Financing sanitation – resource recovery from faecal sludge in Dakar, Senegal

Dakar has three operating faecal sludge treatment plants. However, poor FS collection and transport services lead to discharge of large amounts of faecal sludge into the urban environment. Large-scale enduse of dried faecal sludge by industries such as cement companies could provide the necessary incentive and revenue to improve services along the faecal sludge management service chain. Public funding and involvement is required for this to become a reality.

Photo 1: Faecal sludge collection and transport companies discharging faecal sludge at Cambérène Faecal Sludge Treatment Plant in Dakar.

Background

In Dakar, sanitation needs of 65% of the population are met by onsite sanitation technologies (EDE/H20, 2011). Virtually all of these are septic tanks. Once onsite sanitation technologies are filled-up, management of faecal sludge (FS), the (semi-) liquid waste accumulating in these technologies is required in order to provide sustainable sanitation. Dakar has three operating faecal sludge treatment plants (FSTPs). However, due to a series of inefficiencies along the faecal sludge management (FSM) service chain, only a portion of the FS produced is collected and transported for treatment. Large amounts are discharged into the urban environment, jeopardizing public and environmental health.

The Faecal Management Enterprises (FaME) project investigated the financial viability of using dried FS as industrial fuel or as soil conditioner in agriculture. The objective was to develop a financial-flow model that could help to evaluate the financial viability of FS enduse as well as to assess the broader economic costs and benefits for stakeholder along the FSM service chain.

Activities and Methods

The financial viability of FS treatment products was assessed in three steps.

1. Quantifying the volume of FS that is produced in onsite sanitation technologies, and that is collected and transported to designated FSTPs by mechanical collection and transport services;
2. Estimating revenues from potential resource recovery of FS treatment products; and
3. Assessing the distribution of these revenues to stakeholders (i.e. households, mechanical collection and transport companies, FSTPs and customer of treatment products), the financial viability for each stakeholder, and whether there would be adequate revenue for a financially sustainable service chain.

Results

The volumes of FS and how they are distributed along the FSM service chain is shown in Figure 1.

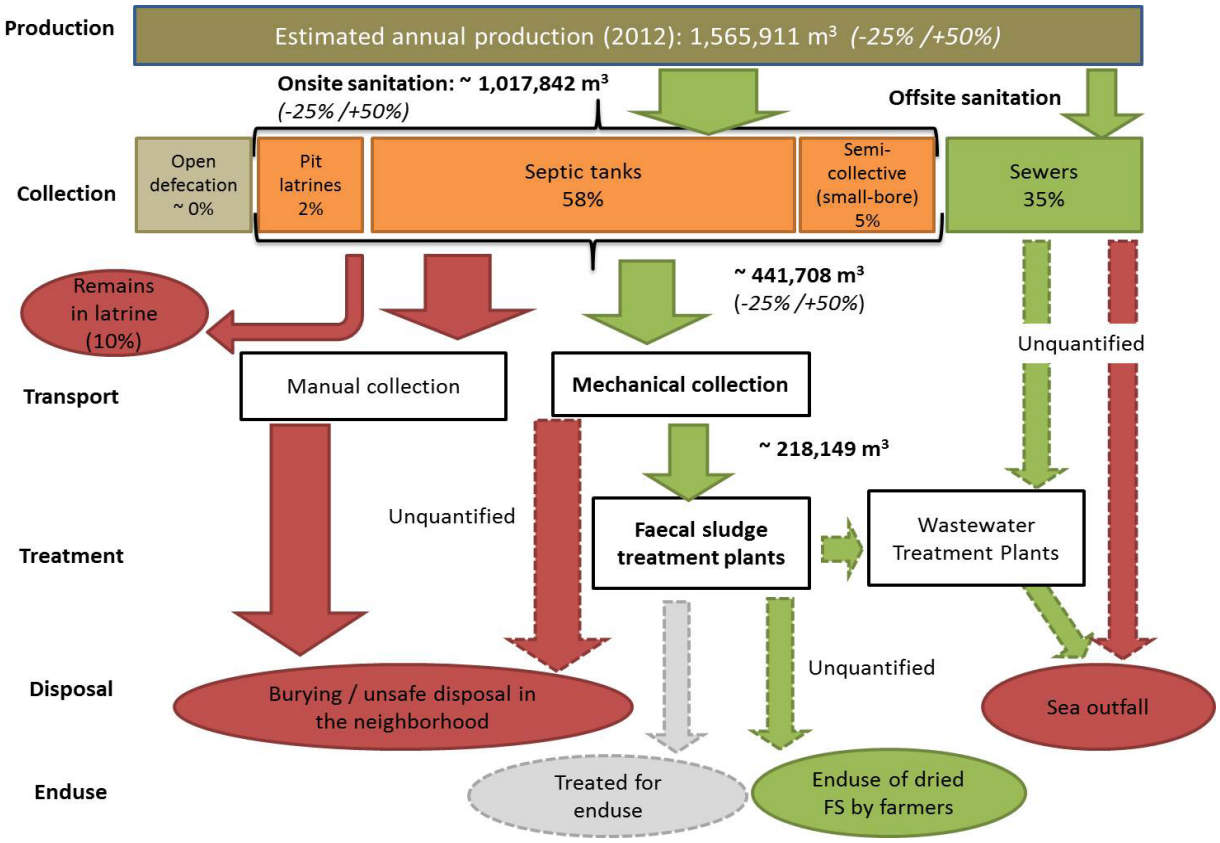

Figure 1: Annual flow of faecal sludge along the faecal sludge management service chain in Dakar. Red indicates flows lost to the environment; green indicates captured flows; grey indicates treated faecal sludge for enduse.

The volume analysis revealed several inefficiencies along the FSM service chain. According to the collected data, only about 21% of FS produced in Dakar currently reaches the existing FSTPs. Reasons for this are:

- **Poor quality of septic tanks.** Due to inadequate septic tank design and high water tables, septic tanks fill up quicker than in other contexts thereby increasing the required emptying frequency and overall sanitation costs.
- **Poor FS collection services.** Poor quality of FS collection trucks only generate a low vacuum which has difficulties in mobilizing the full sludge content accumulated in the septic tanks. Commonly, 90% of the tank volume is collected with a layer of dense solids remaining at the bottom of the tank.
- **Unaffordable emptying services.** Many households cannot afford mechanical emptying services and rely on manual emptying.
- **Illegal dumping of FS into the environment.** According to data provided (ONAS, 2008), only 49% of the FS collected by mechanical collection and transport is delivered to the existing FSTPs.

Market value of FS treatment products

The FaME calorific value and market demand study showed that dried FS has the potential to be sold as a solid fuel to industries (Murray Muspratt et al., 2014; Diener et al., in press). In Dakar, discussions took place with two potential industrial users: a cement company and a company regenerating waste oil. Currently, the bulk of the energy they consume is provided by coal and liquid fuels respectively. Thus, using dried FS would require an investment to adapt the combustion process for use of dried FS.

Proportional to its calorific value an take up-price of dried FS was valued at 59 USD/t. Given that dried FS is likely to be more difficult to manage than coal and would require initial investment to adapt the burning process, a 50% markdown to the price of coal paid by the cement company is included. During the project, both companies have indicated no immediate interest in using dried FS in their energy mix.

For the cement company, a reason was that the quantity of dried FS that could be produced would not be sufficient compared to the initial investment requirement. The company regenerating waste oil had just invested in a new combustion technology suited to liquid fuels.

Dried FS is already sold to famers as a soil conditioner in agriculture. Depending on its availability, dried FS is currently given away for free or sold to farmers at an average price of USD 3.6 USD/t.

Potential revenues from dried FS

With the current inefficiencies in FS collection, transport and treatment, low revenues are created from enduse of FS treatment products. The current revenue from selling dried FS to farmers could not be quantified during the study. At the current levels of FS delivered (1520 tonnes per year), an annual revenue of USD 5,500 is created if all sludge treated would be sold to farmers. In contrast, if this amount of sludge would be sold to the evaluated cement company (USD 59 per tonne), revenue of USD 89,680 could be generated per year.

If the FSTPs were supplied to their full design capacity at 425,680 m^3 per year, a total amount of USD 2,980 could be produced per year. This could generate revenues of USD 176,380. In contrast, selling this amount of dried FS to farmers could only generate revenues of USD 10,730. The higher revenue generated from selling FS as a solid fuel may be able to significantly offset running costs of the treatment plant and provide an incentive to increase the performance of the FSM service chain.

Measures to increase enduse of FS treatment products

The following incentives could increase revenue at different stages along the FSM service chain, and help to achieve financial viability of FS treatment products for various stakeholders:

- Ensure that FSTPs produce dried FS at volumes and quality to supply adequate fuel to identified endusers;
- Decrease the dumping fee`s at FSTPs;
- Tackle identified inefficiencies of FS collection and transport to maximize the volume delivered to the FSTPs;
- Assist mechanical FS collection and transport companies to increase the efficiency of their businesses, to increase the volume of FS delivered to the FSTPs (e.g. zonation of the city, truck routing or a centralized bidding system through mobile phones).
- Provide facilitated access to poor households to construct adequate sanitation technologies. For poor households, sanitation costs compared to annual household income are substantially higher than recommended levels.

How could these reforms be financed?

In the absence of initial revenues from enduse, but bearing in mind the substantial costs of inadequate sanitation for society as a whole, initial investments to increase FS collection, transport and treatment services need to be financed with public funding or cross-subsidies from other services. These subsidies could be replaced with income generated from FS treatment products, once reliable demand has been established. Another possibility is providing dried FS to industries free of charge during an initial testing phase to encourage industries to use dried FS and explore the benefits. This would also encourage industries to invest in adapting their industrial process while not bearing extra costs.

As the sanitation markets become more efficient and the availability of FS treatment products increases, FS enduse products could become more attractive for industrial users and farmers. These revenues could then be used to further increase the performance of service along the FS management service chain.

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Highlights

- There is no clearly established demand for dried FS in Dakar at present. This is partly due to the fact that an insufficient amount of FS is treated for enduse.
- Once the existing treatment plants would produce dried fuel at full capacity with the quality desired by industries, interest on the industrial side could be raised and attractive revenues for the FSM service chain can be generated.
- Public funding could finance initial measures to increase the efficiency of the FS market, such as supporting households to build better designed septic tanks, reducing the dumping fee for mechanical emptiers, or helping them become more efficient.
- Once such a market is established, it could generate in the region of USD 180,000 per year and provide funding to support functioning of FS markets.

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Further reading

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