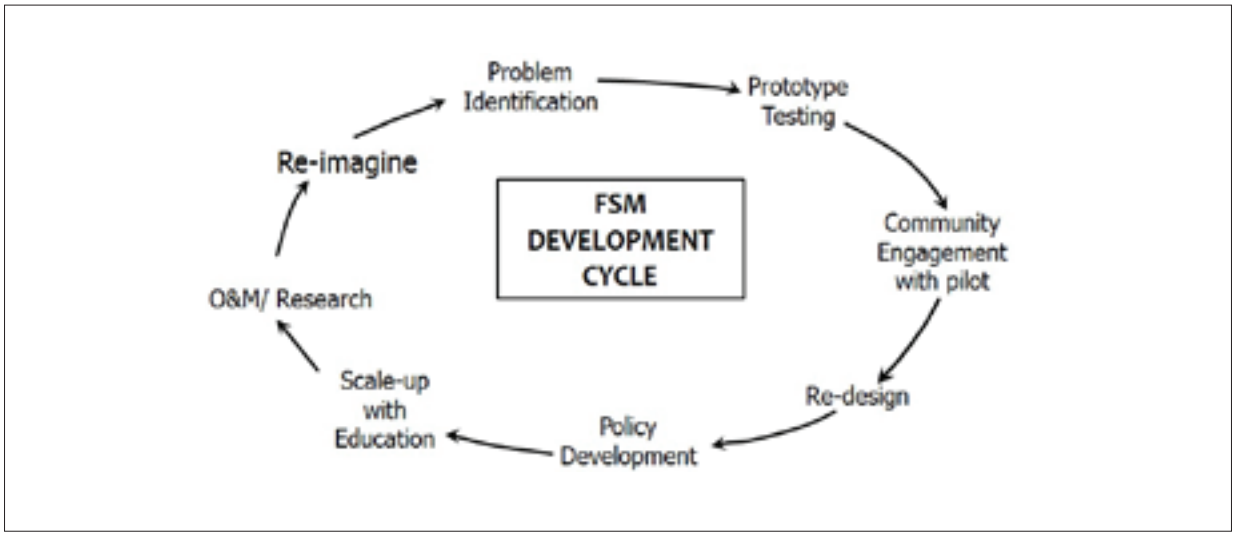

Figure 10: FSM development cycle

The operation of the BSF processing plant will be analysed this year. Should the plant be viable in terms of reducing costs through sale of products, additional plants will be planned and constructed within the municipality.

Improving the operational and proactive management of the caretakers in the CAB programme. The social franchising system (described earlier) aims to achieve more efficient and cost effective management and maintenance of the CABs and empowerment of women through franchisee opportunities.

The provision of flush toilets at new housing projects that cannot be connected to the existing sewer networks. Residents strongly aspire to owning a flush toilet. Two technologies are being piloted to try to meet this aspiration. First is pour-flush technology, which uses limited water (a scarce resource in the municipality) and waste is disposed of in a pit close to the house. The second is DEWATS or Decentralised Waste Water Treatment System. It is hoped to test this at a new housing project soon.

Exploration of new technologies that advance to the circular economy approach. Technologies that recycle water from effluent and grey water, derive valuable products from waste and operate off the electrical grid will be developed over the next few years.

The **municipal approval processes and delays** experienced during procurement for rollout. Approval by Municipal management and procurement challenges have delayed the CAB franchising system, the rollout of UD waste removal, and the second VIP waste removal programme. New ways to address these challenges need to be sought. The most fundamental step would probably be to build relationships between officials and key politicians (decision makers).

Other challenges needing attention include:

- Creation of sustainable small-scale independent service providers to assist the municipality with improving service delivery efficiencies
- Exploring possible revenue generation from resource recovery and reuse of waste products
- Deepening the understanding of city leaders and politicians about the value proposition of FSM and that 'it's not all about flushing'
- Changes in procurement processes to allow for more local community involvement in projects
- Relaxation of by-laws and policies for onsite sanitation within urban areas.

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ABBREVIATIONS AND ACRONYMS

BSF	Black Soldier Fly
CAB	Community Ablution Blocks
DEWATS	Decentralised Wastewater Treatment
EWS	Ethekwini Water and Sanitation
LaDePa	Latrine Dehydration and Pasteurisation
UD	Urine Diversion
VIP	Ventilated Improved Pit

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Leveraging FSM to Close the Urban Sanitation Loop in Kampala

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EXECUTIVE SUMMARY

Kampala is experiencing rapid population and economic growth. Provision of basic services, including adequate sanitation for the city population has not kept pace with these developments. The municipal sewerage network serves less than ten percent of the city's population, leaving the vast majority (over 90 percent) reliant on onsite sanitation, which is mostly unimproved. Only about half of the faecal sludge from these onsite facilities is safely collected and treated, and large parts of the population have no faecal sludge management services. Kampala Capital City Authority, which is in charge of regulating and planning the waste and sanitation sector of the city through its Directorate for Public Health and Environment, has made it a priority to tackle these challenges to achieve its environmental sanitation ambitions.

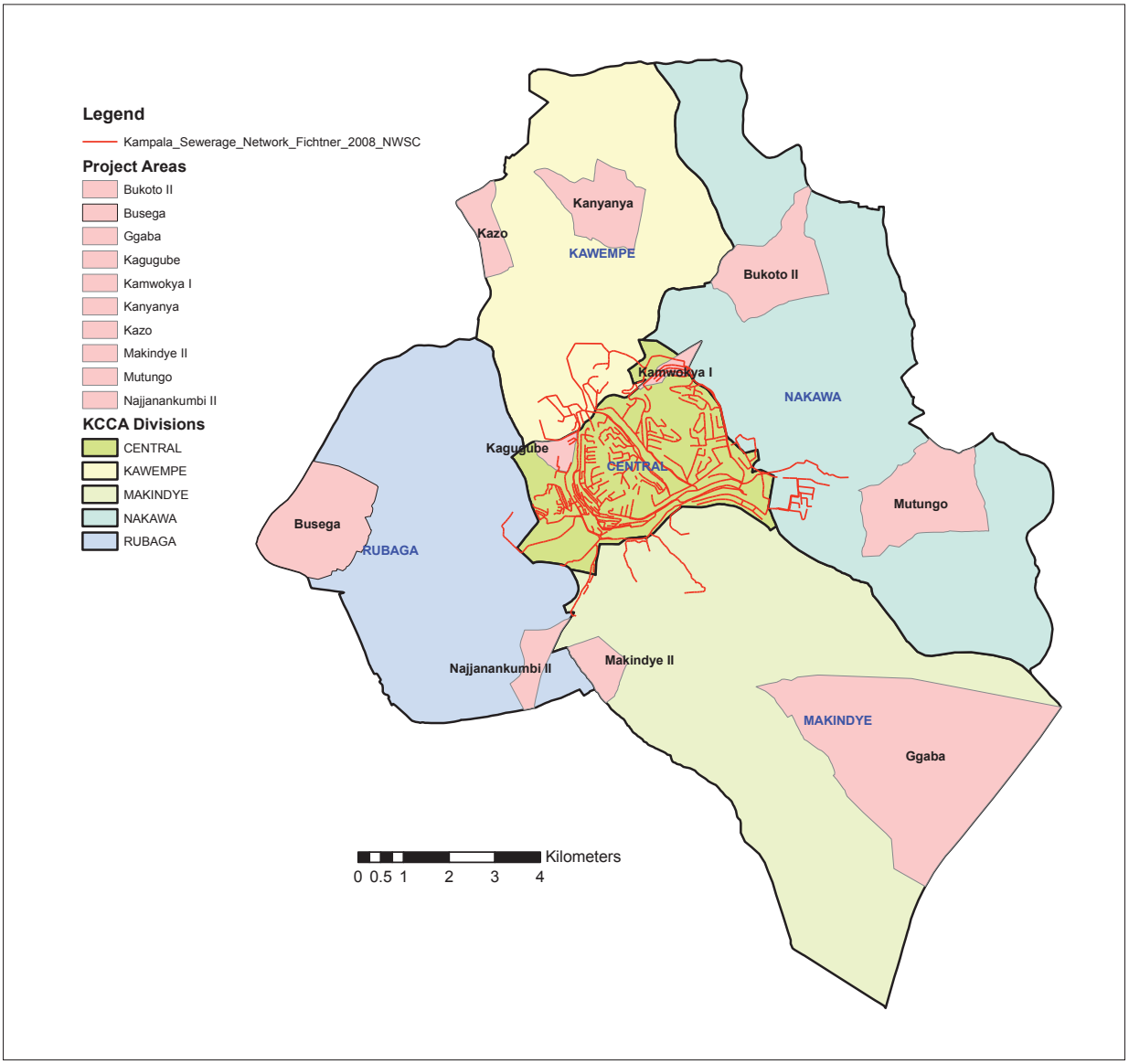

Figure 1: Map of Kampala

Firstly, it strengthened its coordination of sector actors in the city to minimize duplication and optimize the available resources and capacities. It then embarked on a sanitation improvement programme with strategic partners including the Bill and Melinda Gates Foundation (BMGF), DfID, GIZ, WfP and other NGOs. The programme addresses the whole sanitation service chain with a focus on private sector participation to accelerate and improve coverage and levels of service. Three strategic interventions have been implemented along the sanitation chain, initially on a pilot scale and now in the scaling-up phase. These included strengthening the legal and institutional framework of the sanitation sector, intensive engagement of the private sector, focusing on faecal sludge collection and transport, and the creation of demand for sanitation services. Ultimately, the city authority is working towards a public-private-partnership model based on service level agreements to regulate and monitor service delivery.

The programme has already achieved considerable results. For instance, access to formalised faecal sludge management services has increased, and the private sector is in constant and institutionalised exchange with the city authority. Minimum standards for onsite sanitation have been developed and facilities are being upgraded or constructed to meet the standards. Streamlined behavioural change communication material has been developed and applied in a city-wide campaign. In addition, sanitation coordinators are in place in all five divisions of Kampala, and a sanitation call centre has been established and been in in operation since mid-November 2016.

CONTEXT

Kampala, Uganda's capital city is located beside Lake Victoria, one of Africa's great lakes. Originally a city on six hills, Kampala has expanded to accommodate a resident population of 1.5 million (2014 census) that doubles during the day due to commuting flows. It has become the largest urban centre in Uganda, accounting for 80 percent of the country's industrial and commercial activities and generates 65 percent of national gross domestic product. The city is divided into five administrative divisions: Kawempe, Nakawa, Central, Rubaga and Makindye. The central business district is the economic and industrial hub, but all five divisions are characterised by a mix of residential and commercial areas. Due to rapid urbanization and rural-urban migration, approximately 60 percent of city residents live in informal low-income settlements, which occupy 10.8 percent of the city area, and of which 95 percent lie in valleys.

The urban poor predominately reside in these growing informal settlements that are typically characterised by high population densities, inadequate infrastructure and limited access to social services, including sanitation and waste management. Policies for service provision are inadequate and often fail to cover the poor in these settlements. Resources are difficult to mobilise due to the illegal status of the settlements. When services are provided, the value of the area, property prices and rents increase and the poorest residents have to move to cheaper accommodation where there are fewer services.

Following decades of inefficient city management, Kampala Capital City Authority (KCCA) was established by parliament in 2011 to administer Kampala on behalf of the government. Since then, KCCA has been responsible for the city, including, but not limited to, physical planning, education, social and public health services. KCCA therefore has the mandate for regulating and planning the waste and sanitation sector of the city through its Directorate for Public Health and Environment.

The mission of KCCA is to transform Kampala by building key institutional, infrastructural and social structures that will ensure the delivery of goods and services, and respond to the challenges of increasing population and urbanization. In the first years since its inception, the authority has been focusing on improving solid waste management. It has developed a public private partnership (PPP) framework, in which KCCA remains the regulator but the private sector is the implementer. This system, though quite new, is proving to be successful. Recently, KCCA has adopted a similar approach and PPP model to improve sanitation in Kampala, with KCCA as regulator and the private sector taking over collection, transportation and treatment of faecal sludge.

The sanitation situation in Kampala

Sanitation is one of the major development challenges facing Kampala Capital City. Like many other cities in developing countries, Kampala is experiencing rapid population and economic growth. However, provision of key services including adequate sanitation has not kept pace with these developments. The municipal sewerage network is out of reach to the majority, serving less than 10 percent of the city, mostly in the central division (see Figure 1). Over 90 percent of the population rely on onsite sanitation, most of which is not classified as "improved" or "acceptable". In many cases, multiple households share a toilet, leading to unhygienic conditions. Pit latrines are mostly unlined, contain a large amount of solid waste, and are difficult to access for emptying, ultimately resulting in filled pits

that are either abandoned or directly emptied into the environment, posing health and environmental risks for the city and its people. The predominant sanitation technology is the pit latrine (64 percent) followed by septic tanks. According to the 2014 census, 30 percent of Kampala's households have access to improved toilet facilities such as flush toilets, VIP latrines, pit latrines covered with a slab, and compost toilets.

Besides improving personal hygiene and the cleanliness of toilets, a major challenge is the safe handling of faecal sludge from the onsite facilities. It is estimated that only half of the faecal waste generated daily in Kampala is currently emptied from the pit latrines and safely managed.

Improper solid waste disposal and sanitation facilities that are emptied during heavy rains or connected directly to open drains contaminate the wetlands and Lake Victoria's Inner Murchison Bay, the city's main water source. Furthermore, the latrine pits pose significant health hazards due to the high groundwater tables, leading to a situation where, according to the city administration, all natural springs in Kampala are contaminated with *E. coli* bacteria.

FAECAL SLUDGE MANAGEMENT (FSM) SERVICES IN KAMPALA

Whilst significant investment has been made in providing access to sanitation (99 percent of city residents have access to sanitation facility, Census 2014), minimal effort has been placed on the downstream components of the sanitation service chain. Effluent from latrines and septic tanks is often discharged into the environment untreated, and where pit emptying services are provided, service providers travel long distances to the treatment plants. Additionally, many premises in informal settlements are inaccessible by road. Overall, only 43 percent of the faecal sludge generated is currently collected, transported and disposed of safely. A study in 2014 (BMGF, 2014) also identified unregulated emptying services, insufficient treatment capacity and a lack of public awareness as challenges to faecal sludge management (FSM) in Kampala.

Emptying services

Faecal sludge collection and transportation services in Kampala are provided by KCCA and largely informal and unregulated private operators. Two associations with a membership of more than 100 service providers are to some extent organising the private vacuum truck operators, but this does not give them legal status. Most of the vacuum truck operators work informally without a certificate of incorporation, trading license, environmental license or a formal office. The objectives of the two associations are to strengthen the operators' market power, set minimum industry standards, and provide pricing guidelines. There are 88 vacuum trucks active in Kampala varying in size from 2 m^3 to 10 m^3. As the operators are not accountable in any way to the authorities, it is hard to keep track of the ownership of the trucks.

There are also ten Gulper operators in Kampala. A Gulper is a mechanical sludge emptying device similar to a borehole handpump that has been designed for pit emptying in densely populated, informal areas not accessible by the larger vacuum trucks. The emptying charges range from USD 7.00 to USD 11.00 per 200-litre barrel. With an average daily income of USD 2.00 in poor urban households of Kampala, this service is considered expensive. Vacuum trucks are proportionally cheaper, charging from USD 20.00 for 2.5m^3 to USD 50.00 for 10m^3 of faecal sludge. Informal

Figure 2: A vacuum truck in Kampala

Figure 3: Gulper in operation

FOREVER SANITATION: A SMALL FSM ENTERPRISE

Because of the inconvenience and expense of pit emptying, it is common practice in Uganda to dig latrine pits as deep as possible – typically 4m–6m, but not infrequently up to 10m – reasoning that a deep pit will take a long time to fill up. However, this means that sludge at the bottom of pit is rock-hard and almost impossible to remove. This may be further exacerbated by the use of "DX-4" or similar liquid additives, which some people use to reduce the sludge volume by separating liquids and solids, resulting in a lower volume of more solid sludge.

Forever Sanitation's standard operating practice, which has evolved over the past four years, starts by adding up to two drums of water to the pit to soften the sludge. The sludge is then broken up and mixed using wooden poles, and any solid waste is removed with rakes and spades. A Gulper is then used to remove the first couple of metres from the top of the pit, beyond which it cannot function effectively. The remaining sludge is then scooped out using a cut down three-litre plastic container suspended on rope, which is effective down to about 6m. The whole operation usually takes about three hours, but can take up to ten hours for difficult pits. It is hard work, carried out by a team of two people – one to empty the sludge and the other to transfer it to the truck parked on an accessible road – but there is little alternative in places that vacuum trucks cannot access.

Health and safety are important, and the workers wear rubber boots, gloves and protective clothing, and clean up any spillages as they work. Safe disposal is also a challenge, as the designated sludge dumping sites are designed for vacuum tanks with hoses, and cannot accept sludge in barrels. To address this, Forever Sanitation has developed a funnel with hosing at one end and a cage screen in the middle to screen out solid waste.

Figure 4: Scooping sludge from a pit latrine

The Gulpers are useful, but better equipment specifically designed for emptying inaccessible or poorly constructed pits is needed, as are improved techniques for processing faecal sludge into saleable products. Applied research collaborations with local or international academic institutions and practitioners have much to offer in this regard.

Transport and disposal also present challenges: the designated dumping sites are designed to cater for vacuum trucks, and have limited opening hours that coincide with the business day, and hence heavy traffic. Transfer stations and/or tankers would also reduce time lost in traffic jams. Forever Sanitation is also considering the use of motor tricycles and/or mini-trucks for better access in unplanned areas.

manual emptiers also exist, but as their work is illegal there is no record of their number. In addition, Kampala Capital City Authority (KCCA) owns six 5 m^3 vacuum trucks for emptying public and institutional toilets, such as those in public schools and health centres.

Faecal sludge treatment

The city has two wastewater treatment plants. Bugolobi Sewage Treatment Works is designed to treat only domestic and industrial effluents, and has a capacity of 14,500 m^3/day, which is currently being expanded. Lubigi Sewage and Faecal Sludge Treatment Plant, commissioned in 2014, has a sewage treatment capacity of 5,000 m^3/day, which is to be expanded to 12,500 m^3/day, and faecal sludge treatment capacity of 400 m^3/day. The latter is currently receiving around 600 m^3 of faecal sludge per day, so is already overloaded. Furthermore, Bugolobi is also receiving

faecal sludge on a daily basis, even though it is not designed to treat sludge, which should be directed to the Lubigi plant. There is no official data on the amount of faecal sludge received per day at Bugolobi.

Business models

As the FSM market is currently not regulated, there is a free market for emptying services, and operators negotiate their charges with individual customers. Only the dumping fees at the treatment plants are fixed.

The majority (76 percent) of formal emptying takes place in formal settlements (KCCA, 2017), although they house only 40 percent of the population. There are no geographical service boundaries, and operators can offer their services anywhere in the city. This leads to "cherry picking" of customers who are easy to access, close to the treatment plants and/ or who can afford to pay higher charges, leaving large numbers of customers and geographical areas of Kampala unserved (Figure 5). The Gulper operators were intended to solve the access issue, but as their charges are relatively high for the volume of sludge emptied, they are not considered a pro-poor alternative for low-income areas.

THIS LEADS TO "CHERRY PICKING" OF CUSTOMERS WHO ARE EASY TO ACCESS, CLOSE TO THE TREATMENT PLANTS AND/ OR WHO CAN AFFORD TO PAY HIGHER CHARGES

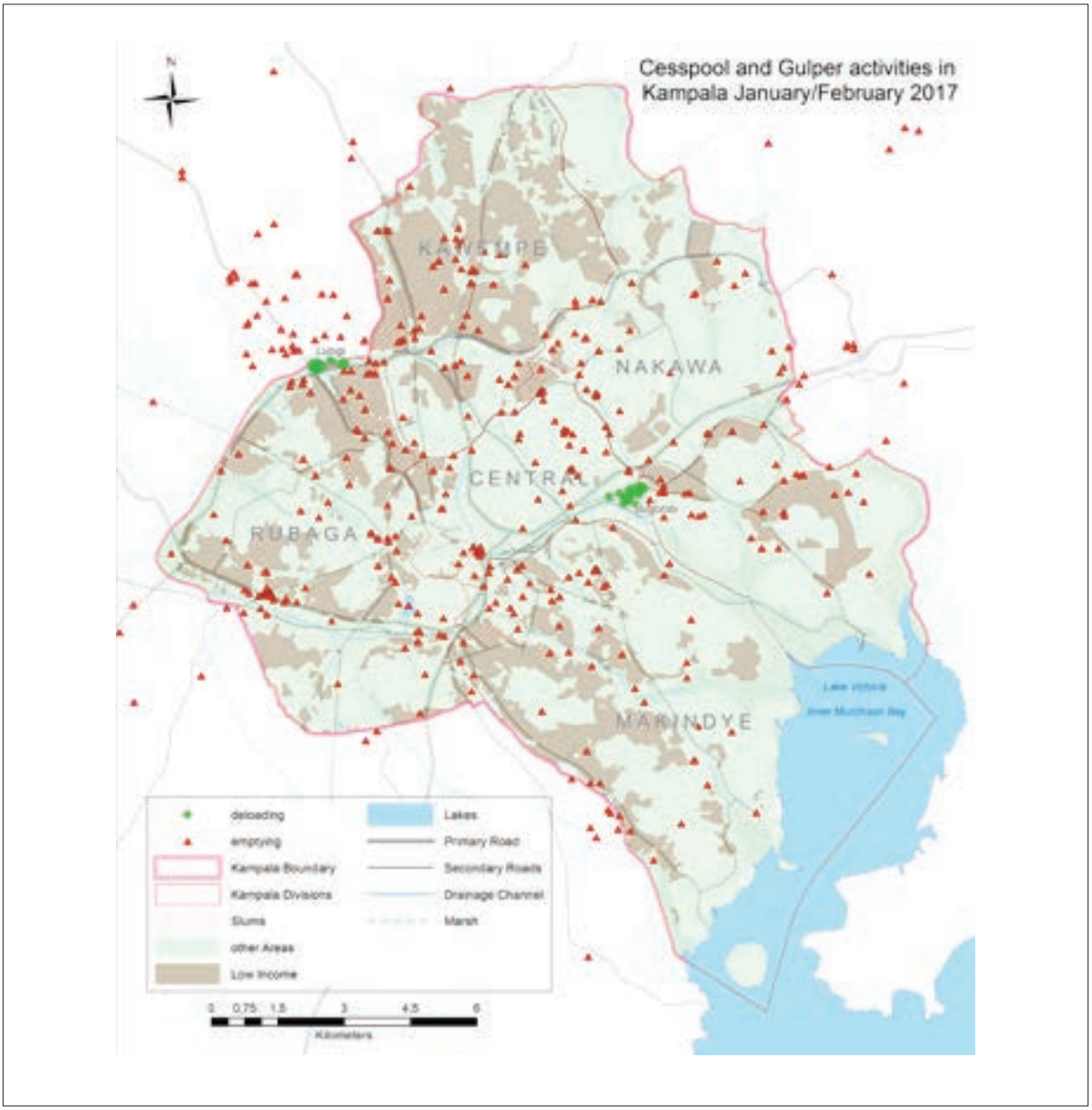

Figure 5: Preliminary results of a tracking exercise of vacuum trucks in Kampala

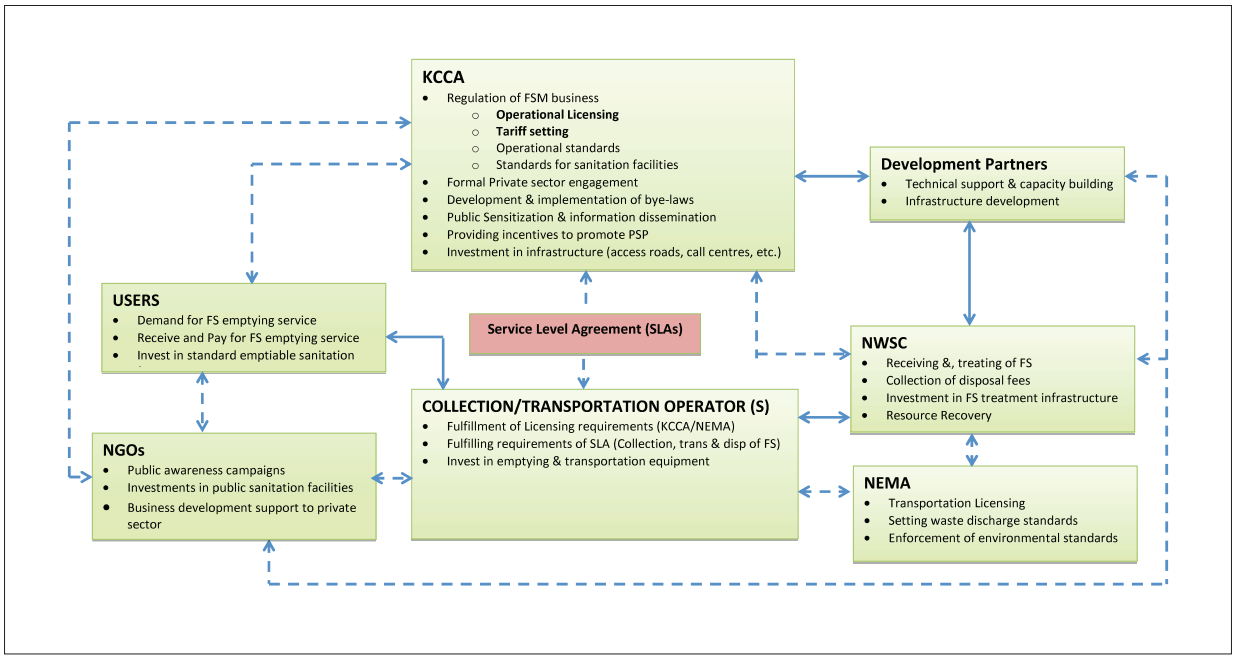

Figure 6: Proposed Institutional and operational framework for Kampala (KCCA, 2014)

FSM stakeholders

While collection and transportation of faecal sludge is currently carried out by the private sector, responsibility for treatment lies with the National Water and Sewerage Corporation (NWSC), a government parastatal that has the role of developing, operating and maintaining water supply and sewerage services in urban areas. The NWSC falls under the Ministry of Water and Environment and operates in Kampala and 174 other towns. Using internal funds and donor funding, the NWSC is working to improve and expand the sewerage system in Kampala, and is also increasingly engaged in pro-poor onsite sanitation projects. For the latter, three micro faecal sludge treatment plants, each with a capacity of 5 m^3/day, and three disposal points, with an aggregate capacity of 100m^3/day, are planned.

Regulation of waste transportation and disposal is carried out by the National Environment Management Authority (NEMA). To date, only one company has a licence from NEMA to transport FS legally. NEMA collaborates with KCCA in enforcing environmental protection policies – for example, solid waste operators can only get a license from NEMA on the recommendation of KCCA.

NGOs and community based organisations (CBOs) such as Water for People (WfP), Community Integrated Development Initiative (CIDI), AMReF and WaterAid are active in sanitation services provision in the city. However, they operate on a piecemeal basis, duplicating or contradicting one another. That said, the role of these NGOs and CBOs is crucial and their increased future involvement will be an essential component of continuous and reliable service provision in the informal settlements.

IMPROVING FSM AND CLOSING THE SANITATION LOOP

Since 2015, KCCA and its development partners, GIZ-RUWASS and BMGF, have developed and implemented a programme to improve FSM in the city based on a coordinated and holistic approach where FSM interventions are identified and planned along the entire sanitation service chain (containment, collection, transport and disposal, treatment and reuse.) The rationale for the FSM programme is that onsite sanitation is a mid- to long-term reality in Kampala, so FSM has a critical role in contributing to the citywide provision of sanitation services. The main principles followed in developing the programme include:

- Creating a strong legal and institutional framework with clear roles and responsibilities for sector stakeholders
- Private sector engagement and business development
- Capacity building and coordination of stakeholders
- Awareness and demand creation among user groups

The FSM programme recognises that to ensure citywide service coverage, and to informal settlements in particular, KCCA will need to partner with the private sector, based on a viable business model. The model adopted divides the city into operational zones that are assigned to different operators through a tendering process. This will ensure citywide service coverage.

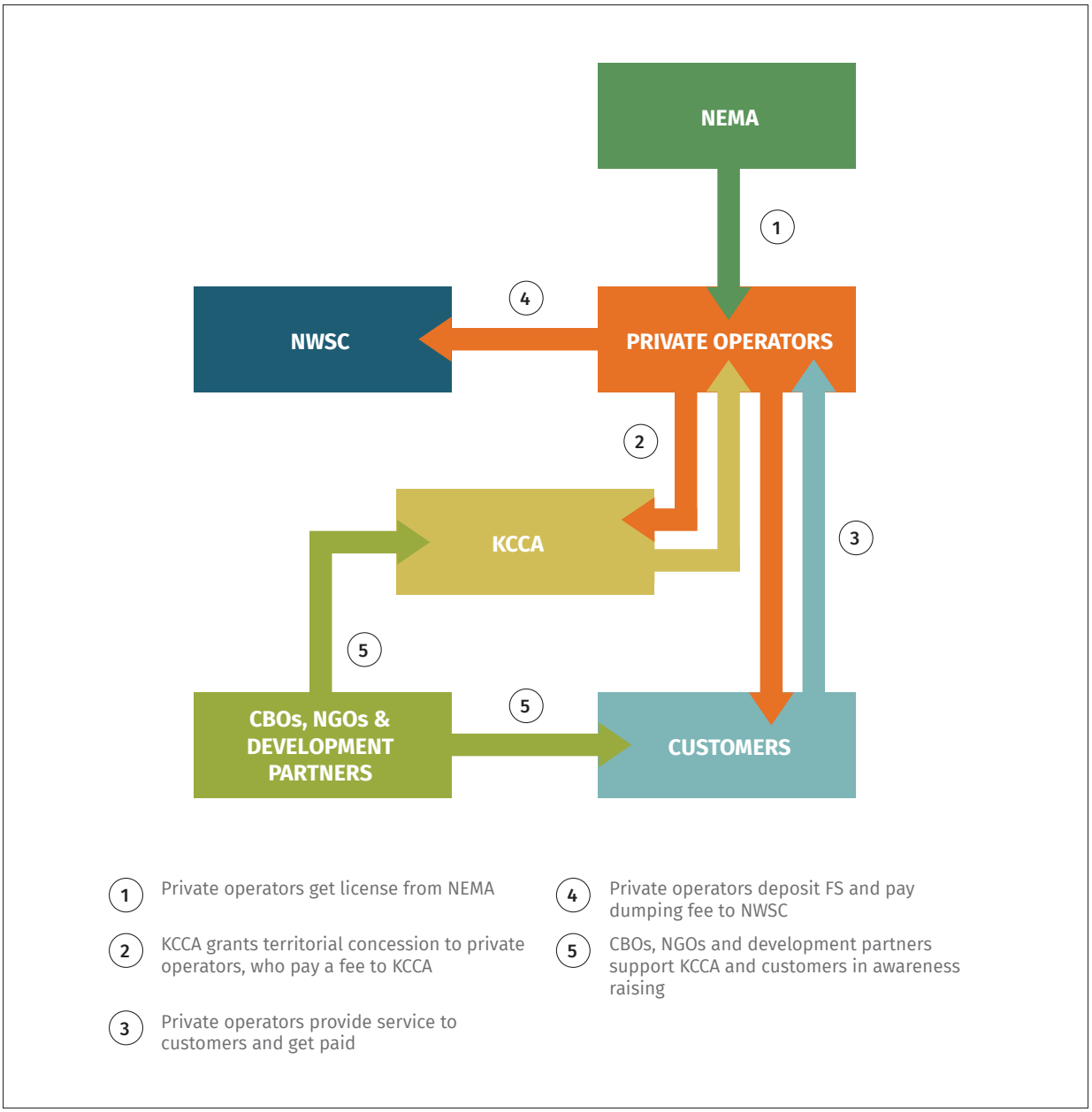

Figure 7: Business model for FSM in Kampala

This business model was first piloted in five parishes in the city for 18 months (January 2016 to June 2017). This successful experience is now being scaled up across the rest of the city (since January 2017).

Pilot phase

In the pilot phase, ten service providers were selected to operate in the five parishes and monitored. The following interventions were undertaken:

Private Sector Engagement This was undertaken mainly to create a foundation for a partnership based on trust rather than through an enforcement-only approach. The aim of the partnership with the private emptiers was to increase service coverage, affordability and efficiency of emptying services, particularly in the informal settlements.

An inventory of private emptiers was developed to facilitate mobilization and engagement activities. The private operators, under two umbrella associations, are in a constant and productive exchange with KCCA. They are part of the planning process and have provided input into a memorandum of understanding with KCCA, which serves as a model for future service level agreements (SLAs).

The zoning and the establishment of SLAs with selected private operators was then tested in five pilot areas. Each ward was assigned two designated operators who worked under a memorandum of understanding with the objective of identifying the challenges of working in one specific area.

Furthermore, since treatment capacities are already exceeded and infrastructure projects take time, KCCA

is considering resource recovery and safe reuse (RRR) of faecal sludge. Six entrepreneurs that are adding value to the faecal sludge by producing briquettes, compost, biogas and other saleable materials were supported in this pilot phase.

Legal and institutional frameworks It was essential to bring together the various stakeholders and interests within the existing institutional and regulatory framework relevant to FSM in Kampala, to enable synergies and facilitate better planning. A high-level steering committee for sanitation projects in Kampala was established with representation from the key stakeholders. The committee meets biannually to discuss developments and progress, and to provide strategic direction to FSM interventions in the city.

To guide the implementation of the pilot SLAs, KCCA with the support of GIZ and in collaboration with the private emptiers developed a memorandum of understanding between KCCA and the private service providers specifying their obligations, service delivery standards, targets and performance measurement.

To focus FSM at the divisions, five Sanitation coordination officers were recruited to support the public health section at divisional level by providing technical support and coordinating communities and local leaders in adopting good sanitation practices. Further, KCCA established partnerships with key stakeholders such as NWSC, and NGOs such as WfP and CIDI, to supplement its capacity through the technical, social mobilization, academic or financial capacities of these organisations. For instance, the partnership with WfP supported and nurtured sanitation business start-ups particularly the small-scale Gulpers to self-sustaining businesses.

Development of an operational framework An operational framework to guide service provision and sector regulation was developed. The framework comprises standards for onsite sanitation technologies, minimum health standards for sanitation-related processes, obligations for the safe collection and transport of faecal sludge, monitoring tools, incentives and penalties. These were developed using a consultative and integrative approach. Implementation of the new regulations started only about two months prior to the date of writing, but some landlords have already built improved facilities to meet the new standards.

Capacity building and business development KCCA received support from GIZ, including high level benchmark visits and trainings, to strengthen its supportive and regulatory role, and assist in developing the framework for sanitation service delivery by the private sector. On the private sector side, much initial work was undertaken by WfP to develop small-scale service providers based on Gulpers and other manual tools. WfP recruited entrepreneurs and helped them develop into sustainable businesses, providing training and assistance with registration, licensing, and equipment procurement. KCCA is now scaling up this work with a series of half-day training events for vacuum truck operators (also attended by some small-scale Gulper operators), covering health and safety issues and business skills development. KCCA is also providing assistance with registration and licensing to bring both vacuum truck and Gulper operators into the new regulatory space.

KCCA IS NOW SCALING UP THIS WORK WITH A SERIES OF HALF-DAY TRAINING EVENTS FOR VACUUM TRUCK OPERATORS COVERING HEALTH AND SAFETY ISSUES AND BUSINESS SKILLS DEVELOPMENT

Demand creation and awareness raising Sanitation marketing and promotion of emptying services was conducted in communities. Communication, awareness raising and behaviour change messages were streamlined into a set of messages addressing three key behaviours identified by KCCA, namely: 1) safe pit emptying; 2) improved, and therefore emptiable toilets; and 3) toilet hygiene.

The sanitation coordination offices at division level played a key role in creating awareness and sensitizing communities about the FSM programme.

Innovation New approaches were needed to overcome historically neglected FSM problems, and were developed in close collaboration and partnership with stakeholders, and included:

- A **sanitation call centre** to coordinate service provision. KCCA (with the support of GIZ and BMGF) established a sanitation call centre to strengthen the link between customers, service providers, and KCCA itself. Through a toll-free number, the centre offers customers a platform for inquiries and complaints, as well as a simple means to contact emptying service providers. The call centre is not a bidding platform, but staff do record prices in follow-up calls, also assessing customer satisfaction and gathering information on sanitation issues. Based on this, they can give customers an indication of market rates,

FOREVER SANITATION: A GROWING FSM BUSINESS

Forever Sanitation Limited was established with the help of the NGO Water for People, which advertised the new business opportunity through their sanitation marketers and on the radio, and provided business training and support to the entrepreneurs who they accepted. Since starting operations in March 2013, Forever Sanitation has emptied more than 1,250 pits, removing 2,500m^3 of sludge in 12,500 barrels, typically emptying two pits a day. Initially they focused their business on slums in Kampala, but later identified demand further afield, and may now travel up to four hours to a customer's site.

Customers pay UGX 30,000 (USD 8.60) per 200-litre barrel removed and transported to the treatment plant, equivalent to UGX 150,000 (USD 43.00) per m3. Although this is expensive in terms of cost per unit volume compared with the charge for a full vacuum truck, it compares favourably with a vacuum truck call-out charge of around UGX 175,000 (USD 50), always assuming road access is possible. Additionally, customers with cashflow constraints can decide how many barrels they can afford to have removed. The average revenue per job is UGX 300,000 (USD 85.70), equivalent to 10 barrels. Labour, dumping fee, fuel and disinfectants cost a total of UGX 122,000 (USD 34.80), yielding an average profit per job of UGX 178,000 (USD50.85), or about USD 100 for two jobs a day.

Figure 8: Forever Sanitation proprietor John Busingye with Sato pans for installation

The business started in 2013 with 20 barrels and two Gulpers, expanding enough by 2014 to rent a truck to transport the full barrels to the discharge site, and then to buy one in 2015. Forever Sanitation has now started saving for a vacuum truck, because of the high demand for this service, also believing that their extensive experience with pit latrines will give them a competitive advantage in the marketplace.

Noting the difficulty of emptying pits with a high solid waste content, Forever Sanitation has generated extra business by selling and installing Sato traps, which make it harder for users to put solid waste in the toilet, as well as providing a more hygienic and pleasant user interface. This also saves the user money in the long run by reducing the pit filling rate.

Lessons learned over the last four years include the following:

In the pit emptying market: Many customers cannot afford the services offered by Forever Sanitation, even though they would prefer their more hygienic emptying. This could be tackled on three complementary tracks:

- Increased enforcement of improved and emptiable latrines (this is now starting to happen);
- Putting "foot soldiers" on the ground to raise awareness of FSM (also now happening);
- Introducing a subsidy (possibly up to 75 percent) to make the service affordable to the poorest slum dwellers.

In the job market: Initially, young people were reluctant to work in FSM due to the social stigma, but now the business is established they are never short of new workers. However, the company is not paying their workers much more than food and transport (although this is not insignificant in a low-wage economy with high unemployment), and wishes to pay stable wages and provide insurance in order to retain its trained teams.

and this seems to have resulted in a significant decrease in prices. The call centre has been operational for eight months and is considered highly successful, having already received 1,213 calls and much positive feedback. The information it provides to KCCA has also proved valuable to inform their sanitation activities.

- A **GPS tracking system** for service providers to improve service efficiency and avoid illegal dumping. This was piloted for four months and showed that emptying was mainly taking place in the formal sections of the city.
- **Mobile transfer stations** to reduce transportation distances for small scale service providers. KCCA, in partnership with WfP and GIZ, has converted a vacuum tank from an old truck to a trailer into which small operators can discharge their collected sludge for a small fee (UGX 3,000, or slightly less than one US dollar). Being mobile, the transfer tank can be located close to emptying operations in communities. It is then hauled by a tractor to the utility's faecal sludge treatment sites. In its first week of operation, over 35 households were served, and approximately 200 households were served over the first two months. Preliminary feedback is very positive, and it clearly stimulated demand for emptying in the informal settlements where it was stationed.
- **Promotion of small entrepreneurs** using innovative technologies. Technically, the use of Gulpers for pit emptying, the production of briquettes from faecal sludge, etc. are not recognised by the existing legislation. However, the municipality acknowledges the gap that they are filling, especially in inaccessible areas, and therefore promotes them where they are relevant, while also working with them in parallel towards legalising their operations.

KCCA ESTABLISHED A SANITATION CALL CENTRE TO STRENGTHEN THE LINK BETWEEN CUSTOMERS, SERVICE PROVIDERS, AND KCCA ITSELF

Scaling-up phase

The programme is now (since January 2017) being scaled up into a citywide programme known as the Kampala Faecal Sludge Management (KFSM) Programme under the overall coordination of KCCA, with various partners contributing to the programme. This has enabled more efficient use of the available resources, as well as minimizing duplication and learning times.

The following interventions have so far been undertaken as part of the scaling-up process:

Citywide sanitation mapping This serves to guide sanitation investments in the city and to inform the zoning of the whole city into financially viable areas for use in the SLA model. Two hundred enumerators carried out a door-to-door assessment of sanitation in all five divisions of the city over the six-month period January to June 2017, and a geo-referenced database of all onsite sanitation facilities in the city was created. Local politicians played a critical community mobilisation role in this exercise, which was supervised in conjunction with KCCA's technical team. Local leaders, community opinion leaders and village health teams[1] also mobilised communities and acted as local guides.

Citywide community mobilization The pilot phase produced three key learnings regarding community mobilization: 1) the need for constant engagement with the communities; 2) door-to-door engagement was the most effective mobilization tool; and 3) enforcement or the threat of enforcement plays a convincing role in behavioural change.

A citywide community sensitization programme targeting informal settlements and their landlords is being implemented based on these learnings. The streamlined behavioural change communication material already developed forms the basis of this campaign, focusing on the three key objectives of safe pit emptying, improved toilets that can be emptied, and toilet hygiene. This initiative is spearheaded by local community leaders.

A phased roll-out of the campaign has been adopted in order to maximise impact. Twenty-two parishes are now at the centre of the campaign, which will be extended to 20 more parishes every two months to cover all the 99 parishes that make up Kampala by the end of 2017. This community mobilization campaign has already made an impact in parishes yet to be engaged, as shown by data from the sanitation call centre.

Coordination of the various stakeholders Increasingly, KCCA has prioritised the coordination of the various stakeholders in the city through the Kampala WASH forum, to share best practices (from the pilot), and to streamline and optimize the available resources to achieve citywide sanitation. The forum, hosted by KCCA, has four thematic working groups: hygiene and public health education; appropriate technologies; knowledge management; and governance and policy.

Figure 9: Operator training

Business development This activity is key to delivering a sustainable sanitation business sector, where products and services demanded by households and institutions are supplied in a well-regulated market. As previously mentioned, business development and capacity-building of private emptiers is being carried out to enable them to be licensed and subsequently regulated. To reinforce this, a service delivery framework and operational guidelines have been developed in conjunction with the operators. This informs the capacity building programme and constitutes the basis for compliance monitoring, which is currently being implemented through the call centre feedback mechanisms.

Infrastructure investment A significant constraint on FSM in Kampala is the infrastructure, all the way from containment, to transportation and treatment facilities. KCCA has invested in schools and public sanitation facilities, and has reduced pupil stance ratios in public primary schools from 118:1 in 2012 to 43:1 currently. Through partnerships with NWSC and NGOs such as WaterAid, AMReF and CIDI, significant investments have been made in public toilets and faecal sludge treatment capacity.

The majority of household pit latrines in Kampala are unlined and would require upgrading to meet minimum standards. The approach being adopted is to persuade landlords to provide facilities which meet the standards through awareness-raising and enforcement. As this will not deal with all the toilets that need upgrading, subsidy and/or credit financing for the remaining facilities is currently being discussed. Central to this discussion is the number of toilets that fall into this category, and it is expected that this will become clearer by the end of 2017 when the current behaviour-change and enforcement campaign has been concluded. To ensure equity and citywide coverage, all these investments are coordinated at programme level.

FINANCIAL ASPECTS

The main payment flows comprise emptying fees that are generally determined by the service provider after assessing the location, condition and size of the sanitation facility. The KFSM programme has consciously not regulated emptying fees but rather left it to the influence of competitive forces and increasing volume of work. At the start of the programme, emptying charges averaged USD 45.00/m^3 for Gulpers and USD 6.50/m^3 for vacuum trucks. Following the various interventions, a reduction in emptying charges has been noted, to USD 40.00/m^3 for Gulpers and USD 5.00/m^3 for vacuum trucks.

With the implementation of the planned zoning and engagement of the private sector through SLAs, it is envisaged that price regulation will be introduced in a phased manner.

DRIVERS OF CHANGE

KCCA has a commitment to reform the sector and the willingness to apply a stepwise approach, which includes a learning and revision process. The success of the solid waste management reforms has motivated the authority to improve the FSM situation too. Partners including GIZ and BMGF have supported KCCA since its inception, and strengthened its leading role in the sanitation sector through sector coordination and capacity building. KCCA has gained momentum and ownership under a focused strategy where activities were streamlined and additional funds could be generated thanks to confidence and a shared vision.

THE SUCCESS OF THE SOLID WASTE MANAGEMENT REFORMS HAS MOTIVATED THE AUTHORITY TO IMPROVE THE FSM SITUATION TOO

Close collaboration with the private sector. Their trust in and collaboration with KCCA has brought the programme forward in an efficient way. However, the more striking fact is that the private sector brings

valuable and significant inputs into the planning process, helping to avoid failures when strategies are implemented on the ground.

Creation and dissemination of information. The project has produced a number of publications to inform the sector, such as an inventory of all private players in FSM and RRR and an analysis of the framework conditions for private sector participation in FSM, while GIZ and BMGF have supported KCCA in widening and improving its databases. For example, the exhaustive database of the state of household, institutional and public sanitation in Kampala and the maps of all public and community toilets including information about their sanitation, ownership and operation and maintenance status, have informed investment planning.

LESSONS LEARNED

Coordination of stakeholders and activities is key to avoid duplication, create synergies, and pool funding. Fora and steering committees that meet on a regular basis can support this. However, they need to have clear descriptions of their roles and responsibilities, such as terms of reference, and the outputs, outcomes and agreements of meetings need to be written down and circulated. A lead agency that invites and does the follow up is essential, and it should not be a donor or NGO but rather a local entity – KCCA in this case.

Public-private-partnerships need close cooperation right from the start. Regular meetings are not enough – the public sector needs to genuinely consider the concerns of and inputs from the private sector.

There can never be too much community engagement. Communities need to be constantly engaged right from the start of an intervention to ensure buy-in, continuity and sustainability.

NEXT STEPS

In terms of next steps, financing infrastructure and securing the legal framework through ordinances are the key next steps. A simple lined VIP latrine meeting the minimum standards costs approximately USD 900, which is beyond the means of the majority of the urban poor. A subsidy system similar to that implemented in Kenya by the National Water Services Trust Fund and GIZ might encourage people to start constructing improved sanitation facilities. Subsidies would only be paid for new toilets that meet the minimum standards when construction is complete. Funds to implement this subsidy programme are currently unavailable, and it remains to be seen how quickly the 70 percent of Kampala's population using unimproved sanitation facilities can upgrade to improved toilets. The overall success of the sanitation reform requires that all steps in the sanitation service chain, including containment, emptying, transport, treatment and re-use, are of an adequate standard, thus closing the sanitation loop.

NOTES

[1] The village health teams are community volunteers, directed by the Public Health Inspectors, who support various public health activities at community level

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ABBREVIATIONS AND ACRONYMS

KCCA	Kampala Capital City Authority
PPP	public private partnership
BMGF	Bill and Melinda Gates Foundation
FSM	faecal sludge management
NWSC	National Water and Sewerage Corporation
NEMA	National Environment Management Authority
NGO	non-governmental organisation
CBO	community based organisation
WfP	Water for People
CIDI	Community Integrated Development
SLA	service level agreement
RRR	resource recovery and safe reuse

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Approaches to Faecal Sludge Management in Peri-Urban Areas: A Case Study in the City of Lusaka

Aubrey Simwambi, Sophia Hibler, Björn Pietruschka, Peter Hawkins

EXECUTIVE SUMMARY

Lusaka is the rapidly growing capital city of Zambia, and as in many Sub-Saharan African cities, the majority of the population lives in informal, unplanned peri-urban areas where the ever-increasing sanitation deficit results in high levels of faecally transmitted diseases. In response to this, government agencies and their partners have been developing improved faecal sludge management systems in these areas, with improved non-motorized emptying and local faecal sludge treatment facilities. These systems are working well, and have started to displace informal and unhygienic manual pit emptying. Strong local involvement and ownership of the program have been key success factors, supported by intensive capacity-building and the active involvement of both the Lusaka water and Sewerage Company and local government structures. The services have been established on a commercial basis, but are to date unable to fully cover costs whilst remaining affordable to the local population. However, continuous efforts are being made to improve their administrative and financial management.

CONTEXT

With 40 percent of its inhabitants living in urban areas, Zambia is one of the most urbanized and fastest growing countries in Sub-Saharan Africa (UN-DESA,

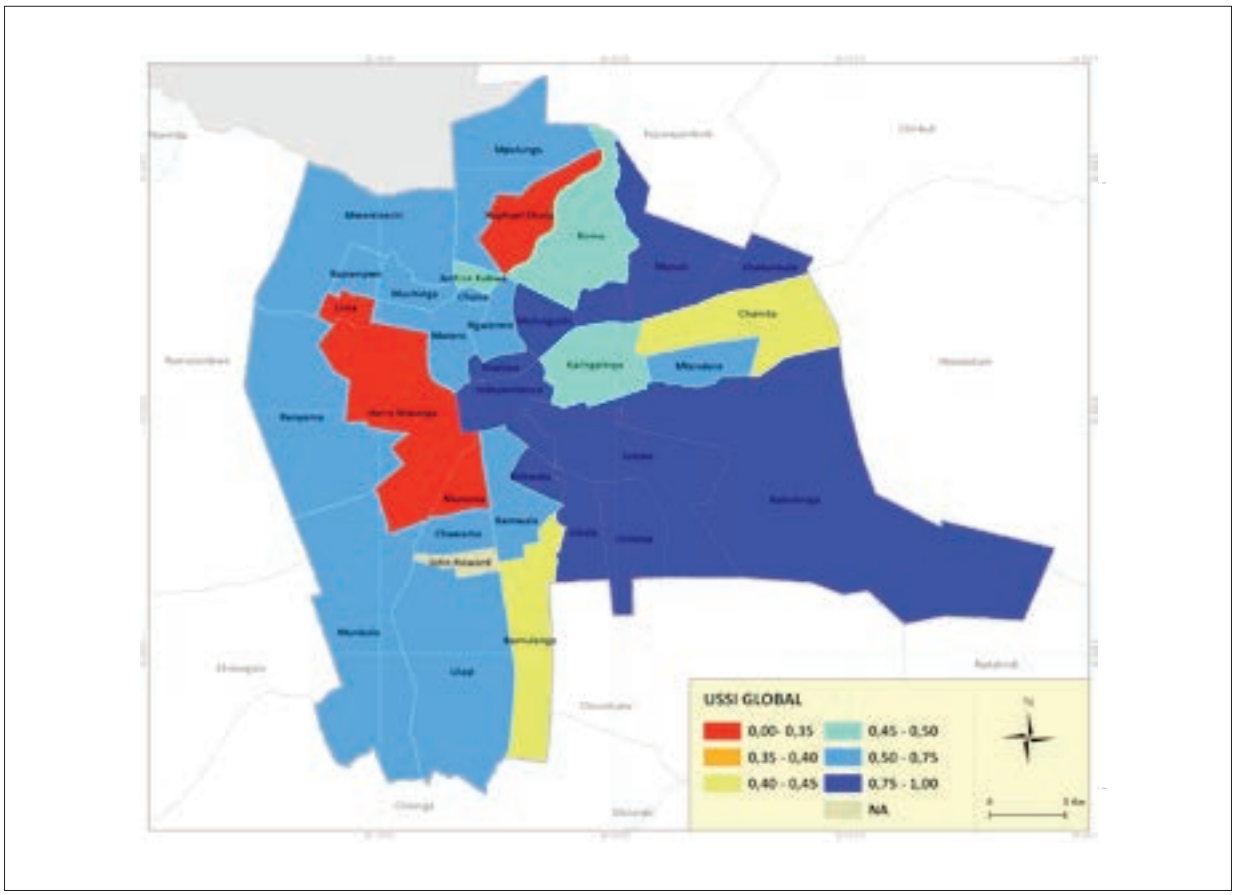

Figure 1: Sanitation status in Lusaka

2015). The national population is projected to increase 60 percent by 2050 (UN-HABITAT, 2015). Sixty percent of the population lives below the poverty line; life expectancy at birth is 61 years; under-5 mortality is estimated at 64 per 1,000 live births; and 48 percent of the population is estimated to be undernourished (World Bank, 2015). Currently, only 63 percent of Zambians have access to clean drinking water, and 43 percent to adequate sanitation. In Lusaka, only 36 percent have piped water on the premises, whilst 56 percent have adequate sanitation (LWSC ESIA, 2017). The lack of adequate sanitation has significant impacts on Zambia's development, causing an estimated 1.3 percent loss to GDP (World Bank Water and Sanitation Program, 2012).

Responding to rapid urban growth, low-income peri-urban areas have developed and absorbed the majority of new residents. These informal areas are characterized by lack of land tenure, high population density, poor housing standards and a lack of basic public infrastructure and services. The capital city, Lusaka, has approximately 35 peri-urban settlements which house 70 percent of the population (UN-HABITAT, 2007). These peri-urban neighbourhoods largely comprise lower income group households (LWSC ESIA, 2017) and are subject to regular outbreaks of cholera, typhoid and dysentery (WHO/UNICEF, 2015). During the 2016 cholera outbreak, 1,179 cases (of which 953 were in the city of Lusaka) were reported nationwide from 5 February to 2 May, with 31 fatalities (UNICEF, 2016).

In Lusaka, about 90 percent of peri-urban households use pit latrines, most of which are classified as "unimproved" by the Joint Monitoring Program. The other 10 percent of peri-urban residents are either connected to the sewerage network, use septic tanks, or defecate in the open (estimated at 1 percent). To further aggravate the situation, 60 percent of Lusaka's water supply is derived from fairly shallow groundwater abstracted within the city, which is prone to contamination through fissures in the underlying rock. The Lusaka Water and Sewerage Company (LWSC) provides sewerage services to approximately 14 percent of residents through 33,000 connections, and water through 91,342 connections serving 1.4 million people. There is little or no integration between sanitation and solid waste management services, mostly due to poor coordination between the relevant stakeholders (LWSC-ESIA, 2017). Solid waste management services are provided by the Lusaka City Council (LCC) while sanitation (excreta management – whether by sewerage or non-sewered systems) is provided by the Lusaka Water and Sewerage Company (LWSC).

The Lusaka Sanitation Program

Major investments in scaling up sanitation are currently in progress through the Lusaka Sanitation Program (LSP), supported by the World Bank, African Development Bank, European Investment Bank and KfW (LWSC, Hydroplan, 2015). The LSP seeks to improve sanitation services throughout the city with an integrated approach involving the rehabilitation, upgrading and expansion of sewerage, the improvement of sanitation conditions in peri-urban areas and informal settlements, and actively raising citizens' awareness around sanitation, public health and the environment and what can be done to improve the situation. The LSP will strengthen the institutional, operational and management capacity of LWSC and introduce measures to promote its long-term technical and financial viability. A faecal sludge management strategy will also be developed to establish a sound basis for this previously neglected issue (LWSC ESIA, 2017).

The LSP will implement 10,000 on-site sanitation facilities and a number of decentralized sewerage systems, benefiting 180,000 people in 37,000 households. Faecal sludge management (FSM) infrastructure and service providers will be developed, with the capacity to serve 25,000 on-site facilities used by about 450,000 people in selected peri-urban areas (LWSC ESIA, 2017). This will be supported by a major campaign of sanitation promotion, hygiene education and support for onsite household sanitation (African Development Bank, 2015).

INSTITUTIONAL AND LEGISLATIVE FRAMEWORK FOR SANITATION

In 1994 the Government of the Republic of Zambia (GRZ) launched a comprehensive water sector reform program, aiming to ensure good quality, sustainable water supply and sanitation at affordable prices. In 1997, parliament passed the Water Supply and Sanitation (WSS) Act in which a national regulatory agency, the National Water Supply and Sanitation Council (NWASCO), was established (International Monetary Fund, 1999). NWASCO's overall mandate is to license service providers, regulate water and sewerage services and advise the government on water supply and sanitation matters (MLGH, 2010). The 1997 Act also empowered local authorities (LAs) to form provincial level Water and Sewerage Commercial Utilities (CUs), which operate along commercial principles for the provision of water and sanitation services under the Companies Act of 1994 (Constitution of Zambia, 2016). Local authorities in the country can operate CUs as joint ventures with private companies as long as they are the major shareholders

of the ventures (NWASCO, 2004). Under the direction of the Ministry of Local Government and Housing (MLGH), the LAs also focus on the enforcement of Ministry of Health's hygiene regulations and, in the larger towns, development of by-laws on sanitation service provision through the Public Health Departments. LAs, through Environmental Health Officers and Health Inspectors, are also mandated to enforce sanitation-related laws under the 1994 Public Health Act (amended 2006) regarding the collection, transportation and treatment of wastewater. Further, LAs are mandated to provide other services related to the quality of the urban environment, and therefore have a broader remit for sanitation, including solid waste management and stormwater drainage (Constitution of Zambia, 2016).

In its efforts to improve water and sanitation services, the GRZ has developed various National Plans and Polices, as well as strategic documents for the urban and rural water and sanitation subsectors. For the urban subsector, an integrated National Urban Water Supply and Sanitation Programme covering the period 2011 to 2030 was promulgated by MLGH in February 2011. MLGH has also developed two sanitation strategies: The National Urban Sanitation Strategy (NUSS) promulgated in 2015 and the Open Defecation Free Zambia by 2020 Strategy. In particular, the NUSS aims to enable low-income households to access adequate sanitation through *"approved lower cost sanitation technologies with designs and standards approved by the Zambia Bureau of Standards; establishment and development of supply chains to manufacture and facilitate distribution of affordable components for construction; support to households for construction of latrines through non-governmental organizations (NGOs) and trained masons; access to finance via micro-finance institutions; voucher systems for marginalized households; increased enforcement of the Public Health Act underlining responsibility of landlords to provide sanitation systems to their tenants"* (NUSS, 2015).

The development of the NUSS revealed weak coordination amongst government institutions promoting, financing and managing urban sanitation, with each authority tending to focus on their own sectoral programs (NUSS, 2015). This was hindering the development of an integrated approach towards the planning, design and delivery of sanitation services, and in October 2016, GRZ re-aligned various departments from many ministries and formed the Ministry of Water Development, Sanitation and Environmental Protection (MWDSEP). This ministry is responsible for national sanitation policy and strategy development, and is mandated to coordinate the implementation of GRZ strategies related to water supply, sanitation and environmental protection (GRZ, Parliament, 2016).

Other institutions mandated for specific roles and responsibilities in the water and sanitation sector include the Zambia Environmental Management Agency (ZEMA) – responsible for regulating discharges into the environment, promoting water pollution monitoring and prevention programs according to enforceable water quality guidelines and standards; the Zambian Bureau of Standards – which defines the required technical standards for sanitation systems; and the Water Resource Management Agency – which manages fresh water resources in the country.

NWASCO has licensed LWSC to provide water and sewerage services in the city of Lusaka and surrounding areas. To extend the provision of water services to peri-urban areas, LWSC has partly delegated the provision of water to community based organizations (CBOs) called "Water Trusts" (founded by LCC with support from WaterAid in 2001) in 11 peri-urban settlements of the city. The Water Trusts are owned by local residents, under community oversight through the Ward Development Committees, with the LCC area Councillor as the Water Trust board chairman. In the peri-urban neighbourhoods of Kanyama and Chazanga, Water Trusts have been providing FSM services since 2012 and 2014 respectively, besides managing community market ablution blocks.

HOUSEHOLDS ARE RESPONSIBLE FOR THE PROVISION OF ON-SITE SANITATION FACILITIES WHERE NO SEWER NETWORK EXISTS

FSM SERVICES AND STAKEHOLDERS

According to the 1997 WSS Act, households are responsible for the provision of on-site sanitation facilities where no sewer network exists (constitution of Zambia, 2016). Although regulation of on-site sanitation construction standards is officially mandated to the LAs under the Public Health Act, in practice LAs usually lack adequate capacity and resources to enforce regulations (UN-habitat, 2015). Thus, on-site sanitation facilities vary according to the household's ability and willingness to invest in sanitation facilities.

As responsibility for FSM at household and community level in Lusaka is undefined, emptying of on-site

Figure 2: Tankers discharging faecal sludge

sanitation facilities has historically been undertaken by informal, unregulated individuals and operators. The type of emptying service available is dependent on the economic status of the area, type of sanitation facilities and the degree of road access.

In unplanned low-income areas where unlined pit latrines are the norm, pits have generally been emptied manually by informal pit emptiers (46 percent), household members (13 percent), CBOs (5 percent), vacuum trucks (30 percent) and, recently, by the new Water Trust services (6 percent). Thirty-nine percent of the emptied sludge is reported to be buried in household backyards, two percent dumped in the trash, seven percent dumped in nearby ditches, one percent sold to farmers, whilst the fate of 20 percent is unknown. Only 30 percent of the emptied sludge is transported to the treatment plant (LWSC, 2016). In the past, the predominant practice was to abandon pits when full, but with rapid urban population growth and increasing numbers of households within family plots, land for new toilet pits is increasingly scarce (UNESCO-IHE,2007). Only 41 percent of residents using pit latrines report having the potential to replace them with new ones (LWSC, 2016). Therefore, a change of habits is inevitable for many peri-urban residents. Mechanized pit emptying is often impossible due to poor road access, and the common practice of solid waste disposal in the pits (due partly to inadequate waste management services) makes them impossible for vacuum trucks to empty. Informal pit emptiers are the main service providers, often operating at night without the use of safety equipment. Prior to the FSM interventions in Kanyama (2012) and Chazanga (2014), no treatment options for faecal sludge were available in peri-urban Lusaka. Risks associated with unlined pits and burial of untreated sludge are exacerbated by the climatic and geological characteristics of Lusaka, which has intense rainy periods, a high water table and is located on a rocky sheath of dolomite. During the rainy season, severe flooding can resurface the buried faecal sludge, hence posing a threat to water resources and to human and environmental health.

Requests for informal pit emptying services are usually made through social contacts or direct inquiry to a person seen digging a pit near a latrine during the day. According to residents of Kanyama, the cost of pit emptying is about USD 80, inclusive of removing the sludge from the latrine and disposing of the extracted material, either by digging a pit nearby and burying it, or removing it from the site. In middle to high-income areas where vacuum truck access to the pit latrine or septic tank is possible, semi-formal services for mechanized emptying and disposal of faecal sludge are available.

Vacuum trucks in Lusaka are mostly owned by businessmen and operated by drivers, who may be mechanics, plumbers or simply self-trained by trial

and error. The vacuum truck drivers themselves hire helpers to provide manual labour for handling the desludging hoses, and fishing out solid waste from the pits, for which an extra fee is charged. If the faecal sludge is too thick for the truck to pump, the helpers usually desludge the pit manually, and either bury the sludge in a pit dug nearby or transport it to the authorized municipal sludge dumping site contained in sacks. The vacuum trucks discharge faecal sludge at LWSC's Manchinchi sewage treatment plant. The vacuum truck drivers interviewed reported a monthly salary of USD 150, plus USD 3.00 lunch money which they take from their daily receipts, whilst the helpers get USD 5.00 per emptying.

Currently, around 12 commercial liquid waste transport companies are licensed for public service in Lusaka, in addition to vacuum trucks registered to industrial companies for their in-house services and those belonging to housing estate firms and institutions such as the army and the Zambia National Service. To transport any type of sludge, vacuum trucks must be licensed by ZEMA, with fees set according to the estimated annual tonnage of waste likely to be transported (see table 1).

CLASS	ANNUAL TONNAGE	LICENSING FEE [USD]
I	> 200	1,000
II	100-199	630
III	1-99	330
IV	0.1-1	100

Table 1: ZEMA toxic waste transportation licensing fees, valid for three years

The cost of emptying depends on the distance of the household to the dumping point and negotiation by the customer. The vacuum trucks line up for hire at two locations in the city – next to the Manchinchi sewage treatment plant, and in the central business district next to the well-known Findeco building. Within Lusaka, the price of septic tank emptying by tanker is around USD 12.00 to 13.00 per m^3 (around USD 100 for a typical vacuum tanker load), and the dumping fee at the LWSC treatment plants is USD 3.60 per m^3. Illegal sludge dumping is reportedly non-existent, as trucks have to travel further than to the legal tipping point, and risk losing their licenses if detected. However, truck drivers mentioned a few cases of households buying sludge perceived to be of good quality from the trucks for fertilizing their grass lawns.

FSM INTERVENTION IN KANYAMA AND CHAZANGA

In September 2012 LWSC, with funding from Water and Sanitation for the Urban Poor (WSUP), engaged the Water and Sanitation Association of Zambia (WASAZA) in partnership with the Bremen Overseas Research and Development Association (BORDA) to develop and implement FSM services in Kanyama. This included the recruitment and capacity building of identified informal pit emptiers in safe emptying and transportation practices, and the design, construction, operation and maintenance of a faecal sludge treatment plant (FSTP). WSUP developed a comprehensive business model to ensure the financial sustainability of the project. The first FSTP, under the management of the Kanyama Water Trust, commenced operations in February 2013. It consisted of a 58 m^3 digester, desludging chamber and expansion chamber, with sludge drying beds situated three kilometres away due to land availability issues. The initial pilot project was designed to provide FSM services to about 30,000 residents of Kanyama (Zone 11), and also included raising community and local government awareness on FSM services through community meetings and site visits to decentralized waste water treatment plants.

Similar to water supply in the project areas, which LWSC has delegated to the Kanyama and Chazanga Water Trusts, the same Water Trusts were put in overall charge of the effort to professionalize and grow the improved manual emptying business. After three months' initial operation, the FSM system was evaluated by BORDA and WASAZA over a period of six months, during which time lessons were learned about dealing with solid waste in pit latrines, biogas production from pit latrine sludge, total solids content in the effluent, pit emptying methodologies and sludge transportation (Kanyama FSM M&E, 2013). The results of the evaluation delivered valuable data for the development of operation and maintenance schedules and expansion of the services.

Figure 3: Kanyama faecal sludge treatment plant

Building on the lessons learnt from the first FSM facility and pit emptying services, two more treatment facilities were commissioned one year later, extending services in Kanyama with a new sludge holding tank[1] to meet more of the demand from Kanyama's total population of 250,000, and another FSM facility in Chazanga, 11 kilometres away from the pilot facility, to provide FSM services in the northern peri-urban settlements. The Chazanga FSM infrastructure consists of a 50 m^3 biogas unit, a 10 m^3 two-chamber secondary settler, recirculation chambers, solid waste drying racks and sludge drying beds. Sludge at the Kanyama FSTP is partially stabilized in the biogas digester or holding tank before it is taken to the drying beds by vacuum truck, whilst in Chazanga the sludge is stabilized in a digester and dried on-site. An estimated 2m^3 of faecal sludge can be discharged into the facilities per day both in Kanyama and Chazanga, with the addition of water to fluidize the sludge both at the household and at the FSTP, bringing the total feed volume to approximately 3m^3. The sludge has been found to have an average solid waste content of 22 percent (BORDA, WASAZA M&E, 2013).

To generate revenue through resource recovery, dried sludge was to be sold to farmers as soil amendment. However, this product has yet to establish itself in the market, and was seen in piles at the Chazanga FSM facility, although some of the sludge from Kanyama was reported to have been sold to a training institute to fertilize their lawns. It had also been intended to pipe the biogas produced at the FSTPs for sale to nearby households at a value equivalent to that of charcoal, but this failed as these households are predominantly occupied by tenants who could not get consent from their landlords for gas connections. The gas is therefore used by the Water Trusts themselves, for the workers' canteen in Kanyama and by the caretaker living at the Chazanga FSM site. A weekly average of 4.2m^3/day of biogas was produced at the Kanyama biogas unit during the monitoring period (BORDA, WASAZA M&E, 2013). No monitoring of gas generation has yet been done at Chazanga.

The FSTPs become blocked up about twice every year due to the high sand and solid waste content of the faecal sludge from pit latrines. This requires FSM services to be suspended for an average of three weeks for the solids to be removed using buckets, and for extra funds from the Water Trust to cover the pit emptiers' salaries while they undertake the work. In addition, the solid waste screened out from the sludge has to be removed periodically to the municipal landfill by a registered waste transporter at USD 40 per 10-ton load.

FINANCIAL ASPECTS AND BUSINESS MODELS

Under the Kanyama and Chazanga Water Trusts, the FSM service operates independently from the water supply section, with each emphasized and weighted in the operation by assigning specific personnel to each department. The capital costs of the facilities were covered by WSUP as well as the procurement

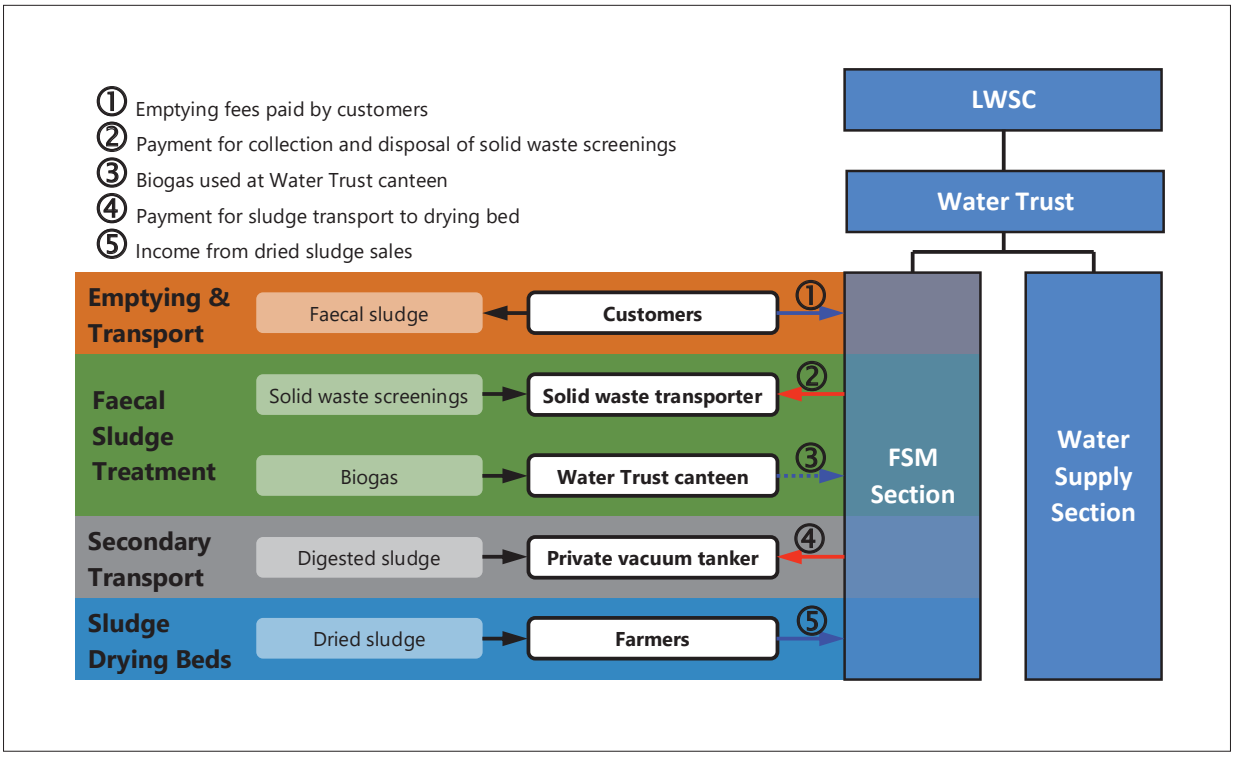

Figure 4: FSM management by the Kanyama Water Trust

of a light truck for transporting the 60-liter drums of faecal sludge. WSUP also paid for modifications and renovation works on the Kanyama and Chazanga FSTPs in 2013 and 2017.In order to gain market share, intensive marketing is required, together with enforcement to phase out informal pit emptying. Pricing of FSM services is based on estimated operation and maintenance costs, but constrained by the willingness of households to pay for the services, and the need to compete with informal service providers. Pit emptying revenue is administered separately from other Water Trust revenues and ring-fenced for FSM operations and maintenance. Initially, customers paid USD 24.00 for 12 sixty-litre barrels, USD 38.00 for 24 barrels and USD 48.00 for 32 barrels, but due to rising transport costs this has been raised to USD 34.00, USD 48.00 and USD 68.00 respectively. The emptiers are paid 60 percent of the total FSM revenue, and 40 percent is retained to sustain maintenance costs such as solid waste collection, transportation of sludge to the drying beds, disinfectants, safety equipment, etc.

The current pricing model based on packages of 12, 24 and 32 barrels has not been sufficient to cover all operation and maintenance costs, and a change to pricing on per barrel basis has been recommended. This is being promoted by the Water Trust managements in an effort to expand the market, and is expected to allow even the poorest households to call on the service depending on their available resources. With the current pricing model, the Chazanga Water Trust needs to empty at least 60 pit latrines per month to cover a monthly minimum wage of USD 100 for each of its six emptiers, plus basic tool maintenance and chemicals. However, the truck drivers are paid a fixed salary of USD 180 per month in Chazanga and USD 300 in Kanyama. The Chazanga driver's salary comes from pit emptying revenues, whilst the Kanyama driver is paid by the Water Trust.

THE EMPTIERS ARE PAID 60 PERCENT OF THE TOTAL FSM REVENUE, AND 40 PERCENT IS RETAINED TO SUSTAIN MAINTENANCE COSTS

The analysis of monitoring and evaluation data in 2013 showed that the services lost revenue through time used for walking to the household (hence the acquisition of trucks to substitute the pushcarts used initially), breaking the concrete latrine slab for access to the pit, and reinstating the slab on completion of the service, with average cement costs of USD 1.2 per latrine (BORDA, WASAZA M&E, 2013). This triggered a recommendation to modify all pit latrine slabs to facilitate access to the pit and to save the time and resources used for reinstatement. It was also recommended to charge extra, as the vacuum tankers do, for removing solid waste, as the large volumes of solid waste found in pits complicate emptying and also incur costs for its transportation to the dump site. Though this may increase service costs in the short run, it should also help to sensitize the community on solid waste management and thus result in overall savings.

SANITATION HAS BEEN WIDELY NEGLECTED BY THE INDUSTRY AND THERE IS AN URGENT NEED TO ADDRESS IT MORE INTENSIVELY AND PROFESSIONALLY

Overall, the FSM businesses were found not to be financially sustainable. Management costs are reportedly very high and cross-subsidies are often required from other revenues, such as water sales, to supplement revenue from FSM services.

CAPACITY DEVELOPMENT

The study found that utility companies mostly assign unskilled personnel to work in the sewerage department, with skilled personnel assigned to work in the department in most cases doing so against their will, due either to demotion or for disciplinary reasons. This shows that sanitation has been widely neglected by the industry and there is an urgent need to address it more intensively and professionally.

In Kanyama and Chazanga, the respective Ward Development Committees and Water Trusts mandated a "free-water" taskforce to create public health awareness, identify informal pit emptiers for formalization, and work to phase out informal pit emptying. The informal emptiers identified and selected were exposed to a training and capacity building program to formalize their activities. In Kanyama, a woman with no previous pit emptying experience joined the 11 informal pit emptiers. Initially, she was tasked to wash the sludge barrels after emptying, but she later joined the pit emptying teams and the barrel washing was shared around the group.

Figure 5: Pit emptying team

WSUP financed BORDA and WASAZA to develop an FSM operations and maintenance manual, which has been used as the basis for training the pit emptiers. GIZ (in coordination with LWSC) is also funding the development of a training plan, curriculum and training modules for more systematic technical/vocational training on FSM. In parallel, the capacity of students in higher learning institutions is being developed through projects related to FSM. Additionally, workers within the CUs are being exposed to faecal sludge management through hands-on workshops on pit emptying services and FSTPs.

Experience in Lusaka shows that the FSM business is an economic opportunity for community members. Eleven former informal pit emptiers have been trained and employed on FSM in Kanyama, and ten in Chazanga. The new service has empowered informal pit emptiers in the community; their new employment has delivered regular employment, a stable income, better working hours, and safer working conditions. Recruitment of new pit emptiers in Chazanga was initially quite challenging, due to the need to overcome social stigmas within the community, but the financial rewards available quickly overcame these challenges. However, some employee turnover has been recorded due to workers expecting more money than they actually earned. The pit emptiers reported that their new jobs were quickly accepted by their social peers. The good reputation of LWSC has also helped in building acceptance of the services by the community.

THE REGULATED NATURE OF THE WATER TRUSTS HAS MADE IT EASY FOR CUSTOMERS TO TRUST THE SERVICE WHICH THEY OFFER

DRIVERS OF CHANGE AND LESSONS LEARNED

Due to the provision of FSM services in peri-urban areas during daylight hours, customers have slowly been shifting from using informal operators to the Water Trust's pit emptiers, largely due to the higher perceived quality of the services. However, the proportion of latrines emptied by the formal Water Trust emptiers is still only 11 percent, compared to 59 percent by household members and informal service providers. The conventional vacuum truck business takes care of the remaining 30 percent of sludge from the septic tanks and latrines in the city. The regulated nature of the Water Trusts has made it easy for customers to trust the service which they offer, as evidenced by the capture of 11 percent of the market by formal emptiers despite the temporary suspension of services during the 2016 cholera outbreak (LWSC, 2016). Marketing by the pit emptiers through the distribution of flyers as they do their job has also helped to advertise the service. Additionally, competitive prices and pricing models have proven

crucial in attracting customers and promoting acceptance of the improved service.

As decentralized FSM services are new in the water sector, it is important for them to demonstrate high standards of public and environmental safety. The Lusaka experience shows that FSM service delivery should be implemented in coordination with household and community awareness campaigns on public health, regulations and the new services, and enforcement activities to curb informal pit emptying. A clear legal framework, together with strong regulation and enforcement, is highly recommended to promote the sustainability of the services. A highly regulated water supply and sanitation framework also ensures that water and sanitation services are strongly monitored to ensure the quality of service provision and client satisfaction. The engagement of a CBO such as the Water Trust, with a local leadership presence such as the Ward Committee Chairman on its board, reinforced by the licensing of its operations by LWSC, has proven to work well in gradually building cooperation with the regulators and acceptance by the community.

In the short term, improved FSM services have shown that they are *"unlikely to be sustainable, hence they require subsidy for a breakthrough"*, (LWSC, 2017). This is concluded based on the need for extra funding to make the services viable by providing a light truck, an accountant and a marketing officer paid through other revenue sources. A need has also been identified to change the institutional structure from a utility department to a self-sustainable entity. The current acceptance of FSM services by the market has been driven mainly by health and hygiene sensitization campaigns, the reputation of the entities involved, safe and reliable service provision, and the restriction of informal pit emptying by the free-water taskforce, which monitors and reports illegal community practices threatening public health to the municipality.

NEXT STEPS

Development of FSM services

To further promote acceptance of the improved FSM services, a sustained high level of performance is crucial, and depends on the efficient and reliable operation and maintenance of the FSM equipment and FSTPs. This includes maintenance of the facilities and trucks, periodic training for all parties involved, and monitoring of operations against the code of practice. These activities must be explicitly catered for in operational and financial planning. To reach scale, these services need to be offered at a price commensurate with the willingness of the target customers to pay for them. However, this will probably require a subsidy.

A city-wide model for FSM management largely depends on the prevailing institutional and legal framework, social acceptance, market conditions

Figure 6: Sludge drying beds

and political will. Three options are being considered for systematic analysis:

- The current Water Trust model – utility managed;
- Lease model – privately managed under the utility;
- Public private partnership – with task- and profit-sharing agreements.

Discussions with key FSM stakeholders favour the public-private partnership model. As a public institution, the Water Trust may have the capacity to invest in awareness creation and has already established a reputation for service delivery, whilst the private sector would be capable of efficient service delivery. The private sector partner can also benefit from investment and close observation by the utility. LWSC has already shown interest in establishing franchise agreements with existing FSM service providers in the expansion of quality services at affordable prices (LWSC, 2017).

A public-private partnership could also be of commercial benefit to LWSC, with the private company emptying pits autonomously and paying dumping fees to LWSC. On the negative side, the private service provider might not be willing to spend money on public health sensitization campaigns as they do not translate directly into profit, and might also cut corners on health and safety. However, they will want to undertake marketing to capture business, and in providing the resulting services should have a positive impact on public health. They will also wish to develop and preserve their reputation with the public, to maintain market share, and with the Water Trusts and LWSC, to generate their willingness to invest in equipment and training of their employees in operations and safety.

Onsite facilities

The existing pit latrines in Lusaka were not designed with emptying in mind, but now that the need is arising due to densification, and with the planned establishment of reliable city-wide FSM services, it is the right time to start working towards upgrading onsite sanitation facilities on a massive scale, which will be initiated under the LSP. Such upgrading should aim not only to make them easier (and therefore cheaper) to empty, but also to improve their performance in isolating faecal material from human contact. A related issue also requiring attention is the exclusion of solid waste from latrine pits, through a combination of user education, improved solid waste management services and technical improvements to latrines.

CONCLUDING REMARKS

The critical factors in defining a faecal sludge management system are numerous and closely interrelated. Each category – the legal framework, social acceptance, management and sustainability, operation and maintenance, safety and reliability – has its own parameters which should be closely analysed for overlaps and dependence. Detailed scoping before planning and implementing a new FSM system, or before adjusting an existing one, is highly recommended.

The motivation and experience of future FSM operators is equally important. Efforts to meet legal standards, provide safe and reliable service and achieve social acceptance will only be successful if there is interest in the provision of high quality services and not just a focus on immediate profitability. This can only be achieved in the context of an appropriate and viable business model.

NOTES

[1] It was found that the partially digested sludge from pit latrines was not very suitable for anaerobic digestion, so a simple holding tank was built instead of another digester

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ABBREVIATIONS AND ACRONYMS

BORDA	Bremen Overseas Research and Development Association
CBO	Community based organizations
CU	Commercial Utility
FSM	Faecal Sludge Management
FSTP	Faecal sludge treatment plant
GDP	Gross domestic product
GIZ	Deutsche Gesellschaft für internationale Zusammenarbeit
GRZ	Government of the Republic of Zambia
KfW	Kreditanstalt für Wiederaufbau
LA	Local authority
LCC	Lusaka City Council
LSP	Lusaka Sanitation Program
LWSC	Lusaka Water and Sewerage Company
MLGH	Ministry of Local Government and Housing
NUSS	Nation Urban and Sanitation Strategy
NWASCO	The National Water Supply and Sanitation Council
WASAZA	Water and Sanitation Association of Zambia
WSS	water supply and sanitation

WSUP	Water and Sanitation for the Urban Poor
ZEMA	Zambia Environmental Management Agency

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