

# BUILDING BLOCKS FOR EFFECTIVE FAECAL SLUDGE MANAGEMENT IN PERI-URBAN AREAS: THE ROLE OF SMALL-SCALE SERVICE PROVIDERS IN MAPUTO.

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## ABSTRACT

*Faecal Sludge Management (FSM) is a major challenge for peri-urban sanitation in the majority of Sub-Saharan African cities. With more than 80% of its population living in peri-urban settlements, and relying on on-site sanitation facilities, Maputo produces on average 150m<sup>3</sup>/day of sludge. Most of the sludge from peri-urban latrines is buried in the yard, or dumped in solid waste skips and drainage channels, whilst only a small portion is delivered to the municipal sewage treatment plant. Emptying services are mainly undertaken by small-scale service providers (SSPs), ranging from bucket emptiers, to small enterprises which combine emptying with transportation to the treatment plant.*

*Having identified the potential role of the private sector in improving sludge management in peri-urban areas, Maputo Municipality partners are developing support programs to improve sludge management in the city. This study analyzes the role of private sector in improving sludge management in peri-urban areas, looking at the options developed and implemented so far, as well as their potential for scaling up in different socio-economic environments.*

*Findings from these studies show great potential for SSPs to provide adequate FSM services in peri-urban areas. There are however some challenges regarding the quality of the on-site sanitation facilities to be emptied, sludge transfer for treatment, and financing for SSPs. The study recommends the adoption of an integrated approach, with a clear strategy for integrating SSPs under sustainable business models.*

Key words: FAECAL SLUDGE MANAGEMENT, SMALL-SCALE PROVIDERS

## INTRODUCTION

Access to sanitation services is still a major challenge in Mozambique's urban areas, especially for the poor. Despite wide-ranging sector reforms and investments in infrastructure and service provision, only 38% of the population has access to a hygienic excreta disposal facility<sup>1</sup>. The sanitation situation is even worse than indicated by this number, as more than 90% of Mozambique's urban residents rely on on-site sanitation facilities which are mostly not emptied hygienically, so that large quantities of faecal sludge are dumped directly into the urban environment, with obvious and extremely negative implications for public health and amenity.

Although the issue of urban sanitation is receiving at least some attention from the authorities, following approval of the government's Urban Water and Sanitation Strategy, attempts to date to improve the situation have been frustrated by the need to involve and effectively coordinate many different institutions and actors, and the lack of proven approaches to tackling the problems on the ground.

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<sup>1</sup> WHO and UNICEF JMP <http://www.wssinfo.org/data-estimates/table/>, accessed August 2011

The lack of access to improved sanitation is acute in the informal settlements and peri-urban areas of Mozambique's capital, Maputo, resulting in frequent cholera outbreaks (on average 7,500 cases per year), widespread diarrheal disease (on average 25,000 reported cases per year) and high child mortality (108 per 1,000 live births)<sup>2</sup>. In peri-urban Maputo responsibility for sanitation falls on individual households, which have to build their own sanitation facility and seek solutions for emptying it, when necessary.

Although Maputo Municipal Council (MMC) has ultimate responsibility for providing sanitation services to its citizens, it lacks capacity to manage both the existing sewer system (covering less than 15% of the city) and faecal sludge in the peri-urban areas. This gap in service provision has opened a space for small-scale independent providers (SSPs), ranging from manual bucket emptiers to vacuum tanker operators, who provide emptying and transportation services for faecal sludge. Maputo already has experience of successful service provision by small scale independent providers in water supply and solid waste management, which emerged due to the lack of services in peri-urban areas.

This paper aims at analysing the role of SSPs in the sanitation services chain, with a focus on faecal sludge management (FSM) in peri-urban Maputo. It also considers experience with the involvement of SSPs in providing water supply and solid waste management services, and goes on to recommend actions to build on their potential to bridge the current gap in sanitation service provision.

## **METHODOLOGY**

Information for this study is based on semi-structured interviews with the three existing microenterprises/community-based associations providing faecal sludge management services, and focus group discussions with 6 bucket emptiers and with MMC staff responsible for sanitation. The bucket emptiers were randomly selected in the neighbourhoods where they are most active (Urbanização, Maxaquene A and B, and Nhlamankulo C, Xipamanine) and the discussion was held at their meeting point at a peri-urban bar, where they often drink together. The interviews focused principally on: i) services provided and their management; ii) methods and costs; iii) financing; and vi) main challenges.

A desk review of recent studies on the provision of solid waste management and water supply (currently for 25% of the population<sup>3</sup>) services in Maputo by SSPs was also conducted to complement the analysis for this study.

## **PERI-URBAN SANITATION SERVICES IN MAPUTO**

In Maputo, Mozambique's largest urban centre and national capital, at least 33% of the population, who live mostly in peri-urban areas, still rely on inadequate<sup>4</sup> and, in many cases, shared, sanitation facilities – in some cases serving more than 30 families. With an estimated one million inhabitants<sup>5</sup>, most peri-urban neighbourhoods are unplanned and densely occupied, and suffer from a lack of basic services<sup>6</sup>. Access to improved sanitation is in general limited, and this is compounded by inadequate water supply and drainage. Inadequate solid waste management, and the incompleteness and inefficiency of the existing drainage system are the root causes of the frequent flooding, overflowing latrines and erosion experienced almost everywhere in peri-urban Maputo.

The Water and Sanitation Infrastructure Board (AIAS) – under the Ministry of Public Works and Housing (MOPH) – is the primary agency responsible for ensuring both water supply in small towns and sanitation in all urban areas in Mozambique, whilst CRA, the water and sanitation sector regulatory agency, is

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<sup>2</sup> Disease data from Ministry of Health and mortality data from National Statistics Institute (MICS 2008)

<sup>3</sup> Water utility data, as at August 2012

<sup>4</sup> Less than the government approved minimum of an “improved latrine”, basically one with a concrete slab

<sup>5</sup> 80% of 1.2M, reported by INE (2010)

<sup>6</sup> DINAPOT & MICOA (2006)

responsible for balancing the interests of the main stakeholders, principally the asset manager, service providers and consumers.

However, MMC has ultimate legal responsibility for providing sanitation services to its citizens, which it does through its Water and Sanitation Department (DAS), as set out schematically below. DAS is currently responsible for coordinating and implementing sanitation services within the municipality. However, it is not delivering very effectively on this mandate, due on the one hand to a lack of capacity and political will to invest in sanitation, and on the other, to inadequate or non-existent definition of the services required, and weak organization and implementation through the institutional framework represented below.

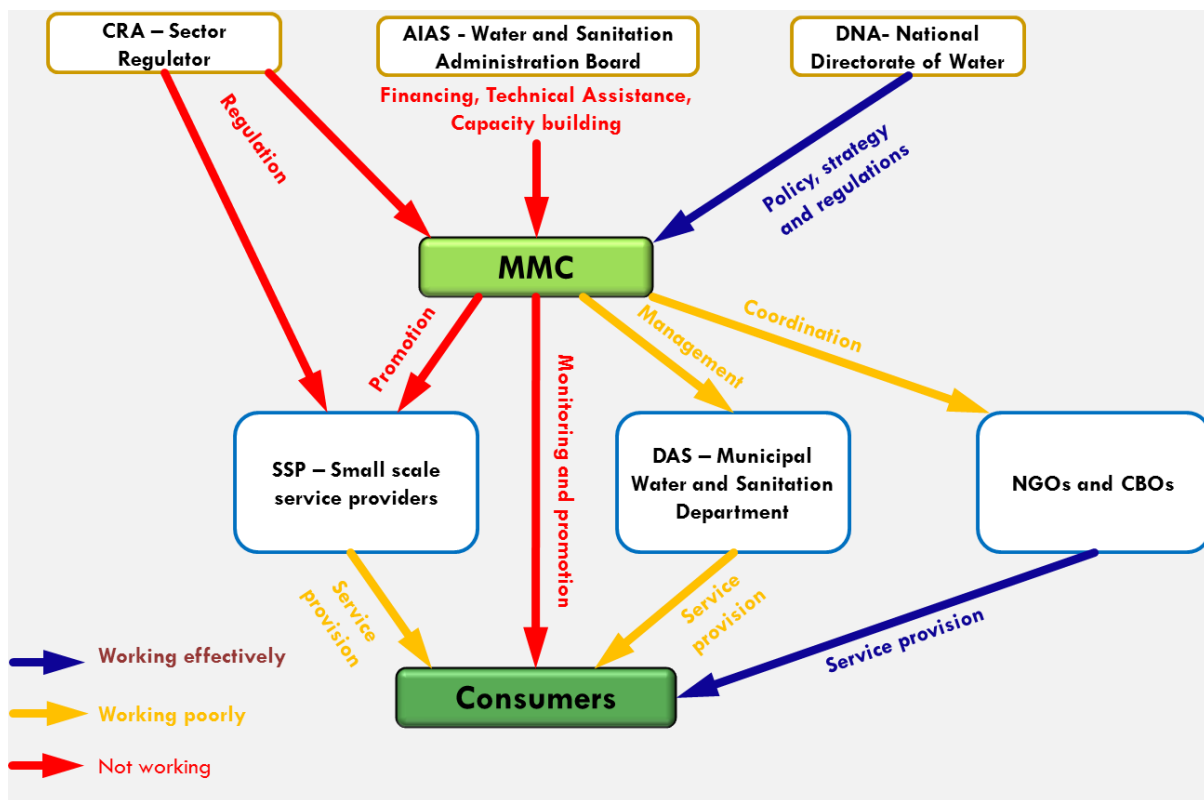


Figure 1 – Urban Sanitation Institutional Framework

While there are clear policies, strategies and an institutional framework for sanitation service delivery, implementation leaves a great deal to be desired. Most of the existing institutions are not discharging their responsibilities effectively, and service provision is highly fragmented.

With less than 15% of its citizens covered by the sewer network, sanitation in Maputo is mainly on-site, with an estimated average faecal sludge production is 150m<sup>3</sup>/day. However, as in many Mozambican cities, on-site sanitation is almost exclusively a household responsibility<sup>7</sup>, and there is little or no public sector involvement. Many of the facilities built by households on their own fail to meet technical and environmental standards, and therefore pose a threat to the environment and public health.

The diagram below shows schematically how excreta are managed in Maputo. It can be clearly seen that rather little of the total sludge and sewage produced actually passes through the treatment plant, but rather contaminates backyards, the drainage system and Maputo Bay.

<sup>7</sup> The National Low-Cost Sanitation Program, which provided partially subsidized latrines, collapsed in 1999 when external support was withdrawn by donors who saw it as top-heavy and unsustainable.

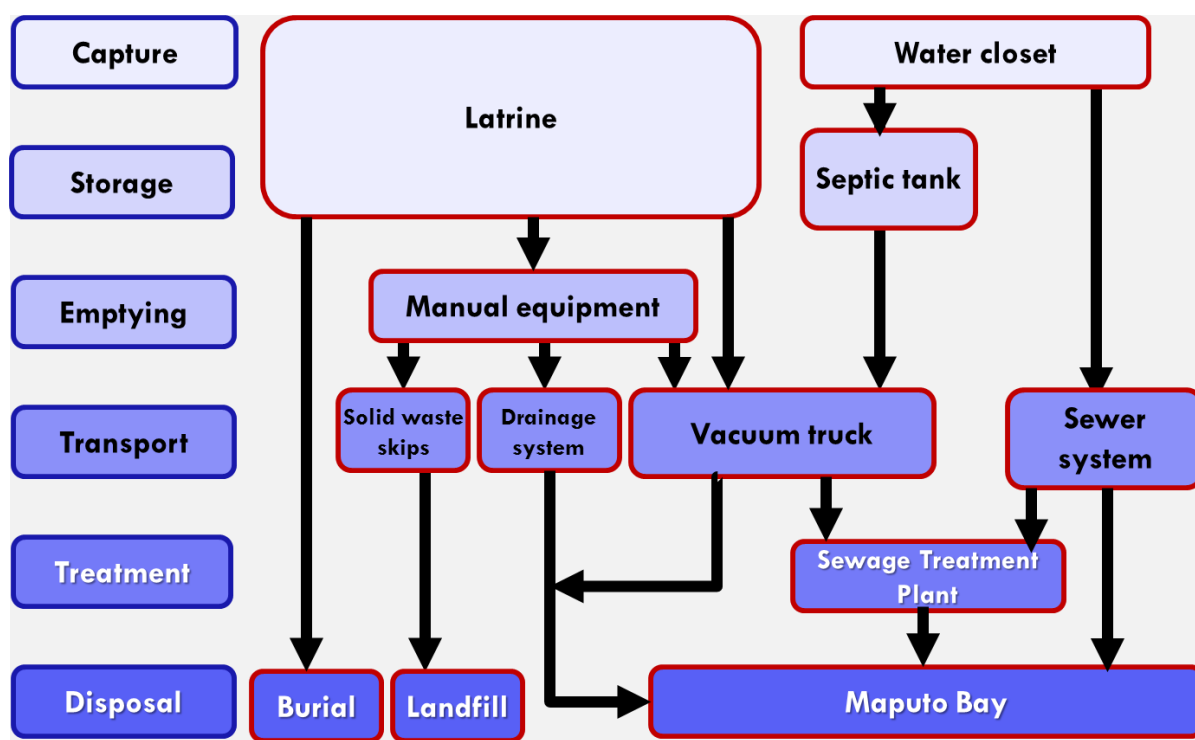


Figure 2 – The Sanitation System in Place in Maputo

Latrines are the most common facility for the capture and storage of excreta in peri-urban Maputo. A recent survey carried out by local authorities, with support from WSP, in 10 of the city's 53 neighbourhoods<sup>8</sup>, shows that almost 80% of peri-urban households rely on latrines (Figure 3), for excreta disposal. Only 18% have a water closet, of which very few are connected to the sewer system, which runs along the edge of some of the areas surveyed.

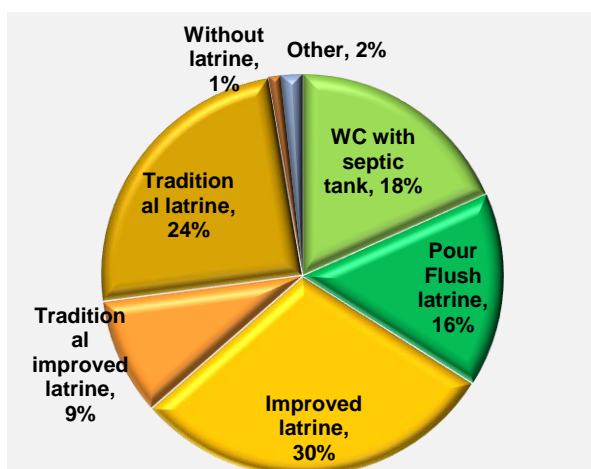


Figure 3 – Sanitation Coverage in Peri-urban Maputo

The types of latrines include pour-flush latrines, improved latrines with a concrete slab, and traditional latrines built from tyres, barrels and/or timber.

Construction of sanitation facilities is mainly by SSPs, ranging from informal masons to microenterprises with prefabrication yards where they sell latrine components, amongst other items. Some now privately-run units of the defunct National Low-Cost Sanitation Program, and some community-based organizations

(CBOs) also offer components or build latrines for low-income households. Traditional latrines are normally built by householders themselves, and they buy only the materials.

Many of the components and/or latrines provided by these SSPs are of low quality, and there is no quality control either by themselves or by Local Government, giving rise to risks of collapse and harm to users.

In general, there is a lack of hygienic toilet desludging services in peri-urban Maputo, where it is often difficult for conventional vacuum tankers to gain access. Although some sanitation facilities are emptied using vacuum trucks<sup>9</sup>, the majority of latrines are emptied manually by individuals and very small-scale,

<sup>8</sup> The survey covered 25,000 households in Municipal Districts of Nhlamankulo and Maxaquene

<sup>9</sup> Mostly in the case of septic tanks and middle-income households

informal service providers using buckets, charging from US\$ 7 to US\$ 13 per latrine emptied. In these cases, the sludge is generally buried in the user's backyard, or dumped in the drainage system or in the skips used for secondary collection of solid waste.

Two CBOs and one microenterprise, supported by WaterAid and WSUP respectively, provide desludging services using small tankers (VacuTug or a motorized diaphragm pump) and hand pump ("Gulper") at a cost of US\$ 15 per 0.5m<sup>3</sup> of sludge. The sludge is stored in a transfer tank and from there transported in tanker trucks to the sewage treatment plant (STP), where it is dumped.

These services are unaffordable to the lowest-income residents, resulting in pit latrines being abandoned when full and left to overflow during heavy rains. Meanwhile, space is usually not available for new latrines, and even some households which were previously served, albeit poorly, are slipping back into the use of shared facilities or open defecation. This is especially true of compound houses, some of the cheapest and lowest-quality accommodation on the rental market.

There is no treatment plant in Maputo specifically for faecal sludge. Some of the faecal sludge from the city is partially treated at the STP, but it is not maintained at all, and no monitoring is done to assess its effectiveness. Meanwhile, there are uncontrolled industrial discharges into the STP, which can be presumed to aggravate the situation.

## **EXPERIENCE WITH SMALL-SCALE SERVICE PROVIDERS IN MAPUTO**

As happened in the cases of water supply and solid waste management, the gap in sanitation service provision led to the emergence of SSPs. However, the development of each group followed a different course.

Informal water supply by SSPs started in Maputo in the 80's. In the last 10 years, they have increased in number and population served, making Maputo a reference point for this type of service<sup>10</sup>. There are currently 500 SSPs, providing water to 25% of Maputo's population. These service providers emerged spontaneously in the peri-urban neighbourhoods of Maputo, where water supply services were lacking or of low quality, and now compete with the formal water utility. They are self-financed and recent studies describe them as successful entrepreneurs, operating with full cost recovery, and being flexible, innovative, efficient and customer responsive (Bhatt, 2006; Guida, 2009; Thompson, 2010). However, as there was no forethought on the SSPs' contribution to the sector (Bhatt, 2006), sector planners failed to develop an inclusive framework for urban water supply, resulting in ill-defined and unregulated service provision by SSPs in Maputo, although it has now been partially formalized (Matsinhe et al, 2008; Thompson, 2010).

For more than three decades, MMC has failed to manage solid waste effectively, and the floods in 2000 exposed the critical lack of an efficient system (Kruks-Wisner, 2006; Grest, 2006). Many low-lying neighbourhoods, especially low-income informal peri-urban settlements, were inundated for weeks by waste-laden standing water. Municipal drains, including several major conduits, were blocked by accumulated waste, further exacerbating the flooding (Bowen and Helling, 2011). In response, two initiatives emerged independently in two different peri-urban neighbourhoods in 2001, providing primary solid waste collection services in areas away from the main roads. A local entrepreneur, Paulino Uaiene, introduced house-to-house waste collection services through his company, UGSM, in Maxaquene, and similar services were introduced in Urbanização by a CBO, ADASBU.

Despite some challenges in implementation and financing, the experiences in Maxaquene and Urbanização, together with the failure of CMM to provide efficient services, and the reform process within MMC supported by the World Bank and GTZ, led to the design and implementation of a Solid Waste Management

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<sup>10</sup> Guida, V. P. (2009)

(SWM) framework, starting in 2006 (Bowen and Helling, 2011). This is an innovative public-private partnership between MMC and SSPs, whereby the SSPs are contracted by MMC for primary collection and transfer of solid waste into the secondary collection system. Integrating the SSPs resulted in greater efficiency and improved solid waste management in the peri-urban areas (Kruks-Wisner, 2006; Grest, 2006; Bowen and Helling, 2011). However, there are still some challenges to be addressed, concerning service coverage, management of the secondary collection system, monitoring, and accountability.

## **THE ROLE OF SSPs AND KEY CHALLENGES IN PROVIDING FSM SERVICES**

### Historical Overview

Informal faecal sludge management started in the 80's, mainly in low-income compound housing with shared latrines. Traditionally the latrines were emptied during the night using buckets and the sludge buried nearby. The rural exodus, which started during the civil war (1976-1992) and continues to date, has resulted in a major increase of population density, and consequent reduction of available space in peri-urban areas. This has led to an increase in the demand for emptying services, though mostly undertaken informally by SSPs, using the traditional and unhygienic bucket method.

The floods of 2000 and subsequently, stimulated some NGOs to work on FSM, and this led to the introduction of more formal services by CBOs in Urbanização (ADASBU) and later in Hulene (Xivoningo), using VacuTugs and similar mechanized equipment. The main objective was to fight cholera by providing low-cost emptying services to peri-urban households living in low-lying areas. Although these CBOs have played an important role in FSM during the last 10 to 12 years, they failed to provide sustainable services, mostly due to their socially-oriented business model and dependence on external funding for capital investment and major repairs.

UGSM, one of the pioneers in SWM, has recently (2011) entered the FSM market, with support from the NGO Water and Sanitation for the Urban Poor (WSUP), applying a strictly commercial approach. With a series of simple technology options, including buckets, the "Gulper" and a diaphragm pump, UGSM provides services in two neighbourhoods, Maxaquene A and B, and is interested in expanding to other areas. It is still too early to assess the sustainability of this approach, although initial results look promising and UGSM has started to repay capital costs.

### Profile and Role of FSM Service Providers

There are currently three types of FSM service providers in Maputo: i) the individual manual bucket emptiers (IEs), ii) the CBO service providers ADASBU and Xivoningo, and iii) the microenterprise service provider (MSP) UGSM. Table 1 below summarizes the main features of existing FSM service providers in peri-urban Maputo.

Most of the IEs provide their services during the night, as it is less troublesome to the neighbours. Moreover, these service providers are perceived as doing undignified, demeaning work, and are marginalized socially, whilst at the same time providing this essential service. From their perspective, peri-urban residents prefer these traditional services, as they are less expensive and more effective. The mechanical emptiers do not usually remove the heavier, more compacted, sludge at the bottom of pits, and it is common for an IE to be called in after a mechanical emptying. Although they take the business seriously, they state that FSM services alone are insufficient to survive on, and they need to combine this with other activities. Fluctuations in demand are high, and they can only rely on FSM services during the rainy season. Most of them combine emptying with latrine and general construction work. According to them, it is essential to drink heavily before emptying a latrine, as they feel unable to confront faecal sludge when sober. They do wish to expand and improve their services, but they perceive access to finance as a major challenge.

The CBOs were established on a social development, non-profit basis, and depend on external funding. Similarly to many other CBOs in Maputo, both ADASBU and Xivoningo lack sustainability. Since WaterAid

withdrew their financial support to these CBOs in 2010, their FSM services have been deteriorating and they currently have no capacity to provide secondary transport services, leading them to depend on MMC, which empties the transfer tanks every two weeks. In contrast to the SWM services, where they are regularly paid by the municipality, it can be predicted that FSM services provided by these CBOs will collapse over the short term, if no recovery strategy is put in place. This would create a significant gap in service provision, leaving more than 20,000 households without access to FSM services, with consequent risks to public health.

The MSP, well documented by Godfrey, 2012, has been providing emptying services on a commercial basis for almost one year. Well equipped,<sup>11</sup> and assisted by sanitation specialists, UGSM's FSM activities have been tested, and a business plan for sustainable services developed, including marketing and flexible service options. UGSM offers a range of services from traditional bucket emptying, to manual and mechanical emptying, as well as transfer to the treatment plant. However, UGSM also faces challenges regarding storage capacity, as it has no transfer tanks and it is not sustainable to transport the sludge directly to the treatment plant. Its future is also unclear, as no official management framework has yet been established for peri-urban sanitation.

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<sup>11</sup> Capital investment financed by WSUP at zero interest rate

**Table 1 – FSM Service Providers in Peri-urban Maputo**

Type of SP	No of SPs interviewed	Services provided	Areas Covered	Technology used for FSM	Price for emptying	Challenges
<b>Individual emptier (IE)</b>	6	<ul style="list-style-type: none"> <li>Emptying of traditional and improved latrines</li> <li>Emptying of septic tanks during the dry season</li> <li>Excavation and other manual labor for latrine and drain construction</li> </ul>	Mafalala, Munhuana, Xipamanine, Maxaquene D, Nhlamankulo C	<ul style="list-style-type: none"> <li>Buckets</li> <li>Burial of sludge in the yard</li> <li>Use of petroleum and creosote to reduce smell</li> </ul>	Depending on the latrine type, depth and diameter, and client capacity to pay: - Latrines (0.2-0.4m <sup>3</sup> ) → US\$ 7-13 - Septic tanks → US\$ 30-70 Client should buy creosote and traditional alcoholic drink	<ul style="list-style-type: none"> <li>Unsafe latrines (mainly traditional latrines)</li> <li>Lack of safety equipment (gloves, boots, masks, etc.)</li> </ul>
<b>CBOs</b>	2	<ul style="list-style-type: none"> <li>Latrine and septic tank emptying</li> <li>Construction of sanitation facilities and components</li> <li>Hygiene and sanitation promotion</li> <li>Primary solid waste collection</li> </ul>	Urbanização, Maxaquene A, Munhuana, Hulene A, Hulene B	<ul style="list-style-type: none"> <li>Mini vacuum tankers (VacuTug) for sludge removal from latrines and septic tanks</li> <li>Temporary storage in a transfer tank</li> <li>Transport to sewage treatment plant by vacuum tanker</li> </ul>	US\$ 7-13 per 0.5m <sup>3</sup> depending on distance	<ul style="list-style-type: none"> <li>Funding of replacement and major repair of equipment</li> <li>Development of a commercially viable business model</li> </ul>
<b>Micro-enterprise (MSP)</b>	1	<ul style="list-style-type: none"> <li>Latrine and septic tank emptying</li> <li>Primary and secondary solid waste collection</li> <li>Transport (taxi)</li> <li>Car wash</li> <li>Micro-finance</li> </ul>	Maxaquene A, Maxaquene B, Mafalala, Urbanização	<ul style="list-style-type: none"> <li>Buckets, handpump and mechanized pump for sludge removal from latrines and septic tank</li> <li>Transport to sewage treatment plant in plastic tanks on a small truck</li> </ul>	US\$ 20-60 per latrine or septic tank emptied, depending on latrine type, depth and diameter, and client capacity to pay	<ul style="list-style-type: none"> <li>Demand fluctuations, with lower demand during the dry season</li> <li>Capacity and willingness to pay, especially by low-income households</li> <li>Marketing strategy</li> </ul>



## CONCLUSIONS AND RECOMMENDATIONS

The provision of water supply and SWM services by SSPs has developed in markedly different ways. In the case of water supply, sector planners failed to predict the massive growth of SSPs and develop a strategy for their involvement in service provision before they had become well established. Some measures to accommodate SSP demands for rights as service providers were put in place by the central government, in exchange for licensing and very light regulation. However, there is neither a clear strategy of integrating SSPs into service provision plans, nor a decision to eliminate them, and they are currently competing with the formal water utility to expand services in peri-urban areas, or, in some cases, moving to new areas.

In contrast, local government took the leading role in designing and implementing a management framework for SWM, with a major role for SSPs, especially in peri-urban settlements where conventional SWM services are inappropriate. This led to a significant increase in solid waste collection efficiency and improvement of the service in general, while contributing to poverty reduction by empowering and providing sources of revenue to the SSPs and their local workers, ultimately improving the environment and reducing public health risks.

Although they provide a far from ideal level of service, SSPs currently undertake FSM for most peri-urban households in Maputo. However, there is currently no strategy to build on their experience and incorporate them systematically into the provision of improved sanitation in peri-urban areas. Various combinations of service models for FSM in Maputo could be formulated, but it is clear that the public sector lacks capacity to provide services in peri-urban areas. At least primary collection should be undertaken by SSPs, and could be expanded to include transfer tank management and secondary transport; some options are illustrated schematically in the figure below.

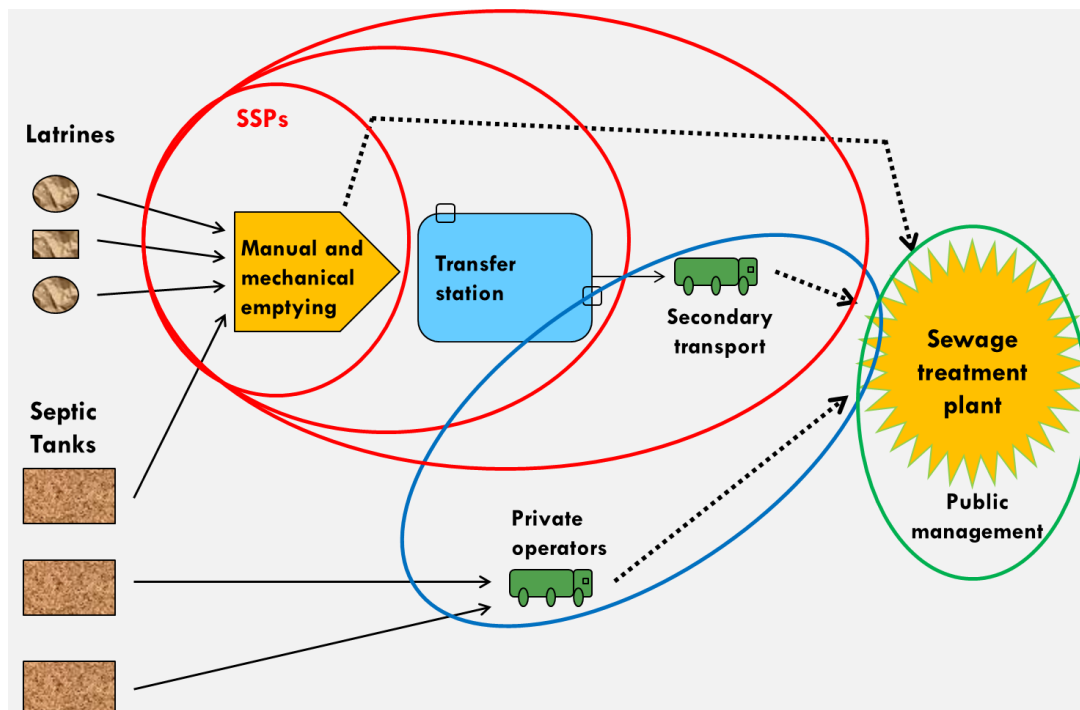


Figure 4 – Options for FSM Involving SSPs in Maputo

Having identified the potential of SSPs to provide services in peri-urban areas, the following recommendations are advanced:

- a) **Develop a strategy to integrate SSPs formally into a FSM framework for Maputo.** Building on the experience of public private-partnerships in SWM, and the FSM services provided so far by the SSPs, MMC could develop a comprehensive framework to tackle the issue of FSM in peri-urban areas, including SSPs, conventional tanker operators and the MMC. Roles and responsibilities would

need to be clearly defined, covering financing, promotion, service provision, regulation and monitoring.

- b) **Develop and implement viable and sustainable business models for provision of FSM services.** It is obvious that the lack of commercial business models for service provision has led to failure in the case of the CBOs, while the entrepreneur seems to be successfully implementing services on a profitable basis. However, commercially viable prices may well be too high for poorer households, so equity as well as public good considerations would suggest the need for partial subsidies, possibly focused on specific steps in the service chain.
- c) **Financial and technical support.** When external funding was withdrawn, the CBOs were unable to replace most of their equipment. Whilst the entrepreneur has shown better financial performance, he has also benefited from financial and technical support. Given the very high cost of capital in Mozambique there is a need to develop alternative modalities for financing capital investment for FSM service providers. Improvements are also needed in the technology aimed at the peri-urban market, and given the very tight financial circumstances of the SSPs, this would also have to be funded from public sources.

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