FSM4

Abstracts of presentations given within Track 2:

Case Studies

Content Page

Case Studies 1.1: Container-Based Sanitation

1. GARDINER, Virginia et al., "Serviced Household Toilets, FSM and ICT in Antananarivo: Lessons Learned", Madagascar 1
2. BERNER, Catherine et al., "Waste Transformation, not Waste Treatment: Understanding the Value of Poop in Sanivation's Waste Processing Model for Cities", Kenya 3
3. KRAMER, Sasha et al., "Developing a Social Business for the Provision of Household Sanitation in Dense Urban Settings", Haiti 6

Case Studies 1.2: Managing FSM in India

1. SCOTT, Cecilia Lauren, "Community Engagement: An Important Part of Successful FSM" 8
2. CHARY, Srinivas et al., "Operationalizing FSM Regulations at City Level: A Case Study of Warangal", India 11
3. MANSURI, Aasim et al., "Toilets and Beyond: How to implement ODF in small towns in India", India 14
4. REDDY, Phanindra and Prakash Govindswamy, "Operationalising Septage Management Guidelines in Tamil Nadu", India 16

Case Studies 1.3: Organizing FSM

1. ASRI, Aldy and Mardikanto Indiyani, "Moving Towards Nationwide Roll Out of Fecal Sludge Management", Indonesia 18
2. SUMARNI, Sanusu and Reini Siregar, "Improved Septage Management: Introducing Regular and Improving on-demand emptying, lessons and experience from Balikpapan City, East Kalimantan Province, Indonesia", Indonesia 20
3. BUSTRAAN, Foort et al., "Introduction of Scheduled Desludging Servcies in Indonesia", Indonesia 22
4. REDDY, Malini et al., "Application of Information Communication Technology (ICT) for effective Planning and Implementation of FSM Programme: A Case study of Warangal City", India 25

Case Studies 1.4: Bringing FSM Operators into the Sanitation Service Chain

1. SIMWAMBI, Aubrey et al., "Current and optional FSM operation models for over-coming current and future challenges", Zambia 27
2. ROKOB, Janka and Christian Rieck, "FSM means tackling the entire sanitation chain: examples from urban Uganda", Uganda 30
3. NKURUNZIZA, Allan, "The Case for Private Sector Participation in Faecal Sludge Management Service Provision in Kampala", Uganda 32

Case Studies 2.1: FSM & Urban Management

1. SINGH, Shirish and Dev Bhatta, “An Arduous Journey of FSM in a Small Municipality of Gulariya, Nepal”, Nepal 34
2. OKOTH, Simon Onyango et al., “Scaling up Faecal Sludge Management in Kenya’s Urban Areas”, Kenya 37
3. SAKAI, Akira, “FSM Cooperated with Sewerage in Japan”, Japan 39

Case Studies 2.2: Public-Private Partnerships for FSM

1. DE LA BROSSE, Noemie et al., “Tackling the post-ODF challenge in Bangladesh through public-private parnerships: Preliminary results of Faridpur FSM business model”, UK 42
2. MENZIES, Iain et al., “Hybrid PPP for Non-network Sanitation Improvements in Greater Colombo”, Sri Lanka 45
3. CHARY, Srinivas et al., “Improving Sanitation Services through Service Level Agreements and Public Private Partnerships: A Case study of Warangal City”, India 47

Case Studies 2.3: Resource Recovery with FSM

1. MUSPRATT, Ashley et al., “Leveraging resource recovery to pay for sanitation: Pivot Works demonstration in Kigali, Rwanda”, Rwanda 49
2. BINALE, Aidah Nelima, “Turning Human Faeces in Resource in Kenya Informal Settlements”, Kenya 50
3. ROY, D. Chandra and P. Kumar Saha, “Learning from Demonstration of FSM Value Chain in Satkhira, Bangladesh”, Bangladesh 52

Case Studies 2.4: Developing Small FSM Businesses

1. DRABBLE, Sam et al., “From pilot project to emerging FSM service: scaling up innovation PPP model for citywide FSM services in Dhaka” 54
2. SKLAR, Rachel et al., “Designing Pit Emptying Business Models to Facilitate City Scale Fecal Sludge Mangement Services in Kigali, Rwanda”, Rwanda 57
3. GREENE, Nicola et al., “Practical Advances in Pit Latrine Emptying Technology”, Rwanda 59
4. FAWZI, Ammar et al., “Support of Manual Pit Emptiers in Freetown, Sierra Leone” 62

Case Studies 3.1: Fecal Sludge Treatment

1. MUNANKAMI, Rajeev et al., “Lesson Learned on Fecal Sludge Treatment Plant over Passive Landfill Site”, Bangladesh 64
2. RAJBHANDARI, Reetu et al., “ Faecal Sludge Treatment and Reuse in Emergencies: A Case Study from Mahalaxmi Municipality, Nepal”, Nepal 66
3. ROBBINS, David et al., “Co-treatment of Septage with Municipal Wastewater in Medium Sized Cities in Vietnam”, Vietnam 68

Case Studies 3.2: Small FSM Businesses in the Market

1. BERNADO, Deogratius and Mathias Milinga, “Management of Fecal Sludge (FS) by Private Entrepreneurs for a Sustainable Business Model”, Tanzania and USA 69
2. MUXIMPUA, Odete et al., “Emerging Lessons on FSM from Maputo, Mozambique”, Mozambique 71
3. BUSINGYE, John, “It’s not only the technology: Running a successful pit emptying business in Kampala, Uganda”, Uganda 73

Case Studies 3.3: Coordinating FSM Service Providers

1. POTTER, Alana et al., “Successful Sludge Enterprises in Small Urban Centres in Zimbabwe” 75
2. DRABBLE, Sam et al., “Citywide coordination of the septage management market in Vizag, India” 78
3. SHARMA, Debisha, “Desludging-Operators’ Association – Cesspool operator as key stakeholder in FSM policy”, India 81

Serviced Household Toilets, FSM and ICT in Antananarivo: Lessons Learned

V. Gardiner*; F. Costa**; A. Andriamahavita**; P. Gardiner**

Keywords: CBS Toilets; Household Service; ICT

Conference Track: (2) Case Study Track
Track Topic: *Pilots Showing Promise*
Personal Preference: *Oral Presentation*

Loowatt Household Toilets in Antananarivo

Implementation methods for FSM operations in areas without wastewater treatment infrastructure are illustrated by Loowatt's toilet and treatment system recently installed in Antananarivo, Madagascar, with 100 innovative household toilets now serving over 600 customers with a valuable, odourless daily experience, and then treating human waste in product-generating systems including anaerobic digestion.

The crucial link between the toilets and treatment technology is the collection service, which today also requires innovation in order to function and scale in urban environments. Loowatt is currently demonstrating two relevant innovations: (1) the development of clean product interfaces between users, servicers, and toilets, which transform the job description of "toilet emptier", and (2) the implementation of a mobile application and web platform which generates daily paperless data on key servicing metrics and enables head office to track assets and waste through the treatment system.

Data from our recent rollout of these solutions offers informative insights to the state of the art for urban collection-based systems. We aim to present results that can help our business and others facing similar challenges to address barriers to entry for urban sanitation providers globally.

Serviced Toilets: Product Interface

The creation of a clean and user-friendly product interface plays an important role in improving the job of servicing cartridge-based toilets. The Loowatt polymer refill (shown below) is purchased by customers and toilet reloading is self-service.

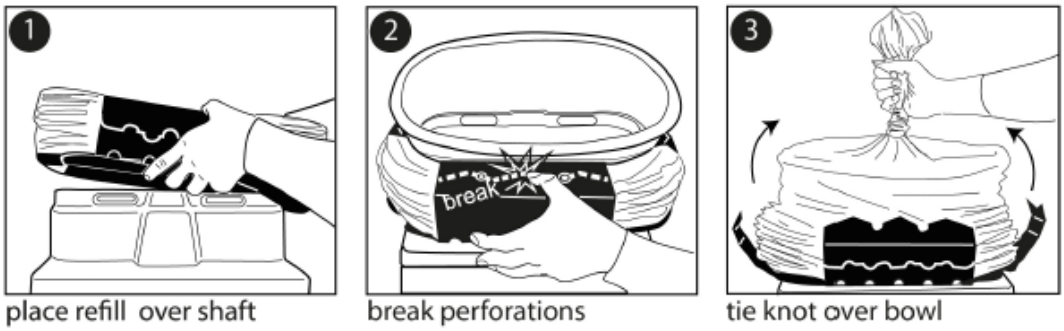


Figure 1.1 Loading a Loowatt refill into the toilet bowl

Refills are manufactured locally and purchased on-demand in a "Pay as You Go" style business model that offers customers in BOP markets a helpful flexibility of cost. The price of refills is US$ 1.15. Households purchase on average one refill per week. Refill purchase data for our recently installed Roso Toilets is shown below. For toilet servicers, the refill makes the job of toilet emptying hygienic, as the emptier simply ties a knot and feeds the remaining material through the sealing unit before closing and removing the container. Refills are also tagged and linked to our ICT system to enable waste tracking (see below).

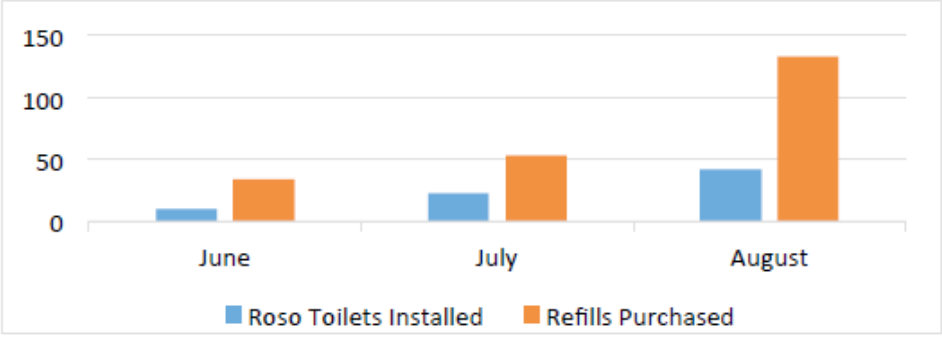


Figure 1.2 Refill Purchase Data from Roso Toilets, our latest toilet model installed in Antananarivo

Mobile App and ICT Platform

Serviced household toilets require logistics management. Mobile-enabled ICT can to lead to a step change in efficiency of service and payment, and offer regulatory assurance related to tracking and documenting waste collection. These challenges to efficiency and assurance are holding back the emerging sector of cartridge-based sanitation provision and FSM[i]. The following issues have been made evident through numerous academic papers and practical field studies,[ii] and mobile-enabled ICT can help to address them:

a. Efficiency challenge: Suboptimal logistics lead to unsustainable collection costs across the FSM sector, for container based toilets and latrines alike.
b. Scale: Significant market penetration is needed for sustainable margins to be generated. To reach and sustain this, customer service must be optimised to reduce abandonment and churn.
c. Distribution: Companies can benefit from tapping into developing countries' mobile distribution networks for product and service dissemination. This has been shown in the energy sector and could be true for the sanitation sector.[iii]

Loowatt's mobile app and platform was rolled out starting in Q1 2016 and has since become a key tool in our Antananarivo office operations. It generates live paperless data on numerous KPIs including (1) waste amounts collected and tracked to the local digestion facilities, (2) improvements to toilet servicer efficiency, (3) customer adoption of SMS collection booking system, and (4) customer adoption of mobile money for toilet refill purchasing. At FSM4 we would aim to present a range of relevant KPI data, a sampling of which is shown in figure 1.3.

Loowatt's mobile app and platform was rolled out starting in Q1 2016 and has since become a key tool in our Antananarivo office operations. It generates live paperless data on numerous KPIs including (1) waste amounts collected and tracked to the local digestion facilities, (2) improvements to toilet servicer efficiency, (3) customer adoption of SMS collection booking system, and (4) customer adoption of mobile money for toilet refill purchasing. At FSM4 we would aim to present a range of relevant KPI data, a sampling of which is shown in figure 1.3.

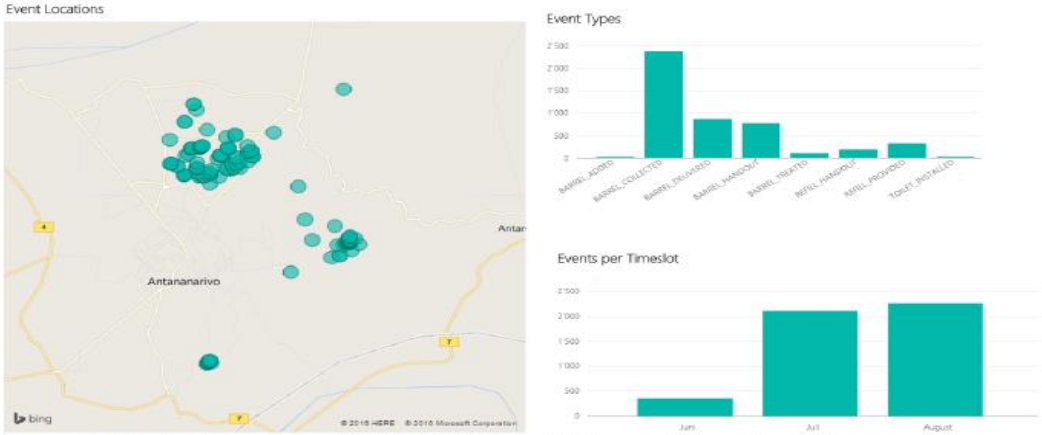


Figure 1.3 Visualisations of data collected by our App and Platform in Antananarivo, 2016

References

[i] Hystra Report (September 2014): Designing The Next Generation of Sanitation Businesses.
[ii] See http://www.susana.org, FSM3 2015
[iii] GSMA Mobile for Development Utilities (2016): Unlocking Access to Utility Services: The Transformational Value of Mobile

Waste Transformation, Not Waste Treatment: Understanding the Value of Poop in Sanivation's Waste Processing Model for Cities

C. Berner*, E. Woods*, A. Foote*

* Sanivation LLC, P.O. Box 262 Naivasha, Kenya

Keywords: feces reuse; carbonized briquettes; waste stream processing

Conference Track: (2) Case Study Track

Track Topic: Emerging FSM Services

Personal Preference: oral presentation

Background

In Kenya, less than 5% of human waste is safely treated before being disposed in the environment, largely due to high capital and operational costs of waste treatment services. For a community of 200,000, traditional sewerage systems require over $40 million in capital costs and ask how fecal sludge can be most easily disposed of with minimal impact. However, viewing fecal sludge as a valuable, reusable resource offers the opportunity for waste treatment cost-recovery plus additional profit. Faeces high calorific value, at 17Mj/kg and comparable to firewood, makes it a potential and plentiful fuel source. In Kenya, the demand for wood and charcoal has grown by more than 50 percent and charcoal prices have tripled. 90 percent of charcoal production is illegally sourced, failing to comply with Kenya's sustainable harvesting laws. There is an urgent need to solve two problems: 1. Cost effective waste treatment and 2. Access to sustainable fuel.

In the past year, Sanivation, a social enterprise in Naivasha, Kenya has been focusing on solving these problems, by operating a waste transformation plant that safely treats fecal waste and recovers costs by transforming it into charcoal briquettes.

Case Study

Sanivation opened their first waste-processing site in September of 2015 to demonstrate their innovative feces reuse model. In the first year of operation, Sanivation safely reused 7 tons of feces and sold 25 tons of briquettes. As of October 2016, they are producing 15 tons of briquettes each month and selling them to restaurants for $200/ton. By January 2017, Sanivation will double their production making them one of the first private service-providers to reach positive gross margins on their waste processing.Selecting a Reuse Product – Sanivation chose to produce a feces based fuel due to high local demand for charcoal coupled with the potential for utilizing feces' high calorific value. Potential products were compared according to four key metrics: revenue per unit of final product, percent profit margin potential, technical difficulty risk of disease transmission, and current market potential in urban communities. Simplified results of this analysis are included below in Table 1.1.

The value of feces as a feedstock metric, was developed to better isolate the value of poop in waste transformation, when combining multiple waste streams to make a final product. Carbonized charcoal briquettes were identified as the most promising due to their high potential for revenue and a readily available market. To make the briquettes, treated feces are combined with waste dust from traditional charcoal. By utilizing waste streams from two separate industries, Sanivation combined their potential to make a high quality product derived entirely from waste.

Table 1.1 Realtive Potential of Feces Based Fuel Products

	Value of Feces as a Feedstock	**Revenue Per Unit Final Product**	**% Profit Margin Potential**	**Market Potential**	**Technical Difficulty**
Charcoal Briquettes	High	High	High	High	Low
Feces Pellets	Medium	Low	Medium	Low	Low
Carbonized Feces Briquettes	Low	High	Low	High	Medium
Electricity Production	Low	Low	Low	High	High
Biogas	Low	Low	Medium	Low	Medium

Financial Insights– In the first year of operations, Sanivation was able to recover most of the costs of waste treatment. Each ton of raw poop that Sanivation processes is valued at $70. Projections indicate that by January 2017, production will surpass 25 tons per month, at which point the sale of the fuel will cover the cost of production. At this scale the revenue does not yet cover local management, overhead, and the cost of selling the briquettes, but overall the revenue generated from treating waste and then producing briquettes is approximately 10% of traditional wastewater treatment plant.

Table 1.2 Summary of Briquette Production Costs.

	Percentage of Total Cost
Char Dust Acquisition	20-40%
Labor	20-35%
Electricity	10-15%
Treatment	10%
Machinery	10%
Other	5-10%

Challenges of Waste Stream Recovery–Through experience with value added processing of waste streams, Sanivation has concluded:

1. More value can be derived from human waste when it is combined with other waste streams
2. Relying on waste streams can be risky due to their inherent variability in quality and availability
3. Quantifying and understanding waste stream viability is a barrier to maximizing a waste streams' potential

To overcome these challenges, Sanivation is developing processes to better classify waste streams. This will include quantitative classification of physical and chemical properties such as, ash content, moisture content, density, BOD and chemical composition. Improved classification systems will allow Sanivation to cost effectively process more waste and expand operations to new sites where different waste streams are available

Conclusions

Sanivation has challenged the traditional view of fecal waste processing. Rather than design a traditional waste treatment plant that minimizes the risk of disposing treated fecal sludge back into the environment, they have designed a manufacturing factory that uses fecal sludge as a material source to create a product that aims to maximize economic and health impact for the local community. The feces based fuel product has had promising market traction and their model shows potential to recover all of the costs of waste processing. This paradigm shift of using feces as a resource, allows waste processing to be more cost-effective, which may greatly help developing countries safely treat more of its waste and improve health outcomes.

References

Gakubia, R., Pokorski, U., & Onyango, P. (2010, January). Upscaling Access to Sustainable Sanitation–Kenya. In International Year of Sanitation (IYS) conference (Vol. 26).

Cairns-Smith, Sarah, Haley Hill, and Emmanuel Nazarenko, "Urban Sanitaiton: Why a portfolio of solutions is needed," Boston Consulting Group, December 2014, Retrieved 15 October 2015.

Muspratt, A. M., Nakato, T., Niwagaba, C., Dione, H., Kang, J., Stupin, L., ... & Strande, L. (2014). Fuel potential of faecal sludge: calorific value results from Uganda, Ghana and Senegal. Journal of Water Sanitation and Hygiene for Development, 4(2), 223-230.

Study Report: Kenya LPG Market and Impact Assessment (Rep.). (2014, September 4). Retrieved https://docs.google.com/file/d/0B8LwMP7Aq_siTEVTTExtZ2Q5T2c/edit.

Ibid.

EkoLakay – Developing a Social Business for the Provision of Household Sanitation in Dense Urban Settings

S. Kramer, E. Lloyd, C. Remington, N. Preneta
*Delmas 33, Port-au-Prince, Haiti
Keywords: EcoSan; composting; Haiti

Conference Track: Case Study Track
Track Topic: *Case Studies Track, Pilots Showing Promise*
Personal Preference: *oral presentation*

Background
SOIL (www.oursoil.org) is a research and development non-profit organization based in Haiti, working to prove the viability of a market-driven sanitation business model for affordably and sustainably providing complete sanitation services (containment, collection, transport, treatment and transformation) to dense urban communities. This paper will focus on SOIL's household toilet business EkoLakay, which is currently providing services to over 1000 household clients (>6000 people).

EkoLakay Service

SOIL is currently developing and implementing a transformative new social business model for the economically sustainable provision of sanitation services and ecological waste treatment in Haiti. In SOIL's simple social business design, wastes from ecological sanitation (EcoSan) toilets are collected and transported to a composting waste treatment facility where the waste is safely transformed into rich, agricultural-grade compost. This compost is then sold for agricultural application, improving both the fertility and water retention of soil. Revenue from monthly toilet user fees, waste treatment fees, and compost sales are collected to support ongoing project costs and to showcase the private sector potential to affordably and sustainably provide sanitation services in the world's most impoverished and water-scarce urban communities.

Customers who register for EkoLakay pay a monthly fee of approximately $5 USD per household, for which they receive both a product and a weekly collection service as described below:

1. **Product:** A **locally-constructed EkoLakay toilet**, which is a simple ferro-cement structure that houses a five-gallon bucket and a plastic container for urine. A built-in urine diverter separates the liquid and solid wastes between the two containers. The toilet is owned by the EkoLakay business and rented to the customers, and the cost of the toilet (approximately $25 USD) is incorporated into the monthly service fee so that it will be paid off over a period of several years.
2. **Service: A weekly collection service** in which EkoLakay staff collect the buckets of solid waste and deliver clean, empty buckets, as well as carbon cover material (used for "flushing"). The service also includes any necessary repairs to the toilet over the course of the contract.

The EkoLakay service currently has just over 1000 paying clients, and SOIL plans to bring the total number of EkoLakay toilet rentals to 1,900 by December 2017, with a 10-year goal of reaching 65,000 households (~350,000 people) in Haiti's two largest cities. Preliminary cost estimates at the current scale show that through compost sales and EkoLakay monthly fees, SOIL is able to recover approximately 50% of the cost of the full service (including the

cost of the toilet, weekly collection, cover material, hygiene promotion, payment collection, repairs, transport, waste treatment, and transformation). This presentation will include an in-depth cost analysis highlighting processes that SOIL is currently targeting for optimization to increase the sustainability of the service; in addition, it will include a discussion of possible pathways to scale with participation of both the private and public sectors. Key topics will include:

Challenges

- Data Management System: SOIL has relied heavily on paper-based data collection and Excel documents to monitor information ranging from payments, bucket quantities, maintenance requests, and marketing and sales information. This system is time-intensive, frequently redundant, and ill-equipped to deal with the quantity of relational data collected. In November 2016 SOIL will be launching a new Salesforce-based system to manage customer data.
- Household Identification: Customers are often located in dense informal housing settlements without street addresses; currently, the weekly service relies heavily upon the memory of the collection team members. The new data management system integrates offline access to customer data (including GPS points and maps) via mobile phone applications to allow any employee to locate homes as needed.
- Monthly Payment Collection: Monthly fees are collected by EkoLakay agents via door-to-door visits, which require significant staff time and costs. SOIL is working to shift to a mobile payment collection system to address this challenge.

Lessons Learned

- Container-based toilets are highly resilient during natural disasters, particularly flooding. Whereas more traditional sanitation systems such as latrines and septic tanks can contribute to disease outbreaks, containers can be safely sealed until the fecal waste can be safely transported out of the neighborhood.
- Developing toilets through an iterative process of community-centered design so as (to ensure they are not only functional but also aspirational) generates significant demand and willingness to pay in the urban Haitian context.
- To achieve the highest public health impact and maximize economic efficiencies, it is critical to increase the density of clients in target neighborhoods before expanding to new zones of service.
- Coordinating with government entities ensures that the service adheres to national guidelines and paves the way for future public sector engagement in waste treatment.
- To ensure payment for services, it is critical to communicate and enforce sanctions for non-payment. SOIL currently relies on a rental model where the toilet is removed from the household after two months of nonpayment.
- To limit transport costs, SOIL uses lower cost vehicles (e.g. modified wheelbarrows and 3-wheeled motorcycles) and neighborhood depots/transfer stations for container collection.

Moving Forward

For the next year, SOIL plans to maintain a steady expansion rate while examining and refining the existing service model to capture any potential efficiencies of scale and to streamline operations to maximize cost-effectiveness. Additionally SOIL will focus on conducting a robust cost analysis, optimizing processes that are currently significant cost drivers, and modelling cash projections for the planned expansion. During this time SOIL will continue to implement cost-saving innovations to the service delivery system to reduce maintenance and service costs.

Community Engagement: An Important Part Of Successful FSM

C.L. Scott, BORDA, 284 Health Society Layout, Annapoorneshwari Nagar, Bangalore, 560091, India, clscott33@gmail.com
Keywords: community; IEC; sanitation
Conference Track: (2) Case Study Track
Track Topic: Pilots showing promise

Background

Only 30% of sewage in urban India is treated, and over 95% of Indian cities and towns have no underground sewerage network, meaning toilets in these areas must be connected to on-site leach pits/septic tanks[1][2]. Meanwhile, 2.4 million urban toilets have been constructed since 2014 under the Swachh Bharat Mission (SBM)[3]. Fecal sludge management (FSM) provides a solution to the widespread lack of treatment of fecal sludge—sewage collected from independent pits and septic tanks. With funding from the Gates Foundation, Consortium for DEWATS Dissemination (CDD) Society has been piloting an FSM model in Devanahalli, Karnataka since January 2015. This model includes fecal sludge treatment plant (FSTP) technology, operations and maintenance, policy, and stakeholder capacity building. One key stakeholder is the community, since its sanitation-related practices affect fecal sludge quantity and quality. Gaps in Devanahalli residents' behaviours were identified, and an information, education, and communication (IEC) campaign was implemented. This case study provides details of the gaps and how they were addressed in Devanahalli, along with recommendations regarding FSM-related community engagement strategies, with the aim of serving as a reference for future FSM projects in India.

Project Summary

In community-based sanitation (CBS), a community is informed about different technologies' pros and cons before selecting one, and the community's requirements and capacities are factored into the sanitation infrastructure design[4]. Such grassroots-level participatory planning was not possible in the Devanahalli FSM project, as the town consisted of dozens of communities, and this FSM model had not been demonstrated in India. CDD Society's strategy was to establish a working FSTP model and then create an enabling environment to ensure project sustainability. The detailed community assessment and IEC campaigns were consequently implemented after FSTP commissioning.

First, CDD Society identified two target groups in the community: the general public, who affect the FSTP input stream, and farmers, who could use FSTP outputs. Several of the general public's sanitation-related behaviours had an impact on FSTP operations:
1. Nearly 15% of households were practicing open defecation or had toilets connected to open drains (insanitary latrines), meaning their fecal matter could not be treated. CDD

[1] Central Pollution Control Board, Ministry of Environment and Forests, Govt. of India. (2009). Status of Water Supply, Wastewater Generation and Treatment in Class-I Cities & Class-II Towns of India. [pdf] Available at: http://cpcb.nic.in/upload/NewItems/NewItem_153_Foreword.pdf [Accessed 14 Oct. 2016].
[2] High Powered Expert Committee. (2011). *Report on Indian Urban Infrastructure and Services.* [pdf] Available at: http://icrier.org/pdf/FinalReport-hpec.pdf [Accessed 14 Oct. 2016].
[3] Swachhbharaturban.in, (2016). Swachh Bharat. [online] Available at: http://www.swachhbharaturban.in/sbm/home/#/SBM [Accessed 14 Oct. 2016].
[4] Borda-net.org, (2016). Community-Based Sanitation. [online] Available at: http://www.borda-net.org/basic-needs-services/communitybased-sanitation.html [Accessed 14 Oct. 2016].

Society worked with SBM to motivate these households to properly construct and use toilets connected to pits.

2. Households with toilets were throwing solid waste in them, which had to be removed at the FSTP.

3. Households had huge pits and waited until they were full (5-10 years) to empty them. This limited the regular flow of liquid fecal sludge into the FSTP.

To address the latter two issues, CDD Society used various IEC tools—videos, posters, and games—to make people aware of these practices' negative consequences. Through the IEC activities, the community was also introduced to FSM and reuse of FSTP by-products such as treated wastewater and co-compost. Farmers initially lacked awareness of several FSM-related topics, including the importance of treating wastewater before reuse. They were using untreated fecal sludge as fertilizer and untreated wastewater for irrigation. Some were unaware of which crops should not be fertilized with fecal sludge, and most did not take adequate safety measures when handling fecal sludge. IEC tools consequently focused on safe fecal sludge reuse practices and education about the FSTP and reuse of its by-products. Exposure visits facilitated the knowledge transfer.

Recommendations

Based on CDD Society's FSM experience in Devanahalli and past CBS experiences, we recommend the following for future FSM projects:

1. While the traditional CBS approach is ideal, urban local bodies (ULBs) may be pressured to quickly install FSTPs at minimal cost. In this case, community engagement initiatives can be implemented in parallel to FSTP construction and operations. The required level of community engagement at each project stage is detailed below:

> a. Pre-construction: The ULB should inform residents living near the proposed FSTP site about the project and give them an opportunity to raise their concerns. While this was not applicable in Devanahalli, a few of CDD Society's past CBS projects never gained traction due to a lack of community buy-in.
>
> b. Construction: IEC activities should be differentiated for three groups: households without toilets/with insanitary latrines, the general public, and farmers. The focus with the first group is on constructing and using sanitary latrines. The second group needs to be sensitized on proper toilet usage and septic tank/pit emptying. Finally, farmers should be motivated to safely reuse wastewater, especially FSTP by-products.
>
> c. Post-construction: IEC activities can continue during this phase. Exposure visits to the new FSTP can be organized with different target groups. The implementing organization should get feedback from residents near the FSTP site and provide a contact number in case there are any questions/complaints.

2. Due to time and budget constraints, ULBs should incorporate FSM-related topics into IEC campaigns for complementary initiatives—SBM, National Urban Livelihoods Mission, Atal Mission for Rejuvenation and Urban Transformation, etc. The FSM-related IEC topics, while not new, should be highlighted during FSM implementation.

3. IEC tools should incorporate modern information and communications technology, e.g. smart phone applications (budgetary constraints prevented this in Devanahalli).

Conclusion

Community engagement is a vital component of FSM projects. Buy-in is required from people living near the FSTP, and the entire community needs to engage in good FSM-related practices to help ensure project success. Furthermore, farmers should be motivated to use FSTP by-products. The community engagement strategy should be fine-tuned based on local requirements. Ideally, in the near future, as more organizations implement FSM projects in India, lessons learned regarding community engagement can be shared and a more detailed framework developed.

Operationalizing FSM Regulations at City Level: A Case Study of Warangal

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

*, **Administrative Staff College of India, Hyderabad
***Greater Warangal Municipal Corporation, Warangal

Keywords: Regulation, FSM, Septage
Conference Track: FSM Case Studies Track
Track Topic: Emerging FSM Services
Personal Preference: Oral Presentation

Background

Over 65 percent of urban India relies on onsite sanitation (septic tanks and pits) which operates in the near absence of a regulated system to manage sanitation across the value chain especially resulting faecal sludge. The standards related to design of septic tanks and periodic desludging are not followed, the emptying and transportation of septage is not scientific, and the septage treatment facilities are not developed in the cities. Indiscriminate disposal of septage has significant health and environmental implications. The Ministry of Urban Development has brought out an Advisory Note and Primer on FSM and Septage Management in Urban India in 2013 and encouraged urban local bodies (ULBs) to formulate their own bye laws and rules for management of septage in the city in consonance with municipal act in place.

Status of FSM in Warangal

Warangal city with a population of 0.61 million as per 2011 census, is the second largest city in the newly formed state of Telangana, India. About 77 percent of households have access to onsite sanitation (59 percent have septic tanks,18 percent have pit toilets). There is prevalence of insanitary toilets and pit toilets comprise both single and twin pits and in many cases septic tanks do not have soak pits and have out let directly connected to open drains. The toilet design and construction is not regulated, desludging is not periodic, desludging is done by private operators using desludging machines where the workers are not trained and not equipped with protective gear. The faecal sludge collected from households is disposed in agricultural areas, drains, low lying areas and water bodies around the city. There is no effective monitoring process for FSM by the municipal officials due to lack of operative regulation and supporting guidelines.

Greater Warangal Municipal Corporation (GWMC) addressed this need by introducing FSM regulation and septage management guidelines in compliance with various national level guidelines and regulations. The objective is to promote a comprehensive and integrated approach to FSM and septage management covering collection, storage, desludging, transportation, treatment, disposal and reuse.

Operative Guidelines for Septage Management in Warangal

GWMC formalized FSM regulation and supporting operative guidelines by issuing a council resolution in March 2016, making Warangal the first city in India to introduce a comprehensive FSM regulatory framework. The following components supported with detailed technical guidelines are covered by the regulations:

1. Design and construction of septic tanks
2. Conversion of insanitary latrines into sanitary latrines
3. Septic tank pumping and de-sludging - every three years
4. Septage transportation
5. Treatment, disposal and reuse of septage
6. Information, education and communication
7. Training programs
8. Record keeping and reporting (MIS)
9. Help line for septage management (S-line)

Operationalising the FSM Regulations

The city has taken several initiatives to ensure operationalising the FSM regulations:

Established a dedicated sanitation help line (S-Line) with trained staff to support citizens on all aspects of septage management including septic tank designs, approval process, methods of construction, contact details of masons and desludging operators etc.

Information Education and Communication initiatives such as printed material on design of toilets - three chamber septic tanks for households, advanced septic tanks and Decentralized Waste Water (DEWAT) systems for Institutional and bulk consumers, and DRDO bio-digesters amongst others. Use of outdoor media for promoting conversion of insanitary to sanitary toilets. Extensive promotion of S-line through various channels. Consultation meetings with members of Resident Welfare Associations to educate them about the importance and legal requirement related to desludging of septic tanks and pits once in every three years or when they get filled-up whichever is earlier.

Establishment of a formal process for empanelment of desludging operators and issuance of license to operate (5 year validity with yearly renewal). The licensed operators undergo training program on safe practices for septage desludging and transportation. They are required to have trained workers equipped with uniforms, safety gear, tools and vacuum trucks.

The septage vehicles are being fitted with Global Position System (GPS) and the details will be used by GWMC for monitoring. An FSM tracker app is implemented for capturing information on septage collection on a real time basis and aid effective implementation of the regulations. All the licensed operators are required to report information as per the prescribed manifest defined by GWMC. A computerized MIS platform is being developed for monitoring and evaluation (M&E) for baseline data and progress on implementation of septage management guidelines.

Supporting capacity building of various stakeholders including its own through appropriate institutions such as NIT, ASCI and CDD.

Establishment of a formal process for empanelment of Masons. A two day 'Toilet Builder' training program leading to certification and empanelment of masons has been implemented to influence the quality toilet constructions. More than 70 masons have been empaneled so far and their details are shared with citizens through S-Line.

Process reengineering of the building approval system to incorporate toilet design and discharge of waste water for according building approval.

Identification of suitable technologies for FSM treatment plants have been completed and PPP models being explored. Feasible sites for setting up if FST plant(s) have been identified.

Conclusion

Warangal is the first city to introduce FSM regulation. Extensive use of ICT tools, citizen awareness campaigns, engaging and capacity building of key stakeholders played an important role in operationalising regulation. Lessons from Warangal are being scaled up at the State level and is being considering to introduce FSM regulation as a state policy.

References

Ministry of Urban Development (2013).Septage Management in Urban India: Advisory Note

CPHEEO (May 2012). Manual on Sewerage and Sewage Treatment: Part A: Engineering – Final Draft, Ministry of Urban Development, Government of India in Collaboration with JICA, New Delhi

Toilets And Beyond – How to implement ODF+ in small towns in India

Authors: Aasim Mansuri, Dhruv Bhavsar, Omkar Kane, Bhagyashree Pardeshi

Address: PAS Project**,** Center for Water and Sanitation, CEPT University, Kasturbhai Lalbhai Campus, University Road, Navrangpura, Ahmedabad

Keywords: Citywide Scheduled Emptying Services; Private Sector Participation; Financing through Taxation

Conference track: FSM Case Studies Track
Track topic: Emerging FSM Services
Personal Preference: oral presentation

Background

Fecal Sludge Management (FSM) has been a neglected area in most of the Indian cities. It has not received attention because of poor understanding of fecal sludge/ septage, lack of proper technical guidance, inadequate resources, shortage of skilled manpower and lack of finance. As per census 2011, toilets connected with onsite sanitation system are higher than the ones connected to sewer networks in India; 40 percent of households with toilets connected to sewer network as compared to 60 percent that depend on onsite sanitation systems, mainly septic tanks. An analysis of service level benchmark information suggests that majority of the cities depend fully on onsite sanitation systems.

With rapid urbanization, especially in peripheral areas of large cities, property owners have to make their own arrangements for septage management. A rapid assessment of septage management in Asia carried out by USAID in 2010 revealed that in India; about 148 million people in urban areas depend on septic tanks. This was recognized by the National Urban Sanitation Policy (NUSP), 2008, which emphasized the need for proper collection, treatment and disposal of sludge from on-site installations. However, no attention is paid to these aspects; the cities need to ensure proper construction of septic tanks, their maintenance and safe collection, conveyance and disposal of faecal sludge from these systems.

Government of India in 2014 has launched Swachh Bharat Mission (SBM) to make India “open defecation free” (ODF) by 2019. Under SBM, emphasis has been put towards toilet construction. These toilets will be connected either to sewer networks or onsite sanitation systems. So while toilets are an essential part of overcoming the sanitation challenge, they are the means not the end. They will only deliver the results we want if coupled with measures to reduce the amount of untreated waste. In Maharashtra going beyond toilets is an avowed goal, as a long term vision, Government of Maharashtra aims to move towards improved sanitation by encouraging access to own toilets with safe management of faecal waste, for which they have developed a concept of ODF, ODF+ and ODF++ cities. ODF+ cities are those cities where 80% of residential properties will have access to own toilets and remaining population will have access to public/community toilets and there would also be safe collection, conveyance and treatment / disposal of faecal matter. The state has also introduced an incentive scheme wherein the cities that are declared ODF are provided incentive grant based on the size of city. The cities can use this fund for attaining ODF+ status.

FSM Efforts in Two Cities

The Center for Environmental Planning and Technology (CEPT) University through its Performance Assessment System[5] (PAS) project is supporting two small towns in Maharashtra, India for making them open defecation free along with improving their wastewater management situation through an integrated fecal sludge management (IFSM) plan under the SBM and Swachh Maharashtra Mission (SMM) which is a state program in line with SBM and which talks about cities becoming ODF+

One of the cities is a pilgrim town named Wai with a population of around 36,025 as per Census 2011. Wai has moderate growth rate and is situated at the foothills of Panchgani in Maharashtra. The other town is Sinnar in Maharashtra with a population of around 65,251 as per Census 2011 and is located on the 'golden triangle' of Mumbai-Pune-Nashik. Due to its strategic location, it has many industrial estates and is a rapidly developing town. In terms of access to sanitation as per Census 2011, around 65% households have access to individual toilets and rest is dependent either on community/public toilets or resort to open defecation. All the individual and community/public toilets are connected to onsite systems, majority of them being septic tanks. Both these cities have city government owned one suction emptier truck and the city government provides demand based septic tank emptying services to its residents against a charge of around INR 400 – 1000/trip. The cities dispose off this collected septage at their existing solid waste dump site.

Under SBM and SMM, both cities want to ensure that with all the new toilets that are built, their cities also become 'Sanitized'. For this both the city governments have passed a city level council resolution to implement an IFSM plan to improve their wastewater management situation. The plan will ensure that the onsite sanitation systems function well, emptying services are scheduled emptying at an interval of 3 years and all the human waste collected is treated through simple, efficient septage treatment facility. To ensure proper functioning of this system, both city governments have planned to engage private firms to build and operate these facilities. For this, both city governments have introduced a sanitation tax to make sure that adequate funds will be available for operation and maintenance of this FSM services. They are also trying to explore the reuse possibility of the treated waste. At present, both the cities have rolled out the e-tender for inviting bids from private sector to operate the scheduled septic tank emptying services for 3 years and the city governments have looked at various fecal sludge treatment options and have rolled out expression of interest for private sector to treat these collected fecal sludge.

For making cities fully 'sanitized', it is not only important that all residents have access to toilets, but also there is proper infrastructure and systems to implement FSM.

[5] www.pas.org.in

Operationalising Septage Management Guidelines

Prakash Govindswamy*, Thandapani V.P.**

*Commissioner of Municipal Administration, Commissionerate of Municipal Administration, Ezhilagam Annex, 6th Floor, Kamarajar Salai, Chepauk, Chennai – 600 005.
**Sub Collector, Revenue Department, Government of Tamil Nadu

Keywords: Operative Guidelines; Municipal Building Rules; Tamil Nadu

Conference Track: (2) Case Study Track
Track Topic: At scale city-wide or nationwide FSM services
Personal Preference: Oral presentation

Abstract

Introduction

The Vision 2023 of the Tamil Nadu envisages universal access to safe sanitation, including the provision of adequate human excreta treatment facilities across all local bodies. The Govt. of Tamil Nadu took due note of the absence of underground sewerage in most local bodies in the State and the prevailing practices for the unscientific disposal of untreated sewage and waste that were causing adverse public health impacts. Thus, Operative guidelines (2014) were developed with a view to regulation of collection, provision for treatment and safe disposal of septage in the State. This followed the Min. of Urban Development's National Urban Sanitation Policy (2008) and the Septage Advisory (2011).

The Guidelines empowered local bodies with the improvements and due procedures to be followed for securing the full chain of septage management i.e. improved construction and emptying of containment structures, to safe conveyance and disposal after treatment. It lists the existing sewage treatment plants in the State and directs local bodies to utilize these facilities in the proximity for co-treatment of septage along with sewage. Thus, 21 clusters of Local Bodies situated at around 20 km radius of the existing Sewage Treatment Plants, were identified and directed to make the necessary arrangements for decentralized treatment of septage from surrounding areas.

Scope

The Guidelines identify the need for adequate attention to the design and construction of septic tanks, maintenance, regular emptying transportation of septage from these septic tanks. To ensure the sanitary nature of on-site sanitation containment structures at the household, the Guidelines provide directions for local bodies towards ensuring proper design and construction of septic tanks, and the conversion of insanitary latrines and tanks (leaking, broken or wrongly constructed) to sanitary ones that confine and treat excreta effectively as specified in National Building Standards. In addition to these, the Guidelines lay out the necessary procedures for (a) Septic Tank Pumping and de-sludging, (b) Septage transportation, (c) Treatment and disposal of septage. The Guidelines dwell on the need for local bodies to be cognizant and informed about the arrangements at the local body for collection, transportation and treatment; and suggest the introduction of fee for services to households; as well as fees for service providers to use treatment facilities. The design and provision of suitable decantation facilities is also detailed. The Guidelines direct the local bodies to carry out sustained information, education and communication campaigns targeted at municipal staff, residents and septage operators to increase the awareness about the full-chain of sanitary operations. Suitable systems for record-keeping and reporting (MIS) are also suggested.

This paper documents the approaches followed, and actions taken by selected local bodies of the State to implement these Guidelines. Though these were early days, some of the Corporations (e.g. Trichy, Dindigul) initiated the steps specified in the Guidelines viz. identification of insanitary toilets, enforcement actions e.g. fine and conversion to sanitary toilets, registration of de-sludging operators, construction of decanting stations, maintenance of manifests and records, and collection of tipping fee, etc. While some of these initiatives showed a measure of success, there emerged a need for further work in terms greater innovations and solutions in complex situations, awareness amongst public and officers, ensuring practical and economical solutions to reaching nearby treatment facilities, and so on.

Summary
The paper presents the experiences and insights from dealing with the challenges of operationalizing the Septage Management Guidelines in selected ULBs of Tamil Nadu. It recounts the initial implementation challenges and successes, identifies areas needing further work and innovations, and summarizes the key lessons for moving forward.

References

GoTN (2014). Operative Guidelines for Septage Management for Local Bodies of Tamil Nadu. Accessed: http://www.tn.gov.in/virtual_directory/dtp/gorders/maws_e_106_2014_Ms.pdf on October 10, 2016.

MoUD. (2013). Advisory on Septage Management in Indian Cities: Preparation and Implementation of a Septage Management Sub-Plan (SMP) as a part of the City Sanitation Plan (CSP). Ministry of Urban Development. Government of India.

THE HINDU (2015). *Plan to improve efficiency of sanitary management.* [Online] Available at: http://www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/plan-to-improve-efficiency-of-sanitary-management/article7947064.ece [Accessed 12 October 2016].

Indonesia towards Nationwide Roll Out of Fecal Sludge Management

Mardikanto, Aldy
amardikanto@gmail.com, Directorate of Urban, Housing and Settlements, Ministry of National Development Planning/National Development Planning Board, Indonesia

Keywords: lessons learnt, nationwide, on-site sanitation, regular desludging
Conference Track: Case studies
Track Topic: Emerging FSM services
Personal Preference: Oral presentation

Background

Indonesia has managed to increase its sanitation access by nearly 2%-points/year in average in the last 10 years, and has overall made a good progress on MDGs. The achievement, combined with the mandate from the National Long Term Development Plan of 2005-2025, has pushed the National Government on setting universal access for sanitation in its National Medium Term Plan of 2015-2019.

The on-site sanitation (OSS) system makes up more than 90% of the existing wastewater treatment system. Based on the development of off-site system, this dominance is predicted to continue until the next 20-30 years. However, only 4% of septage in urban areas is treated in septage treatment plants. As two thirds of Indonesia's population will be living in urban areas in 2035, fecal sludge management (FSM) in urban areas is crucial to improve existing OSS management.

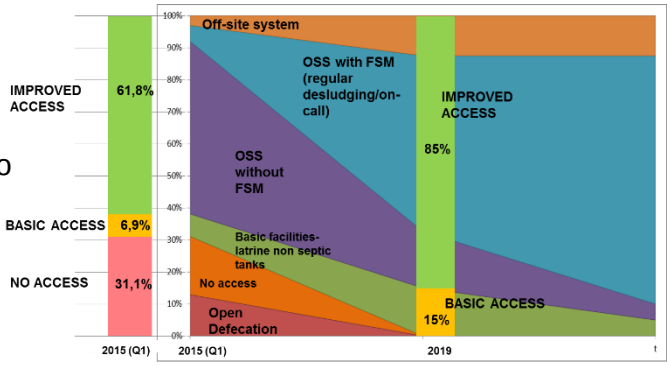


Figure 1 Schematic diagram of Indonesia existing-to-target sanitation access

FSM in Indonesia aims to improve the whole sanitation service chain comprehensively in institutional, regulation, financial, and operational aspects, through improvement of on-call basis and regular desludging system. FSM is regarded important both to the quality of sanitation access and the country's commitment to Sustainable Development Goals. Indonesia has successfully implemented Sanitation Development Acceleration Program (PPSP) from pilot cities to nationwide program, and now is looking to apply the lessons learnt in order to implement FSM nationally.

Lessons Learnt from Sanitation Development Acceleration Program

The program, abbreviated to PPSP in Indonesia, was started in 12 pilot cities in 2006-2010, under ISSDP Program. Through PPSP in 2010-2014, the national government assists local governments (LGs) in comprehensive citywide sanitation planning through the preparation of City Sanitation Strategy (SSK). PPSP is not a national mandatory program, however the cities/districts participating in the program grows from 42 (2010) to 444 (2014). PPSP continues in 2015-2019 with a shift in its focus, from planning to implementation.

The program's impact is increase of awareness and concern over sanitation issues in many LGs. SSK has served as tools for LGs to realize its existing sanitation condition and

create strategies to achieve city sanitation vision. Other impact includes growing budget for sanitation. The awareness improvement is also seen as the Association for Cities/Districts for Better Sanitation (AKKOPSI, in Indonesia) is formed and have pledged for a 2% allocation in city/districts budget for sanitation.

Learning from nationwide implementation of ISSDP into PPSP, the national government has realized that infrastructure is only a part of the system. For a program to be nationally implemented, it requires a clear guidance from the national level to subnational ones on the sector planning, regulation and institutional set up. It also requires strong advocacy to get buy-in from local governments, as well as fund support and well defined structure at the national level.

Towards nationally implemented FSM scheme

Technical assistance to 20 cities/districts in improving the OSS has been conducted by Ministry of Public Works and Housing and development partners. The technical assistance helps these cities in setting up institution, preparing regulations, setting up the technical preparedness to desludge and treat fecal sludge, and calculating tariff. Some cities such as Surakarta, Makassar, Bekasi, Bitung, and Tabanan do very well in this initiative. Other cities/districts still face issues in various aspects. Main issues faced, among others, are in determining which institution should be in charge and the funding of FSM operation. The incomprehensive understanding of wastewater management that puts regular deslugding as independent project rather than as part of the whole sanitation improvement has also become one of the issues when it comes to coordination with existing effort in sanitation.

Based on the Law 23/2014 on Local Governance, FSM falls under the authority of LG because of its scale, thus requires a hands-on support from LGs. Therefore, advocacy becomes an important part in order to get LGs on board with FSM. Fecal Waste Flow Diagram (SFD) is used in 6+ pilots cities and has served not only as an effective advocacy tools but also as tools to help LGs in prioritizing investments to improve their sanitation condition.

To foster synergy in FSM initiative, the national government through National Working Group on Water and Sanitation with Ministry of National Development Planning as coordinator conducts coordination with several FSM-related ministries. The coordination is expected to create push from related sectors for the cities to perform FSM. These sectors include environment, health, and public administration. Coordination is also performed by the national government with development partners to create synergy and get more lessons learnt and practices. The national government also provided various funding scheme to support LGs for comprehensive improvement of sanitation service chain.

Challenges

Challenges ahead include providing clear guidelines from the national government on the institutional set up for local government to conduct FSM, establishing national urban sanitation approach and strengthening monitoring and evaluation upon which the national government could build incentive/disincentive mechanism.

References

East Asia Pacific Region, Urban Sanitation Review. Indonesia Country Study (2003)
Biro Pusat Statistik, 2015

Improved Septage management: Introducing Regular and Improving On-demand Emptying – Lessons and experience from Balikpapan City, East Kalimantan Province, Indonesia

*S.Sanusu, **R Siregar
* sumarnisanusu@gmail.com, Local Water Company (PDAM) Balikpapan, Indonesia
**rsiregar@worldbank.org, World Bank, Jakarta, Indonesia

Keywords: Advocacy, Capacity Building; Promotion
Track Topic: Planning towards Regular Desludging
Personal Preference : Oral Presentation

Background

Balikpapan is one of few cities in Indonesia that has been adapting improved septage management scheme supported by technical assistance from WSP, the World Bank . The city has population of 664,595 inhs (132,919 households), and has a small sewerage system with connections about 1300 HCs, managed by municipal water company, while the sludge treatment was managed by other local agency whom managed solid waste. The demand for sludge emptying is low and served only by the private sector.

As part of efforts to improve better and sustained sanitation for achieving universal access in 2019, Balikpapan committed to improve their septage management by piloting regular desludging and improving current on-call services. Both challenges and opportunities exists, but various actions has been taken to prepare and implement the program.

Strengthening Local Capacity for Planning the Improved Septage management

The assistance to the PDAM team and city working group members through learning activities: series of training sessions, local and national workshops for sharing experiences and lessons learnt among cities which have similar program

Advocacy role - Institutional and Regulatory Framework

A key output is the commitment from the city leader and the main stakehoders to focus on improved septage management, resulting a) local law on domestic wastewater was issued on October 2016; b) final draft of implementing regulations, regular and on- demand emptying tariffs. There were also city workshops conducted to socialize the improved septage management to broader city stakeholders by introducing regular desludging.

In 2015, the responsibility to manage the septage has been transfered to municipal water company (PDAM), however, there none regulation concerning domestic waster nor the regulation on institutional responsible to wastewater. The sifting has been a big challenge for the city stakeholders and requires legitimate steps, careful planning for transferring and preparatory works under the new institution.

The city Mayor issued several circulation letters to proceed preparatory works by establishing a team to bridge the hand-over process from previous agency and enable the main stakeholders and PDAM to work together and to allocate budget for piloting regular desludging and other activities related to improved septage management. e.g promotion of regular desludging, improve on-call basis emptying.

Regular Desludging Charge is included in Water Billing System

The regular and on-demand tariff setting are based on full costs recovery calculation and already accepted. The regular emptying will be applied for 4 year- period with monthly installment tariff and it will be charged using the current water billing monthy payment. The use of single billing system will simplify the administrative process and paper work in PDAM and also can be integrated to their financial system.

On-site sanitation (OSS) Census in Pilot Area for Regular Desludging

The city has been implementing electronic OSS census using android application through mobile-phone in area selected by sanitation stakeholders to pilot regular desludging. The trained PDAM team subsequently partnered and trained local university as their enumerators recruited to carry out the e-census. The survey using android application is more effective and more accurate than using paper work due to human error,however, some issues should be considered e.g network stability, pre-testing and the do's and the dont's for enumetors in using the application.

The OSS census can be linked to base map and can show some thematic required e.g OSS with septic tank or soak pit; households with no OSS ; OSS with and without access lid; OSS has and never been emptied etc. So further intervention programs can be planned using the e-census results. Furthermore, it would a valuable input to update Balikpapan Sanitation Strategy

ICT Application to Monitor Sludge Emptying and Transportation

The ICT application is being developed and will be completed in end of this year. ICT system will be linked and sincronized with PDAM customer data base and with the e-census data. The purpose to develop the ICT application is to monitor the performance of the operating vechiles and to ensure that the tankers transport the sludge to the sludge treatment plant using the barcoding system and it will linked to ICT unit in PDAM office. This is applied for regular and on-demand sevices.

Sanitation Promotion – Regular and On-call Desludging Promotion with and by Balikpapan Trained Promotion Team

The promotion team members consists of PDAM staff, and other related agencies, representatives from community, NGOs and private operator. The team has been trained using the Ten-step Promotion Toolkits to develop promotion plan; design communication materials; pre-test the materials at community level for final designs. The team will then monitor and evaluate the implementation using quantitative and qualitative indicators to measure the impacts after promotion implementation. Follow on promotion activities for replication to other selected city areas will be developed by the trained team using the same approach in next year.

Conclusion

Commitment from city leader and regulation existence are required to move the improved septage management forward. Those are the main keys to get support from the city stakeholders and to plan and develop capacity building activities in the city.

Reference:

Septage Management Pilots and Capacity Building in Indonesia, Synthesis Report (P116114), World Bank

Introduction of Scheduled Desludging Services in Indonesia

Foort Bustraan*, Rudi Yuwono*, Nugroho Andwiwinarno*, Budi Darmawan*

*USAID/IUWASH PLUS under DAI, MayapadaTower 10th Floor, Jalan Sudriman, Jakarta, 12920 Indonesia

Keywords: sludge; collection; Indonesia

Conference Track: (2) Case Studies Track
Track Topic: *Emerging FSM services*
Personal Preference: *oral presentation*

Background

More then 85% of the urban population (120 million people) will rely on onsite sanitation systems to reach the Government of Indonesia (GoI) Universal Access target by 2019 and which is directly linked to SDG target 6.2. Since 2011, Two projects funded by the United States Agency for International Development (USAID) have collaborated closely with the GoI and donor agencies to develop and mainstream a FSM program, which directly support GoI policies, responds to local demand and provides affordable WASH services for Central and Local Government as well as consumers. The FSM program adresses the Sanitation Chain and consist of three main components:

1. Containment of fecal sludge in an approved septic tank
2. Collection and Transport of fecal sludge from the septic tank to a treatment plant and
3. Treatment of fecal sludge in the most effective and efficient manner

Introduction of Scheduled Desludging services

The current sludge collection system in Indonesia is similar to many other countries, within which a houseowner contacts an often unregulated private company when their septic tank is overflowing. The desludging fee is not fixed and paid directly to the driver of the truck, who empties the tank often without using proper health and safety gear and without reporting anything to a Government Agency. Since the driver is already paid, he often chooses to empty the fresh sludge into a nearby river or canal, rather then driving further to a sludge treatment plant with significant health and environmental implications. After reviewing the above with all stakeholders the USAID programs agreed to assist in developing improved septage collection systems, whereby

(a) septage tanks are emptied on a regular basis, following proper health and safety procedures
(b) payment for emptying septic tanks are made through a government appointed operator
(c) collection and transport efficiency will be increased through proper planning and use of IT
(d) emptying of septage will be done at offcial septage treatment plants

In 2012, IUWASH introduced Regular Desludging services (in Indonesian "**LLTT**" = *Layanan Lumpur Tinja Terjadwal*") in three cities where a Waste Water Operator was already in place:

- Surakarta city with the Water Utility (PDAM) as operator
- Makassar city with the Government Technical unit (UPTD) as operator
- DKI Jakarta, with a specialized Waste Water Utility (PD PAL) as operator

In 2014 the LLTT was expanded to three new municipalities: Bekasi, Gresik and Bogor.

The Process of introducing City level Scheduled Desludging

LLTT introduction involved the development of plans adressing following seven LLTT aspects:

Table 1.1 Summary seven planning aspects of Scheduled desludging

Key Aspect	Issues to be adresses
Operation	Septic tank, target areas, road width, distance to treatment plants, period of desludging, private sector operators
Infrastructure	Size of and access to treatment plants, desludging trucks, laboratory, health and safety equipment, GIS and customer relation systems
Procedures	Standard Operating procedures for customer registration, billing, septic tank emptying, treatment plant operation, monitoring and evaluation.
Regulations	(a) institutional framework, (b) mandatory periodic emptying, (c) desludging rates and payment mechanisms.
Financial	- Tariffs covering 100% of operating cost (cross subsidy possible) - Capital Investment in treatment plants by Government; - Trucks, as much as possible, purchased by private sector - Microfinance to asisst in upgrading septic systems
Institutional	Professional Waste Water operator in charge of planning and operation, including customer relation and database and contracting private sector for desludging
Customers	After Intense promotion encourage all households to join and pay ("polluter pay principle) Setup up use friendly customer communication and billing systems

Implemented Activities

Since 2012 the USAID IUWASH / IUWAHS PLUS teams with GoI and local stakeholders have implemented a range of activities, often on a "learning-by-doing" basis. These include:

- Development of Customer database from "paper" to "android-based" data collection
- Development of Manuals and training programs on Treatment Plants O&M, Health and Safety standards, use of IT, and promotion and marketing.
- Developing of models for calculating OPEX, CAPEX and cost recovery tariffs
- Establishment of contracts between operator and private operators
- Implementation of "LLTT Exposure" workshops and trainings for over 50 new cities
- Formal launching of LLTT programs in Makassar (August'15) and Surakarta (October'15)

Issues Identified

The following summarizes the main issues identified throughout the above:

- Early and strong commitment by city leadership (Mayor) is crucial to LLTT initiation
- Regulations on mandatory desludging and cost recovery tariffs take time and must be promoted from the start; Nonetheless the "polluter pay principle" and cost recovery tariff are much appreciated by local stakeholders as it reduces the burden on their, often limited, local budgets
- Survey's by IUWASH and WorldBank/WSP, showed that more then 80% of the households prefer a regular desludging service above the current "on-call" system
- Increasing collection efficiency is crucial and can be achieved by scheduling a truck (capacity 4m3) to empty 2 septic tanks (each 2m3) before traveling to the treatment plant
- The most efficient billing system is for a water utility to combine it with the monthly water bill. If not possible, it is recommended to appoint a local community group as "billing agent"

These lessons learned are incorporated in a LLTT guide, which has been shared in various national workshops for over 40 new cities organized by Ministry of Public Works and Housing

Presentation Content

The presentation will start with a brief overview of the current problems, followed by the seven (7) planning aspects of LLTT and a summary of the activities done to date it in three cities. This is followed by a review of the lessons learned and how these are now applied in the next batch of three (3) cities and will be applied in an additional 40 cities supported by GoI and several donor agencies (IUWASH PLUS, USDP and Worldbank/WSP). The presentation will close with the introduction of the new LLTT guide (including thirteen (13) steps to setup LLTT and the model to calculate cost recovery tariff). By the end of 2016 this guide should be endorsed by the Government of Indonesia as the guiding document for introducing LLTT across all cities in Indonesia.

Application of Information Communication Technology (ICT) for effective Planning and Implementation of FSM Programme: A Case study of Warangal City

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

*Administrative Staff College of India, Hyderabad
*Greater Warangal Municipal Corporation, Warangal

Keywords: ICT, Sanitation, FSM
Conference Track: FSM case Studies Track
Track Topic: Pilots showing promises
Personal Preference: Oral Presentation

Introduction

Greater Warangal Municipal Corporation (GWMC) is implementing several initiatives to improve the sanitation in the city of Warangal with a focus on FSM. It aims to evolve as a model city by introducing effective FSM regulation, deploying innovative technologies and practices, citizen engagement and real time monitoring. World over, Information communication technology (ICT) has indelibly changed the way cities are governed and municipal services are delivered. Recognizing the importance of ICT in effective governance and continuous improvement in service delivery, the City of Warangal has developed and deployed a bouquet of ICT tools for better planning, management and monitoring of FSM services.

Lessons from Pilot Implementations

The tools, some open source and some custom developed to serve a variety of purposes, speak to each other and boost the quality, pace, and scale of sanitation initiatives. What makes Warangal City unique is the holistic approach it has taken by integrating the tools in the overall framework of policy and regulations, involving key stakeholders and building their capacities to ensure usage and sustenance, opening multiple channels for citizens to connect, and establishing mechanisms for timely monitoring and data backed decision making. The tools developed and implemented by the city are listed below.

1. Sanitation helpline (S-Line), a single point contact for citizens to reach out for FSM related services. GWMC's existing toll free phone line is extended to service three purposes:
a) Request for new toilets
b) Technical support for construction of toilets - design, material for construction; trained masons etc
c) Citizen services and Grievance redressal including accessing desluding services, subsidy flows, complaints and suggestions related to provision of public toilet facilities etc

The system is IT enabled after undertaking process reengineering. The S-line services are institutionalized under IT department of GWMC and works closely with sanitation and town planning departments of GWMC.

Launched in May 2016, S-line has become popular and on an average receives 45 requests every day. In the pilot phase of 4 months, 542 complaints were redressed, technical assistance provided to all the 160 callers, 1690 new toilets underway and subsidy flows to the tune of Rs.1.42 million disbursed. The successful pilot is being scaled up city wide to make Warangal a model sanitation city.

2. Public Toilet Monitoring tool is a mobile based app developed for monitoring of PTs by Sanitary Inspectors (SIs) of GWMC. The app is integrated into the existing monitoring system of GWMC and a weekly report is submitted to the Commissioner GMWC for review. This initiative has led to improved adherence to Service Level Standards by PT operators.

3. Citizen Feedback on Public Toilets is captured using a four-point infographic screen. The GPRS system collates information from multiple locations on a real time basis. This data is used in combination with data from PT monitoring tool. In addition to improvements in quality of services in PTs, the tool has brought in citizen involvement and is also providing the city with indicative data on usage rate and pattern.

4. Toilet Finder is an app used by citizens and by GWMC to locate toilets in a radius of 4kms. The mobile app can be downloaded from Google Play store. GHMC has tagged all the PTs, e-toilets as well as toilets available in Fuel Stations in the city for the convenience of citizens. The citizens can also post their feedback on toilets and the information so collected is used in conjunction with other apps to track service delivery standards and usage rate and patterns.

5. Survey of Slums (SoS) app is developed to build a robust central database of information related to FSM in slums. This captures the details of slums, primary information about households, awareness and attitude towards sanitation and current situation related to WASH, access to toilets, toilet typologies, behavioral patterns etc. The Iris scanner in the mobile tablet permits Real time Biometric Authentication by linking it with National database of Unique Identification Number (UID) / Aadhar card. The tool is used in conjunction with S-line to streamline disbursement of subsidy, generate demand for new toilets, monitor septage collection and it also informs the IEBC related initiatives by the city. The tool is being scaled up to include non-slum households.

6. FSM Tracker app is designed to capture information on septage collection on a real time basis and helps in effective implementation of FSM regulations. As per septage management rules introduced by GWMC in 2016, licensed operators are expected to report information as per the prescribed manifest defined by GWMC. The information captured Is accessed through a dashboard integrated into the S-Line. Contact details of desluding operators are sent to citizens when they contact S-line service. This helps in tracking order fulfillment as well as quantity of sludge collected. The app also send auto alerts regarding the next cleaning cycle to the citizens.

Conclusion

The case of Warangal demonstrates the need for ICT deployment for effective implementation of FSM and for real time decision making. These tools are user friendly, inexpensive, real time and replicable. The systems and tools developed at Warangal are being scaled up at the State level and Swachh Bharat Mission, GoI is being encouraged by Warangal experience to implement similar initiatives at Pan India level.

References

Use of ICT for effective urban governance and service delivery in India - A selection of cases - ASCI and CISCO (2011)
Waugaman, A.(2014) Using Technology for Social Good: An Exploration of Best Practice in the Use of Information and Communication Technologies (ICTs) for Development, Available at: http://solutionscenter.nethope.org/assets/collaterals/Using_Technology_for_Social_Good_v2.pdf.
Ndaw, M. F (2015). Unlocking the Potential of Information Communications Technology to Improve Water and Sanitation Services - Summary of Findings and recommendations. WSP

Current and optional FSM operation models for over-coming current and future challenges

A. Simwambi* T. Hoffmann* M. Tembo**

*Bremen Overseas Research and Development Association (BORDA), Lusaka, Zambia

**Water and Sanitation Association of Zambia (WASAZA), Lusaka, Zambia

Conference Track: FSM Case Studies Track

Track Topic*: Emerging FSM services*

- Policy and institutional models – what are the challenges?

Personal Preference: *Oral presentation*

Introduction

In 2011 WSUP (Water and Sanitation for the Urban Poor) and LWSC (Lusaka Water and Sewerage Company) engaged BORDA a nd its local partner WASAZA (Water and Sanitation Association of Zambia) in Zambia to collaborate in the development of an innovative faecal sludge management approach for a low-income peri-urban community (so called compound) in Zambia's capital Lusaka. The inhabitants of this area mainly relied on unimproved pit latrines as a sanitation solution. The usual practice was to dig a new pit after filling up one. With the rapid growth of population in the city leading to congestion of the neighborhoods' and shortage of land to dig new pits, informal pit emptiers established in the areas who were often hired to desludge the pits and bury the feacal sludge next to the emptied pit or dispose it illegally in the nearby areas. The exercise was usually done in the night and without the use of safety equipment. To improve the health and environmental situation in the two compounds, WSUP consulted BORDA and its partner organization WASAZA to design a Feacal Sludge Management (FSM) plant and train existing informal pit emptiers who came out in the open and were known by the community. The emptiers were trained in construction and safe pit emptying with the aim of providing the residents of the area with a hygienic, legal, affordable and financially sustainable pit emptying service.
After months of operations of the FSM plant, WSUP again contracted BORDA and its partner to conduct monitoring and evaluations of the performance of the plant. The lessons learnt lead to the design of two FSM plants, one in the same compound and another one in another compound.

The three FSM plants and the overall responsibility for the trained pit emptiers (called "Dream Team") have been handed over to the commercial utilities delegated management for operations. Since commissioning, the plants have faced various technical, financial, social and economical challenges in their operations due to social and socio-economic aspects.

Methods

The paper aims to conduct lessons learnt from the management model from the Zambian experience. A copious data collection and analysis will be necessary to understand the various correlating interdisciplinary challenges and make recommendations to ensure the sustainability of future FSM plants.

Preliminary Options

Lusaka water and sewerage company peri-urban department operates the water and sanitation components of the FSM system in peri-urban areas through the water trusts and various lessons have been learnt from the current operation models. Some of the learnt lessons have been progressive whilst others have been retrogressive and various models have been suggested to effectively and efficiently operate the FSM plants. The utility can run the FSM units according to the following methods which could be altered accordingly to fit the structures.

Option # 1: Operations by utility delegated management- The first method is for the utility to run the system according to the current setup where the FSM have been allocated to the water trusts of the peri-urban compounds in which they and a team of emptiers have been employed and are paid on commission basis according to the money they make. Various advantages and disadvantages of the Model have been highlighted.The pros of the system are that:

- The water trust is licensed and regulated to offer water and sanitation service,
- The utility has system know-how and has expertise to operate, maintain and manage the sanitation systems,
- The trust has existing structures which make management and maintenance issues easier and convenient for end user.

The cons are:

- The water trust is overstretched in operating, maintaining and managing the system and hence some operation responsibilities are neglected such as housekeeping of the facilities.
- The water trusts are familiar and experienced with providing water services and not FSM
- There is increased O&M costs for the utility,
- High risks and liability for utility and financial risks for utility when the systems is not working but still needs to keep the team

Option #2: Private contractor runs the FSM component of the system (Lease agreement)-In this system, a private contractor is licensed by the utility to run the FSM component of the water trusts the water trust concentrates on water services where they have key expertise. The pros of the setup are that;

- The trust might have less responsibilities over the FSM operations,
- Low maintenance costs on the utility,
- Minimal administration costs,
- Chance for improved service delivery as the contractor will be in for money,
- High chance for quick response on troubleshooting issues and private sector development.

The cons for this setup are;

- Risk of poor maintenance standard,
- Risk of low service level (difficulties in ensuring quality standard),
- Complexity in dealing with boundary issues (system interdependence and contractual obligations) and
- Households might have to report to two entities (utility and contractor) for the service

Option #3: Joint Venture-A joint venture avenue between a private firm and the utility where there is task sharing between the utility. The benefits of this setup are;

- Shared O&M costs, shared risks and capital sharing
- Chance for improved service because of optimized utilization of know-how and expertise
- Job creation within the utility and private sector development.

The threats are that;

- There might arise complicated management structures, shared profits, complexity in dealing with boundary issues (system interdependence and contractual obligations)
- Risks for lack of competencies by the other party.

FSM means tackling the entire sanitation chain – examples from urban Uganda

J Rokob*, C Rieck*

*GIZ Reform of the Urban Water and Sanitation Sector Programme (RUWASS)
128 Luthuli Avenue, Bugolobi
P.O. Box 10346, Kampala, Uganda

Keywords: sanitation chain; system approach; stakeholder coordination

Conference Track: Case Study Track
Track Topic: *Emerging FSM services*
Personal Preference: *oral presentation*

Background

In Uganda, over 90% of the urban population relies on on-site sanitation systems, which in most cases are of questionable hygiene and cause severe health risks, particularly in poor urban settlements. Besides personal hygiene and cleanliness of toilets, a major challenge is the safe handling of faecal sludge from onsite facilities. In smaller towns only less than 10% of the facilities can actually be emptied and the rest is usually abandoned after they are full or broken-down. This provides only little economies of scale for the private sector to engage due to the long hauling distances to the next treatment facility in regards to the volume of faecal sludge. In Kampala, the capital city of Uganda, the situation is quite different. Around half of the sanitation facilities can in fact be emptied and there is a vibrant private sector for cesspool emptying. However, the private operators are not regulated and large parts of the city, mainly the informal settlements with conventional pit latrines where 60% of the people reside, are not being served. Main reasons for the latter are challenges in accessibility, high costs for emptying pit latrines due to lacking accessibility, limited ability to pay for emptying services, and a lack of awareness among the users. Abandonment of filled latrines, unhygienic manual emptying practices and open defecation are therefore an increasing challenge both, for the environment and the public health in these urban areas. With an estimated urbanisation growth rate of 5.9% per year the apparent sanitation challenges in urban Uganda are constantly increasing, raising the question on how to address them efficiently and sustainably.

GIZ's approach to FSM

The GIZ Water and Sanitation Programme in Uganda is taking a holistic approach to tackle these challenges together with its partners, the Ministry of Water and Environment (MWE) through the Water and Sanitation Development Facility – North (WSDF-N) and the Kampala Capital City Authority (KCCA). It is working in six small towns in Northern Uganda and in the capital city, Kampala. While appreciating that two different starting points (small towns versus the capital) are hardly comparable and that GIZ cannot "do it all", it has been anyhow clear right from the start that the overall approach to FSM should be the same: looking at the entire sanitation chain (containment, collection, transport and disposal/treatment/reuse) and coordinating the stakeholders. Broadening the view for all stages and processes along the sanitation chain helps avoiding small-scale interventions and/or short-term solutions that are irrelevant, and helps understanding what is happening on the ground and what the gaps are. A detailed analysis of the context was done to identify gaps in service provision, the underlying reasons and which stakeholders to involve. Development partners such as KfW, USAID, BMGF, and SDC provide financial support. Within the overall approach of addressing the whole sanitation chain, there are a few key principles that GIZ follows: 1. Private sector

engagement; 2. Strong legal and institutional framework conditions with clear roles and responsibilities for sector players; 3. Capacity building and coordination of stakeholders and 4. Awareness and demand creation among user groups.

Implementation examples from small towns and Kampala

While in the small towns the process was guided by the GIZ-developed Town Sanitation Planning (TSP) approach that comes in at a very early stage of sanitation planning, the process in Kampala was more straight-forward in terms of improving what was already there. TSP involves all relevant stakeholders of a town lead by their Town Councils and supports them in a step-wise manner to formulate and capture the short-, mid-, and long-term targets for sanitation. The basic idea behind the TSP approach is not to come up with yet another plan that is shelved and forgotten after some time. It is supposed to clearly highlight the gaps along the sanitation chain to the Town Councils, to raise the topic high on their agenda and to establish a concrete investment plan that can be used by the towns to apply for financing. In Kampala, KCCA has the mandate for on-site sanitation with its current main goal to efficiently regulate the private sector.

As said, in both project areas, GIZ has been taking the entire sanitation chain into account. With regards to each of the key principles, the current situation has been analysed at the different stages of the chain and questions have been asked such as: are there standards and bylaws that can regulate the sector? Is a private sector in place? If so, where is it active, where not and why? Is disposal/treatment/reuse taken care of? Is it sufficient? And if not, what are the mid- and long-term plans? Are the people aware of their obligations and options? Based on these questions, GIZ and its partners started a number of activities that are supposed to fill the existing gaps.

Successes so far

Some of the successes that have been achieved so far are the following:

- Six small towns in Northern Uganda have developed Town Sanitation Plans (TSPs) in a participatory approach.
- Implementation of TSPs has started with setting up of by-laws, kick-off of behaviour change campaigns and construction of toilets and faecal sludge treatment facilities in the six small towns.
- The up-scaling of the TSP approach has become a national “Undertaking”.
- Minimum standards for sanitation technologies have been developed for Kampala and are currently in the official approval process.
- Minimum standards for environmental, public and occupational health in FSM have been developed for Kampala.
- Streamlined behavioural change communication material has been developed and is used.
- All private operators for FSM services in Kampala are being tracked and underserved areas are being identified. Based on these findings, operational zones will be established.
- Service Level Agreements between KCCA and the private operators are in preparation.
- A Sanitation Call Center to create the link between users and service providers is being established in Kampala.
- Sanitation Safety Planning (SSP) has been adopted as a future planning and monitoring tool for sanitation by KCCA.

The Case for Private Sector Participation in Feacal Sludge Management Service Provision in Kampala

AG Nkurunziza*, Dr. NL Bateganya*, JB Zziwa*, J Rokob**, F Atusinguza**

*Kampala Capital City Authority (KCCA) Headquarters
1-3 Sir Apollo Kaggwa Road,
P.O BOX 7010, Kampala, Uganda

**GIZ RUWASS
Plot 83, Luthuli Avenue, Bugolobi,
P. O. Box 10346, Uganda

Keywords: Private Sector particpation; sanitation service delivery; citywide coverage

Conference Track: Case Study Track
Track Topic: *Emerging FSM services*
Personal Preference: *oral presentation*

Background

Kampala, Uganda's capital city has a population of 1.5 million people that grows to 4 million during the day. The city is administered by Kampala Capital City Authority (KCCA) on behalf of the central government. About 60% of the city's population stays in informal settlements characterized by inadequate access to services including water and sanitation. Less than 10% of the city's population is connected to the sewer line while 2% still practice open defecation. Onsite sanitation technologies are very common even among 95% of the urban poor, majority of whom live in informal settlements. 45% of toilets constructed in informal settlements are abandoned because they cannot be emptied due to their inaccessibility and/or technology type.

Problem Statement

Private sector participation in Feacal Sludge Management (FSM) in Kampala takes mainly place in the emptying and transportation of feacal sludge (FS) to the designated treatment plants. Kampala has only 92 vacuum trucks of which 86 are privately owned. The city authority operates 6 trucks that service mainly community toilets, public schools and markets, however these are inadequate to meet the demand for emptying services from these public facilities. Moreover, only 43% of the FS generated is currently collected, transported and disposed safely. Although there are five teams of small entrepreneurs using the gulper technology to provide services in the inaccessible areas, citywide coverage for emptying services is still a challenge; capacities are inadequate and regulation is weak. KCCA acknowledges that improved coordination of and cooperation with the private sector is needed to ensure efficiency and coverage in service delivery for FSM.

Solution

With support from its development partners namely GIZ RUWASS and BMGF, KCCA has set out to organize the private operators with the aim of extending the coverage of emptying services to the whole city, particularly the informal settlements, and to address the costs and quality of services at the same time. The regulation and organization of the private cesspool emptiers is taking place against the backdrop of:

- An un-regulated and informal FS transport sector
- Two associations of private cesspool emptiers with internal rules and guidelines in place
- No structured approach to tariffs charged to clients
- A collection efficiency of only 43%

Approach

KCCA's approach to organizing the FS transport sector is hinged on three key themes namely:

- Creating an enabling environment for private sector participation in FSM (legal and institutional framework conditions)
- Developing and strengthening the capacities of FSM service providers
- Sustaining the provision of FSM services through monitoring and the use of incentives

KCCA, together with its partners, has started to engage the private sector on a regular basis. The idea is to work on the above mentioned key themes together rather than through an "enforcement-only-approach". Through this partnership new innovations have been adopted including the coordination of service providers via a sanitation call center, a tracking system whereby the location of service providers can be tracked in order to improve efficiency of services and to avoid illegal dumping, and an increasing promotion of small entrepreneurs using technologies such as the gulper and UgaVac.

Implementation

The concept of organizing the private sector is being piloted in five wards of Kampala where service providers were selected and are monitored.

1. The city has been divided into zones to create and foster competition within these zones. These zones are currently being defined based on the pilot findings.
2. The mechanism of the partnership between the private service providers and KCCA is set out in a Memorandum of Understanding (MoU) which states the obligations, standards for service delivery, targets and performance measurement of service provision. The MoU also lays out how the incentives shall be applied.
3. Support to FSM service providers to achieve the minimum standards of operating business such as obtaining licenses to operate in the city.

Challenges

Access to sanitation facilities due to poor infrastructure especially in informal settlements

- Solid waste in toilets that makes the process of emptying costly
- Condition of toilets which renders vacuum emptying of this big market inapplicable
- The condition of the vacuum trucks
- Although the small entrepreneurs bridge service provision in inaccessible areas, they are unlicensed which makes promotion of these entrepreneurs challenging

Conclusion

The improving organization of the private sector to particularly extend services to the previously untapped informal settlements has already a great impact on the sanitation situation in these areas and at the same time has increased the market for emptying services, making FSM a viable economic sector. However, this is a process that has just started and citywide sustainable sanitation has yet to be achieved.

An Arduous Journey of FSM in A Small Municipality of Gulariya, Nepal

S. Singh*, D.D. Bhatta*

*Practical Action South Asia Regional Office, Kathmandu, Nepal

Keywords: small municipality; FSM; land for FSTP

Conference Track: (2) Case Study Track

Track Topic: Pilots showing promises

Personal Preference: O*ral presentation*

Background

Nepal is one of the most rapidly urbanizing country in South Asia - the urban population is estimated to have increased to 38.5% from 17% in 2011 and the number of municipalities has increased to 191 (2014) from 58 (2011) (DWSS, 2015). In smaller municipalities, pit latrines predominate sanitation facilities and due to limited availability of mechanical emptying service, fecal sludge from filled pits is either buried into a new pit or spread over nearby agricultural field. Manual handling of fecal sludge and unmanaged disposal of untreated fecal sludge pose high health risk to residents and environmental degradation. There is a pressing need to initiate proper management systems for emptying, collection, transportation and treatment of fecal sludge in smaller municipalities.

FSM in Gulalriya Municipality

Gulariya Municipality is headquarters of Bardiya district in the mid-western region of Nepal with a total population of 60,379. Practical Action/ENPHO has been promoting WASH to improve urban water and sanitation situation in the municipality, which was declared Open Defecation Free (ODF) in June 2015. In a survey carried out by Practical Action/ENPHO, more than 90% of on-site sanitation facilities are pit latrines; 80% emptied their pit content by burying in new pit and the rest spread over agricultural field. It was also revealed that 50% emptied their pit themselves and the rest by informal pit emptiers. Limited knowledge, unavailability of proper emptying and collection service, manual handling of fecal sludge, no treatment and improper disposal along with the risk of reverting back to OD due to filled pit, an urgent need to work on demonstrating FSM was realised. The following process was adopted:

Coordination and sensitizing stakeholders (11 months): The process initiated with identification of relevant stakeholders, which were: district, municipal and ward WASH Coordination Committees; Gulariya Municipality; communities, WATSAN volunteers; Female Community Health Volunteers (FCHVs); political/religious leaders; media; Badghars; Community Forest User Group (CFUG) etc. A number of meetings and orientations were conducted to the stakeholders, which included presentations and video documentary shows along with one to one meetings, door to door visits to sensitize on FSM. These also included field visits to the operational FSTP and proposed land for FSTP to relevant stakeholders.

Design and construction (7 months): Draft design was developed and shared with stakeholders to finalise the design. Concurrently, M-WASH-CC meeting was organised in the leadership of the Gulariya municipality endorsing to form a construction committee comprising members from CFUG and a tripartite agreement was signed amongst the municipality, construction committee and the project. The construction was led by construction committee, which was supported by municipal and project technical staff and provided regular construction supervision and monitoring. In addition, joint monitoring visits were carried out by stakeholders and community people during implementation. The construction works was completed in six months (total cost – USD 30,170), social audit was carried out to maintain transparency and ownership of the plant and finally handed over to Gulariya Municipality in July 2016.

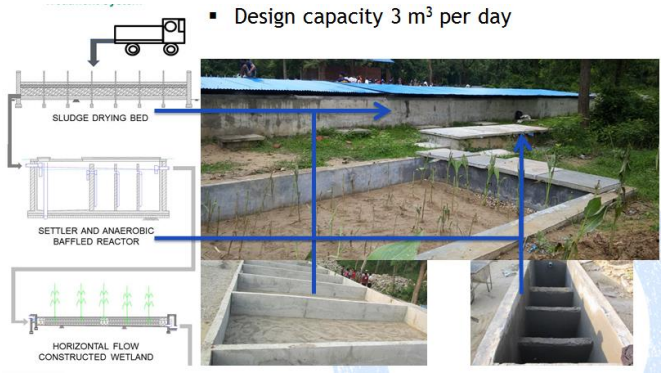


Figure 1.1 Components of FSTP

Collaboration/partnership for construction and O&M: The plant was established in the partnership of Gulariya Municipality, CFUG and project. One of the prominent agenda of discussion during the M-WASH-CC meetings was smooth and sustainable operation of the FSM, which let to formation of a task force (7 members) comprising staff from municipality, project, CFUG and media to develop a business plan. The task force organised a stakeholder meeting to discuss the possible business cases in managing the system and came up with a draft plan, which was finalized after incorporating inputs from M-WASH-CC meeting. Gulariya Municipality assigned an informal worker for daily collection and disposal of fecal sludge and operate and maintain the system, who is also equipped with a rickshaw fitted with a suction pump for collection and transportation of FS from pits, while the Municipality is in process of procuring a suction tanker and exploring a suitable and committed private sector for smooth operation of the plant. Presently, it has been decided to charge an emptying fee of USD 2.8/ring (in general a pit has 3-5 rings which implies USD 8-14 fee per pit).

Major challenge

Stakeholders were doubtful whether the plant will operate smoothly or not and it might create odour nuisance. Since in the Hindu religion, rivers are considered holy, where the remaining of the deceased (after burning) are released and holy bath is taken, there were concerns and

disagreement, particularly, from religious leaders, as they believed that releasing water from FSTP would pollute the river.

Increasing awareness on the need of FSM (to sustain ODF and to achieve “Total Sanitation”) has been a key to overcome this challenge. As these targets were agreed by the communities, local stakeholders and politicians, it helped to convince as well as motivate the stakeholder for a need of FSM. Numerous consultations, orientations, meetings, discussions, presentations video shows and field visits were conducted with stakeholders in different forums to convince the stakeholders during site selection and project implementation – 16 district; 23 municipal and 17 community level; 10 one-to-one meetings with key stakeholders (Chief District Officer, Local Development Officer, District Forest Officer) and 13 meetings with local politicians and field visits. Suggestions from stakeholders were welcomed and were agreed to be undertaken during design and implementation e.g. proper design and operation to control odour and discharging water quality; preserving trees; maintaining cleanliness of the area etc. It also ensured that this initiative is endorsed in the municipal plan and endorsed by the municipal council as well as D-WASH-CC.

Recommendation

Acquiring land for FSTP is challenging, which needs to be well thought and well planned. Engaging all stakeholders and making them realise the need of FSM had been a key for land acquisition. Collaboration and partnership should be sought from the initial stages for successful planning, design and implementation of FSM. Leadership and support from the local government is crucial in getting support from other stakeholders in the municipality.

References

DWSS - Department of Water Supply and Sewerage (2015) Fecal Sludge Management in Nepal: Key challenges and the way forward.

Scaling up Faecal Sludge Management in Kenya's Urban Areas

S. O. Okoth,* J. K. Ronoh**, D. Mbalo***, A. Dubois****
*Water Services Trust Fund (WSTF), 1st Floor, CIC Plaza, Mara Road, Upper Hill, P. O. Box 49699 – 00100 Nairobi, Kenya, **Email**: Simon.Okoth@waterfund.go.ke **Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Water Sector Reform Programme, Maji House, 4th Floor, Ngong Road P.O. Box 19512-00202, Nairobi, Kenya. **Email:** james.kiptanui@giz.de
***Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Water Sector Reform Programme, Maji House, 4th Floor, Ngong Road P.O. Box 19512-00202, Nairobi, Kenya. **Email:** doreen.mbalo@giz.de
****Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Water Sector Reform Programme, Maji House, 4th Floor, Ngong Road P.O. Box 19512-00202, Nairobi, Kenya. **Email:** alexandra.dubois@giz.de

Keywords: Faecal Sludge Management; Urban Sanitation; Up-Scaling Basic Sanitation for the Urban Poor
Conference Track: Case Study Track
Track Topic: Emerging FSM services
Personal Preference: Oral Presentation

Introduction

Access to sanitation in Kenya is a major challenge. Only 30% of the population has access to improved sanitation systems. In Kenya's urban areas, 16% are connected to sewers. The remaining 84% resort to other means of FSM. Wastewater treatment plants are present in only 15 towns serving a total of 900,000 inhabitants. The rest of the urban population uses pit latrines or pour flush toilets connected to septic and conservancy tanks. Due to lack of treatment facilities and enforcement in most of the fast urbanizing areas, the exhausted sludge often ends up discharged directly into rivers or lakes causing environmental damage. The lack of conventional treatment facilities is due to limited financial resources making the application of sustainable approaches difficult, where economies of scale or cross-subsidization exist.

Need for an intermediate solution

To tackle the FSM challenges in Kenya's urban areas, a different approach was needed. The Up-scaling of Basic Sanitation for the Urban Poor Programme (UBSUP) was developed with the purpose of offering sustainable sanitation to residents of low income urban areas. The UBSUP approach ensures a complete sanitation value chain. The implementation of UBSUP is being undertaken by the Water Service Providers, which are commercially oriented public enterprises mandated to provide water and sanitation services in Kenya.

UBSUP further addresses the full sanitation value chain through effective social marketing techniques to create demand for improved toilets varying from Double Vault Urine Diversion Toilets (UDDTs) to flush toilets connected to septic tanks, conservancy tanks or existing sewer networks. The households invest in their preferred toilet construction which is easy to empty. The sludge collection and transportation service is offered by a variety of providers including; private and water company operated exhausters for emptying sludge from pit latrines and septic/conservancy tanks and motor tricycles with a carrier called SaniGo, developed by UBSUP. The SaniGo is operated by a local group of emptiers called Sanitation Teams that are trained and equipped to empty UDDTs.

The FSM concept of the UBSUP Programme

Given that about 84% of Kenya's urban population are not connected to sewers, this prompted WSTF and GIZ to introduce the concept of Decentralised Treatment Facilities (DTF). DTFs are located conveniently within the towns to provide sludge treatment for both UBSUP toilets and existing toilets. The DTFs are small scale decentralized wastewater treatment plants catering for sludge from dry and wet toilets brought in by exhausters or

SaniGo's. The main objective of the DTFs is to treat and reduce the pathogens levels in the effluent to a standard that is environmentally safe. The design promotes resource oriented sanitation, incorporating components for processing sludge by-products.

The modules of the DTF are standardised. Trainings, documents, manuals and designs were provided to the stakeholders in charge of implementation. DTFs do not require existence of sewerage networks. It is technology that is suitable for small/medium sized towns. It is a known fact that sewer networks and conventional systems are difficult and expensive to operate and maintain. Therefore the UBSUP FSM model makes a better fit.

Progress to date

UBSUP has successfully completed 2 pilot DTFs. UBSUP is currently scaling up 10 DTFs and 6 are complete. The 8 complete DTFs have the capacity to serve approximately 80,000 beneficiaries.

Policy and Institutional Framework

The concept is anchored within the water sector institutional framework as provided in the Water Act 2016. In this framework, the water service providers are mandated to manage FSM. UBSUP has developed standardized tools for nationwide up-scaling and is a multi-stakeholder programme that encourages private sector participation to improve the sanitation business component. Out-sourcing the collection and transport services ensures steady supply of faecal sludge into the DTF. Nonetheless, the water companies must ensure that legal provisions and procedures are adhered to in terms of registration, licenses and permits. The concept has developed the system's operations procedure and manuals, which emphasize on sound contracting mechanisms for sustained operations of the facilities.

Sustainability of service provision

For the system to operate in a financially and economically sustainable way, a business model was developed for the DTF. It defines the major elements of the business such as partners, values, resources, costs and revenue streams. The capital and running costs are recovered by the emptying, transportation and treatment services. To ensure sustainability, there are consultations to formulate an affordable tariff structure for the users and emptiers. The definition of the tariffs takes considers the water services regulations, the pro-poor policy and cost-revenue relationship.

Conclusion: Challenges and lessons learnt

National up scaling takes time and only works with structures and concepts in place. It is paramount to include all relevant institutions at national and county levels in order to ensure enforcement, acceptability, sustainability and ownership. Contrary to the belief, water companies are willing to engage in FSM. Low cost decentralized solutions should be built according to national standards to reach more people at less per capita cost.

References

1. Waterfund, 2016. *USBUP SafiSan Toolkit* [online] Available at: < http://www.waterfund.go.ke/safisan/ > [Accessed 14 October 2016]
2. Government of Kenya, 2016. *Water Act 2016* [online] Available at: <http://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/WaterAct_No43of2016.pdf> [Accessed 14 October 2016]
3. Water Services Regulatory Board, 2016. *WASREB Impact Report*: [online] Available at: <http://www.wasreb.go.ke/impact-reports>

FSM Cooperated with Sewerage in Japan

A. Sakai*, H. Harada**

* University of Marketing and Distribution Sciences, 3-1 Gakuen-Nishi-machi, Nishi, Kobe 651-2188, Japan

** Graduate School of Global Environmental Studies, Kyoto University, Yoshida-honmachi, Sakyo, Kyoto 606-8501, Japan

Keywords: night-soil treatment plant; MICS; johkasou

Conference Track: (2) Case Study Track

Track Topic: At scale city-wide or nationwide FSM services

Personal Preference: Oral presentation

Introduction

Japan has a unique history of FSM, where people have used micro-flush toilets connected to a fibre-reinforced plastic pit, and faecal sludge stored in the lined pit. Faecal sludge from these onsite sanitations are transported by vacuum trucks and treated at faecal sludge treatment plants, called night-soil treatment plants (NSTPs). As of 2015, 10%, 9% and 81% of the nation's population used the toilets with lined pits, onsite activated-sludge treatment units, called *johkasou*, and sewerage (MLIT). Around 1,000 NSTPs are under operation to treat faecal sludge from lined pits and *johkasou*.

Along with sewerage development, the amount of faecal sludge transported to NSTPs has been reducing, resulting in overcapacity of NSTPs and plant closure. To make these two sanitation systems (NSTPs and sewerage) cooperate each other and more efficient, the government of Japan started a subsidizing program, called MICS, since 1995. MICS program has promoted co-treatment of sludge from centralized and decentralized sewage treatment plants (STPs), *johkasou*, and/or the lined pits.

Up to 2013, 107 MICS projects has been adopted, where FSM system and sewerage cooperated in various manner. Sound cooperation of FMS and sewerage is one of important challenges to solve the FMS issues in developing countries. The present paper introduces two examples of MICS project in Japan, where FSM system and sewerage cooperate in different manner. Further, we discuss implications from MICS's experiences for FSM in developing countries.

Two cases of MICS in Hyogo prefecture

Demographic, technical and financial data on the two MICS projects in City A and Town B, Hyogo prefecture were collected through secondary data collection from local governments as well as site visits and interviews to municipalities. Areas covered by MICS projects in City A

and Town B have, respectively, population of 48,880 and 15,366, of which 5.9% and 36.9% use onsite sanitation and the remaining depends on centralized and decentralized sewerage.

Before MICS, these municipalities had treated faecal sludge from onsite sanitation at NSTPs, where liquid as well as solid fractions of sludge were treated. NSTPs and STPs had been separately operated. After MICS, these sanitation systems have been operated in an integrated manner. As shown in Figure 1, in the case of City A, dewatering facilities was consolidated in seven of centralized STPs, to which sludge from decentralized STP and onsite sanitation is transported and dewatered. Further, all of dewatered sludge is transported to a sludge drying facility, which was newly introduced at a NSTP. A part of dried sludge is used as compost for farmland. In contrast, as shown in Figure 2, FSM system and sewerage system were simplified in Town B, where NSTPs were closed. A centralized STP have employed pre-treatment facilities for receiving faecal sludge. Pre-treated faecal sludge is lined into wastewater treatment process after diluting by treatment plant effluent. Thus, dewatering and drying were consolidated in City A, and a fecal sludge treatment was integrated into a centralized STP in Town B.

Life cycle cost of the two MICS cases are summarized in Table 1. Integrations of sewerage and FSM systems had great contribution to reduce the cost of whole sanitation service: 14.8% and 35.9% reduction for City A and Town B, respectively. In City A, the centralized drying facility reduced the cost of transportation and final sludge disposal. In Town B, closure of an old NSTP will save the renewal cost of the plant and capacity of centralized STP was enough to treat faecal sludge from onsite sanitation and decentralized STPs.

Implications for FSM in developing countries and conclusions

Cooperation manner of FSM and sewerage may change in local conditions. In addition to two cases in this abstract, MICS projects mostly reduced total sanitation service cost and sustainability of FSM in each municipality successfully. In developing countries, many of urban areas has both of centralized sewerage with or without proper treatment and onsite sanitation such as septic tanks. Although FSM in urban areas has not been prioritized very much in developing countries, cooperation of FSM and sewerage may contribute to establish more efficient sanitation services than separation of FMS and sewerage.

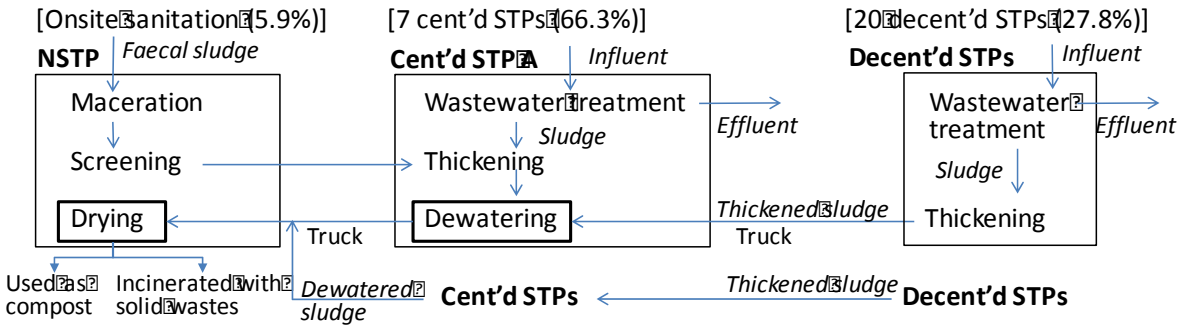


Fig. 1 Wastewater and faecal sludge treatment flow of MICS in City A. Cent'd and decent'd indicate centralized and decentralized.

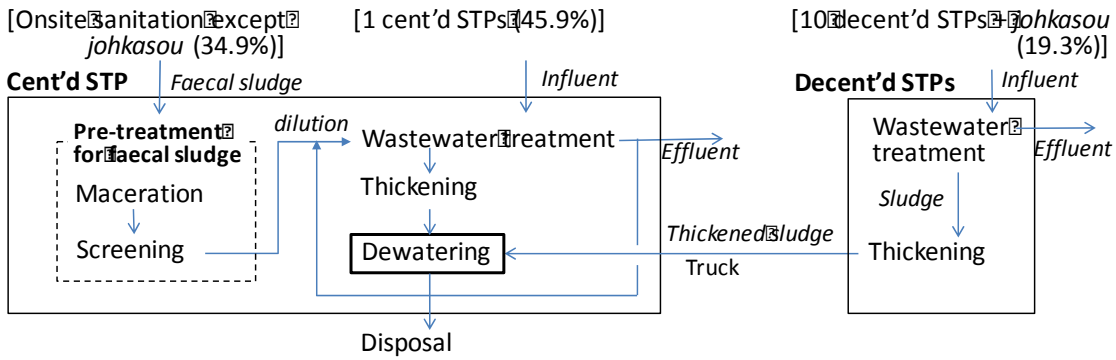


Fig. 2 Wastewater and faecal sludge treatment flow of MICS in Town B. Cent'd and decent'd indicate centralized and decentralized.

Table 1 Life cycle cost (LCC) of both MICS is much less than conventional case

	City A		Town B	
	Before MICS	After MICS	Before MICS	After MICS
Construction (million yen/year)	134.3	135.1	53.9	41.6
O & M(million yen/year)	211.7	159.7	122.7	71.7
Cost reduction compared to before MICS (%)	-	-14.8	-	-35.9

Acknowledgement

Data collection was supported by Department of Sewerage, Hyogo Prefecture. This study was financially supported by JSPS KAKENHI Grand No 16H02748.

References

Ministry of Land, Infrastructure and Transport, http://www.mlit.go.jp/report/press/mizukokudo13_hh_000311.html (2016/9/30 access)

Tackling the post-ODF challenge in Bangladesh through public-private partnerships: Preliminary results of Faridpur FSM business model

N. de La Brosse, Rafiul Islam, L. Stevens, Uttam Kumar Saha, Md. Nazmul Huda.

Practical Action, The Schumacher Centre, Bourton-on-Dunsmore, Rugby, UK

Keywords: Business model; Public-Private-Partnerships; FSM

Conference Track: (2) Case Study Track

Track Topic: *Emerging FSM services*

Personal Preference: *Oral presentation*

This paper shares lessons from the implementation of the "Public Private Partnerships (PPP) for Sustainable Sludge Management Services" project in Faridpur, Bangladesh. The business model calculations, presented in this paper are currently being tested in the operation of a treatment plant (TP) and improved FSM arrangements. As a result, we draw lessons about the relevance of business modelling and market-based solutions in FSM.

Background and context

The World Bank's Water and Sanitation Program estimates the economic costs of poor sanitation in Bangladesh represent USD 4.2 billion each year. This was equivalent to 6.3% of Bangladesh's GNP in 2007, or USD 29.6 per person per year. This shows the health impacts dwarf the economic costs. In Bangladesh, open defecation has decreased to only 1%. However, in most secondary towns, with no sewers residents rely on on-site sanitation combined with unsafe faecal sludge management practices. In Faridpur, 90% of the sludge is not safely managed. The absence of drainage or emptying facilities in the low-income settlements results in toilets overflowing, with the same health risks as direct open defecation. Bangladesh is now facing a second-generation (post-ODF) sanitation challenge of the safe management of on-site systems by both public and private actors. This has been recognised across the South Asian region with the SacoSan VI Dhaka Declaration (2016) emphasising the need for regulatory frameworks which ensure the dignity, health and income of sanitation (informal) workers.

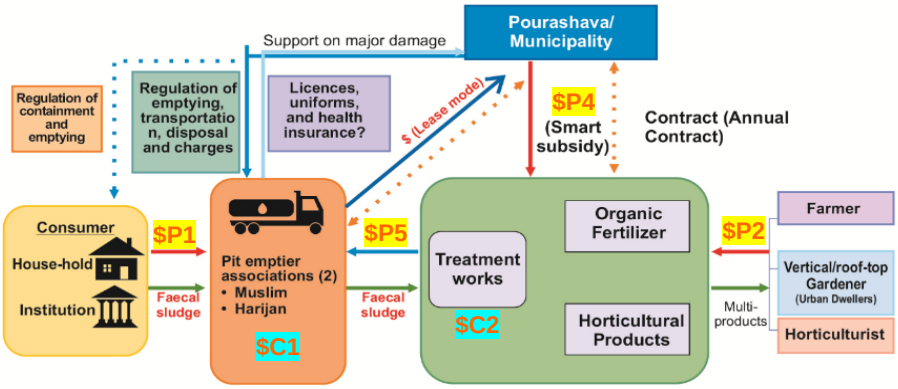
Faridpur's "second generation" sanitation challenge

The Gates Foundation (BMGF) and DFID are supporting Practical Action to adopt a strong focus on secondary towns often left out in efforts to improve FSM. The project jointly carried out by Practical Action and Faridpur Municipality (2014-2017, USD 1.6M) builds on a decade long partnership. In Faridpur (130,000 people), 94% of the population have access to a form of onsite sanitation. Most options (including pits and tanks) require frequent emptying. There

are currently no sewers and the Municipality provides an expensive desludging service with substandard equipment covering only 30% of the population. Informal pit emptiers have historically provided sanitation services in South Asia, but they are highly vulnerable to poor health and social stigma. In Faridpur, they have filled the gap in Municipal services in an unregulated manner, causing considerable negative environmental and public health externalities. To address this challenge, the project focuses on i) the construction of a sludge disposal and treatment plant; and ii) working with the existing service providers on mutually beneficial business models for PPP between the Municipality, the pit-emptying associations and a treatment plant operator (TPO) initially serving a third of the city's population.

Preliminary findings on FSM business model operationalization

After several iterations a business model was developed. A situation analysis of the FSM system was completed with a focus on actors' (often conflicting) incentives and the business environment, looking at market-based solutions. This particularly focused on exploring the potential of existing service providers. Cost and revenue calculation tools were used to design three different scenarios to develop a PPP, service level agreements and



performance based contracts. Finally, a "first year build-up scenario" was designed to guide the implementation of the service-based agreements. This scenario allows flexibility, regular monitoring, and adaptive management over the first year of operation.

Figure 1. Proposed institutional set up for market-based operation of FSM

At the heart of this build-up model, incentives and cross-subsidies appeared to be the most practical/profitable solution. Activities driving an increased demand for emptying service are generating greater revenue for the now-formalised pit emptiers ($P1). The cumulative quantity of sludge emptied and transported is expected to increase from 324c.m to 3,360c.m as the second group becomes operational in year2. Currently the registered group covers its operation and equipment leasing ($C1) through services fees ($P1 estimated at USD 4,120 in year1, USD 38,450 from year2) and payment by the TPO once they have disposed of the sludge safely ($P5, USD210 estimated in year1, USD2,150 from year 2). This innovative "safe transfer incentive" is the cornerstone to support improved disposal practices and the use of better equipment. Since they are partnering with the Municipality through an equipment lease agreement ($P3), the Municipality can use this income for a cross-subsidy to the TPO ($P4) through their operation contract. This supports the TPO to cover the "safe transfer incentive" and its operation costs ($C2, about USD15,000 annum until 2018). This also off-sets low revenues from compost at an initial stage ($P2, estimated at USD 1,600 in

year 1) due to initially low volumes treated and deep-rooted issues around certification, and cultural acceptance of human waste as fertilizers/soil conditioners. The TP is expected to be profitable by the end of year 3 with a net cash-flow of over USD 50K. We report on the extent to which the assumptions made in the modelling are holding true as the system starts to work.

Impact and learning

This model may take up to three years to break even and bring worthwhile lessons for future profitable scale-up. The most challenging part of the modelling was to estimate the size of different revenue streams. The results will help design more optimal cross-subsidies. This business model is transforming informal emptiers into formal businesses and improving their health and livelihoods. The Municipality's investment for treatment and service demand generation is creating a sense of proper FSM among the residents, avoiding environmental hazards. Our work is being recognized nationally and globally: Practical Action is leading the development of the National FSM Regulatory Framework, and is co-ordinating evidence-based policy and advocacy efforts to design a large national programme for the BMGF.

References

DeFrancis, Marc P. (2012) Economic Impacts of Inadequate Sanitation in Bangladesh. Water and Sanitation Program, World Bank, Washington, DC

SacoSan VI (2016) Dhaka Declaration

UNICEF, World Health Organisation (2015) Progress on Sanitation and Drinking Water – 2015 update and MDG assessment, Geneva, Switzerland

Practical Action (2014) Situation Analysis Report on Faecal Sludge Management in Faridpur Municipality, Bangladesh, Practical Action

Hybrid PPP for Non-network Sanitation Improvements in Greater Colombo

Iain Menzies*, Samantha Wijesundera*, Chandana+ and Joseph Ravikumar*

Address: *World Bank, Galle Road, Colombo, Sri Lanka and + National Water Supply Drainage Board, Galle Road, Ratmalana, Colombo Sri Lanka

Keywords: Non-network; Hybrid PPP; Colombo

With a large number of urban households with individual household toilets and significant majority of the households dependent on on-site sanitation (septic tanks), proper management of on-site sanitation would be a cost effective option to improve sanitation in the country. While households had installed on-site sanitation systems, their design and effectiveness needed considerable improvements. For instance, septic tanks did not have a soak aways and the overflow from septic tanks discharged to the drains. In order to improve these conditions, Global Partnership on Output Based Aid (GPOBA) in partnership with the National Water Supply and Drainage Board (NWSDB) a pilot Public-Private Partnership (PPP) arrangements that will benefit 3,785 households in the Greater Colombo Metropolitan with installing or replacing the septic tank; extending the house connection including a toilet latrine where there is none; together with the "operational aspects" of sanitation, namely the regular emptying out of septic tanks and the adequate disposal of the sludge in NWSDB-approved facilities was proposed. It is to be pointed out that this pilot project is targeted at poor households living in low-lying and flood prone areas that are unlikely to be connected to any planned network in the foreseeable future. In order to quicken the pace for installation of septic tanks as well as to reduce construction costs, prefabricated units were proposed.

Following a quick assessment of the market, demonstrated by the number and the evolution in sludge disposal in the area, as well as the number of operators who desludge into specific NWSDB-managed discharge points, the project was conceived for the emptiers to compete through a competitive selection process to become the "operators" in a designated area under the PPP contract. The "operators" will be responsible for the installation or rehabilitation of septic tanks and for their regular sludge collection and disposal, at a designated frequency determined by the septic tank installed. The operators were required to team with a civil contractor to implement the project.

As one of the main objectives of this project was to demonstrate the benefits regular desludging, it was envisaged that the PPP agreements between the operator and the household are for a minimum of five years. Within those five years the operator will be required to regularly desludge the septic tank. The regularity of such desludging will be contingent upon the physical size of the septic tank and desludgings will be scheduled accordingly. It is envisaged that the first two years of the desludging will be subsidized

through the GPOBA Grant[6]. Thus, an operator will return to a given household within a schedule time (say 12 to 14 months) and, subject to a small payment by the customer, will perform the desludging of the septic tank. While this was envisaged under the project, delays in implementation has limited desludging to just one during the tenure of the project and the second desludging post completion of the project would occur under the terms of the PPP contract.

Following a competitive bidding process, a contract with the successful bidder was signed and implementation is underway. It is hoped that this pilot project will demonstrate the benefit of on-site improvements and regular desludging.

Improving Sanitation Services through Service Level Agreements and Public Private Partnerships: A Case study of Warangal City

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

*, **Administrative Staff College of India, Hyderabad
***Greater Warangal Municipal Corporation, Warangal

Keywords: PPP, SLA, Public Toilets
Conference Track: FSM case Studies Track
Track Topic: At scale city-wide or nationwide FSM services
Personal Preference: Oral Presentation

Introduction

The City of Warangal, the second largest city in the newly formed state of Telangana, with a population of close to 0.8 million is undergoing transformational change brought about by urbanization. The city has over 180 low income settlements housing 30% of city population. The sanitation services in the city is sub-optimal with nearly 20 to 30 percent households resorting to open defecation (OD). This figure is particularly high in slum communities ranging up to 50 to 70 percent. Prevalence of OD is largely due to gaps in access to toilets and also because of cultural and behavioral factors. Public toilets(PTs) and community toilets(CTs) are in short supply and existing ones are either dysfunctional or not fit for use due to poor maintenance.

The Municipal Corporation has facilitated construction of 28 PTs through binding service level agreements (SLAs) and Public Private Partnership (PPP). A detailed survey of the PTs revealed that of the 28 PTs, only 16 were clean and well maintained with minimal requirements for repair. While the female to male seat ratio was 1:2, only 7 toilets had separate entrance for women. The number of women using PTs was far below the estimated demand. All the toilets were dependent on their own borewell for water which they used for 1.5 – 2 hours in a day. The toilets did not have advanced safe septic tanks and none of them maintained desludging records. The SLA in detail provides for the roles and responsibilities of each party, levels of services to be provided and penalties for default on services. There is scope to improve the Service Level Agreement to bring changes in the performance as the PTs have inadequacies with regard to design and Operations & Maintenance (O&M) activities.

Strengthening Public Conveniences

Greater Warangal Municipal Corporation (GHMC) has taken several initiatives to improve the access and quality of PT facilities to the citizens of Warangal through PPP. Some of these are detailed below:

Refining the PPP model - Build Operate and Transfer (BOT) basis for a period ranging from 5 years to 15 years. Under the model, GWMC provides the land at free of cost and gives the rights for advertisement space. The private operator is required to finance, construct and operate the facilities during the lease period. Water, electricity and other facilities are expected to be sourced by the private agency. The O&M is met from user charges and advertisement revenues. GWMC imposes advertisement tax on the space allocated for advertisement as per applicable rates. Except this no other revenue is shared by the private operator with the WMC. The service level agreement (SLA) in detail provides for the roles and responsibilities of each party, levels of services to be provided and penalties

for default on services. SLA includes design standards for the septic tank and emptying practices.

Strengthening the SLAs by including elements of design and O&M – Separate facilities for men and women, appropriate lighting and ventilation, provision of ramp, gender and child friendly designs, advanced septic tanks (3 chamber septic tank with anaerobic baffled reactor) with soak pit, appropriate waste water disposal mechanisms, cleaning schedules, other requirements such as dustbins, mirrors, hand wash facilities, soaps etc

Well-developed Request for Proposals with improved SLA for construction of PTs in 20 additional locations. Discussions were held with existing and potential operators to their requirements and challenges in running PTs successfully. The concerns were addressed during pre-bid meeting. The city received good response to the RFPs with the bid parameter defined in terms of lower number of years of operation rights.

Benchmarking of the existing 28 PTs against the new service standards conducted, areas of improvement identified, monitoring system for compliance with service standards instituted.

Public Toilet Monitoring tool - a mobile based app developed for periodic survey by Sanitary Inspectors (SIs) is integrated into the existing monitoring system of GWMC and is used for weekly review of performance of operators of PTs. Participated in research on Odor control. A mobile app for sensory survey developed in collaboration with Ferminich, a global perfumery company. The importance of visibly clean and fresh smelling PTs for enhancing business explained to the operators.

Aesthetics of the PTs enhanced and color theme suggested for bring uniformity and enhancing visual association. WASH related communication material displayed inside as well as on the exterior walls of the PTs. Signage boards designed and installed to help identifying the PT from a distance. Direction boards at 150 meters (2 minutes away) and 500 meters (5 minutes away) installed to enhance usage rate.

Citizen satisfaction with PTs captured using GPRS enabled feedback machines. Information from multiple locations is collated on a real time basis used and used for monitoring service level standards on weekly basis in conjunction with PT monitoring tool. Successfully piloted in 5 PTs, the machine is being installed in all the 40 PTs. Citizen feedback is also captured through a sanitation helpline (S-Line) established as a single point contact for citizens to reach out to for sanitation services.

Conclusion

Warangal is the only city in India with more than 45 PTs on a successful PPP model with robust SLAs. Multiple consultations were held with the PT operators to understand their business model and address any concerns they may have with regard to viability. These social entrepreneurs have been carefully nurtured and capacitated to sustain and grow their enterprises to support the sanitation goals of the city. Four SHE toilets - exclusive women toilets – are being implemented on PPP and would be a role model for the rest of the country. Several senior officials from cities in India and abroad have visited Warangal to understand the successful PPP model.

Leveraging resource recovery to pay for sanitation: Pivot Works demonstration in Kigali, Rwanda

A. Miller*, T. Wade**, A. Muspratt*

*Pivot Works Ltd., P.O. Box 3927, Kigali, Rwanda

**Waste Enterprisers Holding, 118 Kentucy Ave SE, Washington DC, 20005, U.S.A.

Keywords: reuse; Africa; treatment

Conference Track: (2) Case Study Track

Track Topic: Pilots showing promise

Personal Preference: Oral presentation

Background: Pivot Works demonstration in Kigali

Pivot Works Ltd. has been operating a demonstration-scale Pivot Works factory in the city of Kigali, Rwanda, since September 2015. The facility receives up to 100 m^3 fecal sludge (FS) per day, provides primary treatment, and converts the FS to a solid fuel suitable for industrial kilns and boilers. Average daily Pivot Fuel production is 0.5 t.

Pivot was founded on the theory that wastewater and fecal sludge treatment plants often fail in low- and middle-income countries because of the lack of funds for on-going operation and maintenance expenditures (opex). Our mission is to reinvent the economics of waste treatment. If opex costs are *always* a problem, then why build plants that depend upon them? Pivot designs “factories” that eliminate opex costs for governments and citizens.

We have found that, at Pivot Works factories, revenue from Pivot Fuel sales contributes significantly to the opex costs of smaller-scale urban plants, and our projections show that revenue can exceed the opex for large-scale facilities. Treatment is the byproduct of our fuel manufacturing process – a fraction of our equipment serves the single purpose of treatment, while the majority serves to produce the highest quality industrial fuel possible from human waste.

The Pivot Works factory

Pivot Works factories are designed to handle FS (from exhauster trucks and pit latrines) and sewered wastewater. Waste at ≤10% total solids (TS) is received at our headworks and proceeds through a process of mechanical dewatering, solar drying, and thermal drying. More concentrated waste goes directly to solar drying. Liquid effluent from the dewatering process undergoes passive biological treatment.

The Pivot Works factory is designed to be the lowest cost complete fecal sludge treatment option available to cities. In 2016, a multinational engineering firm conducted an independent review of the lifecycle cost of a Pivot Works factory compared to three conventional wastewater and fecal sludge treatment process trains. The firm’s results provided strong evidence in Pivot’s favor. Compared to the conventional alternatives – which ranged from waste stabilization ponds with sludge drying beds for pit sludge, to activated sludge with anaerobic digestion for waste activated sludge and pit sludge – the capital cost of a Pivot Works factory is 32 to 52% less expensive and annual operating costs are 80% less expensive (**Fehler! Verweisquelle konnte nicht gefunden werden.**).

Pivot achieves these savings through radical reorganization of the conventional treatment process train and by maximizing revenue from fuel sales – by “treating” waste as a resource.

Turning Human Faeces Into Resource In Kenya Informal Settlements A Paper For the FSM4 Conference

Author: A.N.B, Aidah Nelima Binale-Ebrahim,
Umande Trust, P;O Box 43691-00100 Nairobi

Keywords: Bio-centres, bio-sanitation, SANDEF-sanitation development fund
Conference Track: Case Study Track
Track Topic: Emerging FSM services
Personal Preference: *oral presentation*

Figure 1.1: photo of Stara bio-centre

Context

A large number of toilets in the informal settlements are not connected to sewer system and space constraints often do not allow for digging of new toilets when old one is full. Existing manual emptiers empty the pits and dump the waste maybe to a local river or stream rather than in appropriate designated locations, sometimes toilet owner's releases waste into the nearest drainage ditch during heavy rains, which is terrible in terms of hygiene and smell, not to mention the impact on the dignity of neighbors. This practices are normally unhygienically and unprofessional and affects health due to prevalence of disease outbreaks and environment contamination.

Our Approach

Umande Trust, a Kenyan Non-governmental organization has a solution of ablution blocks using underground bio-digesters to serve an average of 500people per day. 82of such facilities have been constructed across the country targeting informal settlements, market centres and learning institutions. The areas we target have over 60% of population and characterized by limited space; water supply and inadequate sewerage networks. Bio-sanitation is designed on the need to close the loop in the FSM process by applying ecological sanitation principles to ensure that human waste in ablution blocks are turned into wealth by producing gas for cooking and lighting and producing hu-manure as by-products for urban agriculture. A 1 m^3 biogas from human waste will generate 4,500-5,500 Kcal/m^2 of heat energy when burning effectively sufficient to boil approximately 100 litre of water under ambient conditions or light a lamp with a brightness equivalent to 60-100 Watts for 4-5 hours. These systems vary from the ordinary ablution blocks in that they do not utilize water for flushing away fecal waste thus saving on water compared to a normal ablution block.

Business Model

By design, these facilities are more than just toilets as they have the advantage of providing other enterprises (business centres, community halls and information centres) within, hence the name bio-centres. Bio-centres have been built to provide the communities water and sanitation services (i.e. toilets, showers, water) at a nominal fee. The average monthly income of Bio-centres is KES. 50,000 shared at a ratio of 60:30:10, for dividends, operations and maintenance and contribution to a communal development fund for further investments SANDEF. The facilities use Pay per use, monthly or bi-weekly cards, and prepaid cards to encourage universal usage. Different trainings including: governance and management, artisan training, investments, record keeping, business planning, accountability are held to ensure sustainability and ownership.

Challenges

The Bio-centres face challenges caused by high pressure for sanitation services and the digesters are too small to absorb the full amount of waste and the demand for biogas at the location is smaller than the supply and storage capacity at the centres. The current solution to the problem is to exhaust the bio-digesters when full and burn the excess biogas. The socio-cultural acceptance of use of the bi-products was a major challenge initially but through continuous, marketing and education there is a widespread increase in acceptance. Packing the biogas into user friendly containers has been a technology challenge with an aim of delinking the gas from toilets; we have adopted use of biogas puxin bags smallest size of $1m^3$ which is big for the 10*10 houses. We are sourcing for funds to construct a plant that would pressurize and containerize the gas in 6kg cylinders and palletize the hu-manure and briquettes. We have also promoted the use of the gulper and rammer for de-sludging existing pit latrines, however this has not been integrated or approved by the county policies, hence advocacy and influencing is still required at different government and city levels. Policies exist to promote use of biogas and manure from animal and organic matter, however none from human faeces.

Impact and Recommendation

The technology can be repackaged for non-networked clusters, peri urban and public spaces. We have worked with 3 different counties to scale up in markets and schools and with further engagement, more counties, regions and countries can integrate bio-sanitation as one of the technologies which will influence budgetary allocations, development priorities and potential scale up at county level. We are contributing to three SDGs: 1, 6 and 7 because of addressing poverty reduction, access to water and sanitation and energy respectively. The generated biogas is used at source or households for cooking, home and commercial use food and boiling bathing water, lighting in households charged at an affordable fee, also used in school kitchen and replacing use of firewood, charcoal, paraffin and LPG. This has been made possible because the vast partnerships to establish sustainable and profitable community owned business based on the recycling of energy and nutrients in human waste. This contributes to mitigating climate change and improving health and urban and rural livelihoods, while producing biogas and organic fertilizer for the local market eventually.

Conclusion

Participation is key at all stages of project cycle, we work with the different stakeholders in planning, monitoring and evaluation through joint field visits, design sessions, community forums, monthly accountability sessions, action planning, review sessions, business planning, using cashless platforms, and working with the existing county and community structures to ensure sustainability and easy to scale up models. We also use social media, online platforms, reports and podcasts for communication purposes on our pages and website. We are also members of different networks, thematic working groups, and social movements.

References:

1. Transformation- bio-centre story, 2014
2. Umande Trust website: www.umande.org; umande blog
3. blog post 2014, African Cities for the future,
4. School for civil engineering and geo-sciences, New castle University UK.
5. Network modeling for road based FSM-Ruth Kennnedy walker, Thomas Holderness

Learning from the Demonstration of FSM Value Chain in Satkhira, Bangladesh

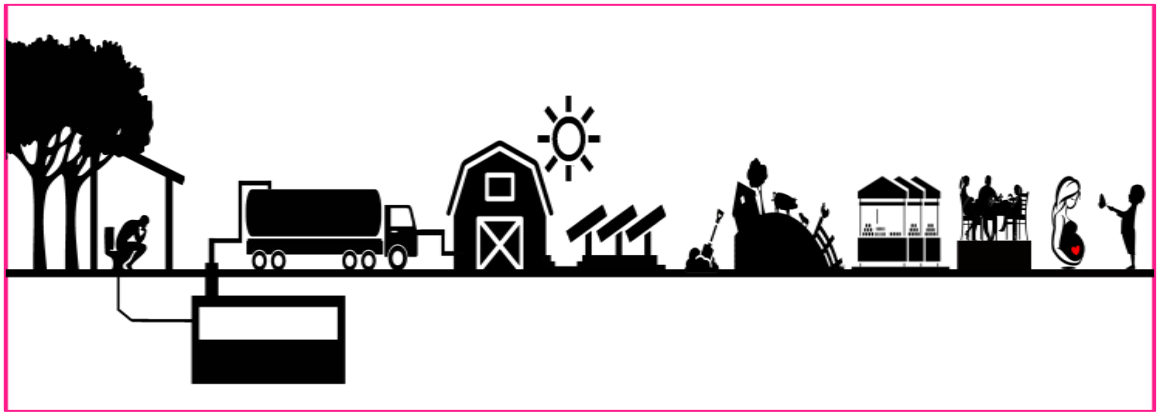
P. Kumar Saha*, D. Chanrda Roy*
Practical Action Bangladesh
House # 28/A. Road # 5, Dhanmondi, Dhaka - 1205, Bangladesh

Keywords: FSM Service and Value Chain

Conference Track: Case Study
Track Topic: Emerging FSM services
Personal Preference: *Oral presentation*

Background and Context

Satkhira is a secondary town located in South Western coastal areas where more than 150,000 people live and generate almost 40 tons of excreta per day. Aound 90% of these sludge rest in containments, mostly pit and tanks. The rest 10% illegally channels to storm drains. More than 43% of the households take emptying service in an interval of 1 to 5 years and around 80 emptier are involved with this business. They mostly use traditional equipment like bucket, drum and rope risking their health. The city wide sludge situation analysis study found this emptying service can be a business of $120,000/year. On the other hand, the municipality has around 1,980 hectors agricultural land along with provisions for rooftop gardening in high income areas and pit cultivation in slums and low income settlement, where the usage of 2,500 tons of compost from the treated sludge can be promoted (PAB 2016). The study also found the potential of a joint project on sanitation-agriculture in Satkhira town. Practical Action, Bangladesh with support from Dutch WASH Alliance demonstrated a pilot project to address the whole service and value chain of Faecal



Sludge in the city.

Design, Manufacturing and Testing of Low Cost Appropriate Equipment and Vehicle

Mud Pump: The project introduced the use of submersible pump to lift liquid and semi solid sludge from pit and tanks. The initiative performed well and was welcomed by the service providers. This is a low cost and locally manufactured pump and supporting services also available. The pump can scope around 2,000 liters of sludge per hour and the making cost is around $900. The pump has excellent performance level since its introduction in 2014. It requires only minor and infrequent modification in the suction part to avoid foreign materials while extracting sludge from containments. Both the Municipality and traditional emptier groups can buy this equipment and run this business which can make their emptying

service quick. The pump takes one third time compared to manual emptying. Moreover, it is hygienic as emptier do not come in direct contact.

Low-Cost Sludge Transporter: A modern vaccutug can cost around $43,000 whereas a locally designed and manufactured innovative Sludge Transporter of 1,000 liter capacity costs around is $4000. The transporter runs at 15km/liter on diesel. The transporter is functioning from 2014 with minor troubleshooting and repairing. Sweeper groups can easily afford the Transporter and maintain it without much hassle.

Sludge Treatment Plant

A 2,000 liter per day capacity treatment plant was demonstrated in a land provided by Satkhira municipality. The treatment plant includes 01 dumping chamber, 04 sedimentation chambers, 04 solar drying beds, cesspools and maturation pond. The STP can produce monthly 700 kg sludge cakes. The quality especially the presences of pathogen and nutrient content of compost is tested regularly to maintain standard quality. Limits of BOD and COD of waste water is also tested before discharging to open environment. In 2015, the plant produced 8.4 tons of compost with a sale value of $1,050 from 70,000 liters of sludge dumped.

Demonstration of Compost

The above compost has been distributed among 02 farmers and 210 households in peri-urban, slum and low income settlement to demonstrate for vegetable cultivation and awareness raising among the mass people. The farmers demonstrated 6 plots with different doses of only soil; soil plus 1 kg sludge compost; soil plus 1 kg cow dung; Soil + 200g Cow-dung + Chemical Fertilizer (Urea-12g+ TSP 6 g+ MOP 4g); Soil + 200g Cow-dung + Chemical Fertilizer (Urea-12g+ TSP 6 g+ MOP 4g) and Soil + 400g Sludge Compost + Chemical Fertilizer (Urea-12g+ TSP 6 g+ MOP 4g). They cultivated Red Amaranths, Radish and Cucumber. It was found from demonstrations that for all the crops the sludge compost mixed with chemical fertilizer brings the best result. In case of radish, sludge compost mixed with chemical fertilizer, enhanced the production and brought additional $6.5 benefit in each decimal cultivation. It was found 1.4 times effective than the cow-dung compost as well, while red amaranth production was 68kg in every decimal after using chemical and sludge compost; on the other hand it brings only 52kg while sludge compost replaced by cow-dung in the same manner.

Mobilization and Capacity Building of Sweeper Group

The introduction of these appropriate technologies and protective arrangement not only increased the income but also improved the personal health and social status of the sweepers. There have been several interventions for awareness raising on health, safety and hygiene issues of the sweepers during service delivery. Their capacity has been built for customer relations management for improved service and customer satisfaction. With this improved FSM services system, a group of 5 sweepers earned $ 7,700 in a single year in 2015. With this increased income they have started to send their kids to schools and invested in improved business options. Their families have improved diet consumption than before. The mainstreaming process of the sweeper groups is now visible.

Learning and Way Forward

The visible and tangible impacts from the pilot attracted the attention of different stakeholders including the municipality, department of public health engineering, agriculture research and extension departments and sanitation consumers. Practical Action is now analyzing the economics of this pilot for citywide scaling with the help of large scale urban sector development investors.

From pilot project to emerging FSM service: scaling up an innovative PPP model for citywide FSM services in Dhaka

Georges Mikhael*, Sam Drabble**, Habibur Rahman***

*WSUP, Fleet House, 8-12 New Bridge Street, London, UK; gmikhael@wsup.com

**WSUP, Fleet House, 8-12 New Bridge Street, London, UK; sdrabble@wsup.com

***WSUP, H.B.Tower, 23/G/1, Panthapath, Dhaka 1205; hrahman@wsup.com

Keywords: Dhaka; PPP; business

Conference Track:(2) Case Study Track

Track Topic: *emerging FSM services*

Personal Preference: *oral presentation*

Context: the urgent need for improved FSM services in Dhaka

The need for improved FSM services in Dhaka is well documented: only 20% of households and institutions are connected to the sewerage network, with 80% of the city's total population (now approaching 16 million) dependent on on-site sanitation systems. Most pit latrines and septic tanks are manually emptied by informal service providers, posing huge health risks to the public. The situation is complicated by the lack of clarity on institutional mandates around sanitation: Dhaka Water Supply and Sewerage Authority (DWASA) controls sewerage and main street drains; Dhaka City Corporation (DCC) has responsibility for lane drains and solid waste; and FSM has historically fallen somewhere and nowhere in between.

Recognising the urgent need for intervention, WSUP worked with DWASA to develop an innovative FSM service delivery model - the SWEEP business - which provides for previously unreached residents of Dhaka. The new service was introduced to participants at FSM3: this presentation will outline the progress made over the past year as the service transitioned from pilot project to emerging FSM service.

Founding SWEEP: a public private partnership (PPP) arrangement

Supported by WSUP and UNICEF, a lease agreement was signed between DWASA and two SMEs for vacuum tankers. As well as providing access to equipment, the agreement allowed the SMEs to provide safe and professional FSM services under the WSUP-created SWEEP brand. Allocation of responsibilities under the agreement is outlined in Figure 1. The model has advantages for both parties: the SMEs benefit from reduced risk to market entry through lower start-up costs, greater flexibility and a faster return on investment; and DWASA is able to service customers in a scalable manner across the city, while remaining flexible and maintaining ownership of its assets. WSUP provided technical and business management training to the SMEs to improve their ability to deliver services safely and profitably; and supported DWASA in developing a promotion and marketing strategy for the SWEEP brand.

Regular Operational Activities	Frequent Maintenance Activities	Infrequent Maintenance Activities	Receiving Demand	Mass Marketing	Regulatory Activities	Replacing and Increasing Fleet	Disposal and Treatment
Entrepreneur	Entrepreneur	DWASA	Entrepreneur	DWASA	DWASA	DWASA	DWASA

Figure 1: Allocation of responsibilities for the FSM service between DWASA and the entrepreneurs

Progress and scale of the business to date

SWEEP was created with a view to providing FSM services at the citywide level and this presentation will focus on the progress made in that regard. As of September 2016, the service has been operational for 18 months and has reached 95,758 people. Based on this figure, and the performance data provided in Table 1 and Figure 2 below, SWEEP has convincingly established itself as a viable business, transitioning successfully from pilot project to emerging FSM service.

Table 1: Overview of SWEEP's performance, April 2015 – September 2016

18 months	**$35,394**	**5 months**	**96k people**	**3,574 cubic metres**
Time in operation	Turnover since launching business	To break even covering fixed and variable operating costs	Served since launching the business	Quantity of sludge emptied

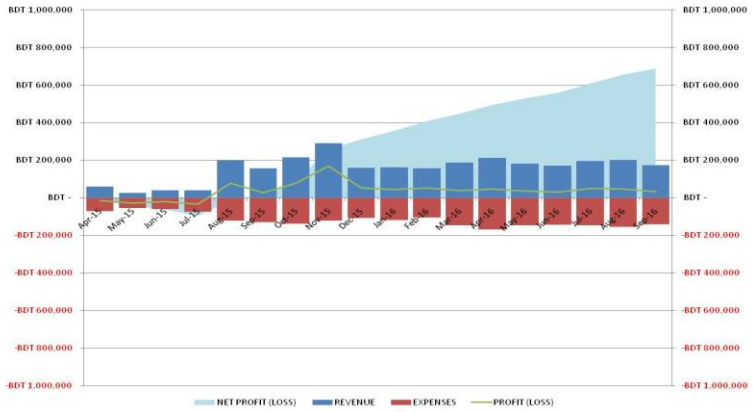


Figure 2: Overview of SWEEP's performance, April 2015 – end-March 2016.[7]

[7]Net Income (Loss) represents total revenue plus total expenditure since inception of the service; Income (loss) represents monthly revenue plus monthly expenses.

Challenges to achieving full scale-up

The key barrier to continued and future scale-up is demand creation: for example, a significant number of households in Dhaka have toilets connected to surface drains and no need for the service. SWEEP's experience has also affirmed that the provision of disposal points is essential in promoting greater operational efficiency (currently the vacutugs must be driven to the main DWASA disposal point when they become full). A significant challenge is adapting the service to reach out more effectively to low-income customers. Current profit levels are the result of an initial focus on middle- and high-income customers, including institutional customers such as hotels (indeed, the SWEEP experience suggests a combination of institutional and household customers can be highly beneficial to a FSM service, particularly in the start-up phase). Customers living in low-income areas are charged a lower tariff - typically between 0.5-0.6 BDT per litre of sludge, compared to 0.7-1.3 BDT for middle/high-income and institutional customers – and the SMEs are aware that low-income customers are less profitable. WSUP is now assessing what incentives need to be in place for the business to gradually transition to serving low-income customers.

Key to SWEEP's long-term success will be an improved enabling environment for sanitation in Bangladesh. Progress has been made since the pilot SWEEP project was launched, including invitations to WSUP to participate in a national-level institutional FSM regulatory framework development committee. The committee is expected to advocate for DCC to adopt the institutional mandate of FSM for on-site sanitation.

Next steps: replication in Chittagong

Replication and roll out of the SWEEP model in other cities in Bangladeshis already underway. Funded by the Bill and Melinda Gates Foundation (BMGF), WSUP has entered into an agreement with Chittagong City Corporation to support the development of a new FSM service under a PPP arrangement. As per the Dhaka experience, WSUP will also provide capacity building support to the private sector SMEs. The new FSM service is expected to become operational in early 2017. WSUP will continue its support to SWEEP scale-up in Dhaka, also with funding from BMGF. In addition to the challenges outlined above, this will include further optimising marketing and sales to identify and close transactions more efficiently, with more repeat and satisfied customers; and ensuring safer, more hygienic disposal of waste.

Conclusion

SWEEP is the first FSM business of its kind in Bangladesh. The innovative PPP arrangement between DWASA and the SMEs offers a model that is already being replicated in other cities in Bangladesh, and could potentially be replicated in urban centres in other countries. Notwithstanding the substantial challenges that remain in achieving genuine citywide scale, the SWEEP experience is generating very useful learning relating to the development of at-scale FSM businesses with the potential to serve low-income customers in dense urban settings. As such, we believe conference attendees will benefit from exposure to this model, the progress and learning to date.

Designing Pit Emptying Business Models to Facilitate City Scale Fecal Sludge Management Services in Kigali, Rwanda

R. Sklar, N.Greene, R.Mahoro, A.Muspratt
Pivot Ltd., Kigali, Rwanda.

Keywords: latrines, informal-communities, low-cost sanitation, bottom of the pyramid customers
Conference Track: Case Study
Track Topic: Emerging FSM Services
Personal Preference: Oral Presentation

Background

Across the global sanitation sector, developing successful pit latrine emptying business models is often hampered by a combination of cost-recovery and regulatory constraints. Here we present learnings from the first twelve weeks of deploying a pit emptying service in Kigali, Rwanda and our approaches to tackling key challenges. The service was designed to provide value to service providers (pit emptiers) by increasing the safety and efficiency of their operations and connecting them with more customers (households with full pits), and value to customers by providing an improved service that is safe, reliable, and affordable.

The ultimate objective of this trial was to develop a pit emptying service with reliable and predictable demand, which also achieved a minimum of *operational* cost recovery. This study discusses: (1) Pit emptying business development in Kigali, Rwanda; (2) Factors driving operational cost recovery in the pit emptying business; and (3) Opportunities and challenges to achieving operational cost recovery while maintaining a strong value proposition for service providers and customers.

Methods

The approaches used to achieve the above aims follow:

1. Pit emptying practices and the demand for pit emptying services in Kigali, Rwanda

a. Rapid market assessment (RMA): A RMA was conducted to assess household sanitation practices, demand for pit emptying services, availability and use of existing service provision, and local rules and regulations around pit emptying.

2. Factors driving operational cost recovery in pit emptying businesses

a. Financial record keeping: Operating costs for individual empties were closely measured. Various customer fee structures were trialed, including depth-based, volume-based, and flat fees.

b. Identification and procurement of pit emptying equipment and tools: Several sludge and trash removal tools were tested for their efficacy in removing pit sludge. The rate of removal and total volume of pit sludge and trash removed using these different tools was tracked using a mobile app.

c. Service deployment and data collection: Based on results of the RMA and following recruitment and procurement, the first iteration of a pit emptying business was introduced in one community of Kigali. After four weeks of rapid feedback and iteration, the service was expanded to a second community.

3. Opportunities and challenges to achieving operational cost recovery

a. Logistics tracking: Mobile apps were used to track logistics during pit emptying including location of the pit latrine, distance between latrine and truck, and durations of different components of the emptying process (e.g., breaking slab, trash removal, sludge removal, sludge hauling).

b. Structured observations: Emptiers were observed during the trial period to identify process inefficiencies and opportunities for service refinement.

Results:

Over the trial period, 68 customers requested and paid for the emptying service, which has since been sustained and expanded. Therefore, the business opportunity for service providers and customers proves strong. However, there remain challenges in maximizing customer satisfaction and improving the cost effectiveness of the operation.

Table 1. Operational Costs and Revenue of Pit Emptying Service.

	Cost Per Empty USD
Total Direct Costs	**$52**
Labor	$14
Transport	$37
Water and Electricity	$1
Total Indirect Costs	**$21**
Space Rental and Security	$4
Marketing	$17
Total (Direct and Indirect) Operating Costs	**$73**
Revenue (Customer Fee)	**$62**

Several fee structures were trialed including a volume based, depth based, and a flat fee, which was preferred by customers and yielded the greatest rate of operational cost recovery. The price of the service was designed to meet the willingness of households to pay while at the same time maximizing direct operational cost recovery (labor, transport, water, and electricity). At the current price point of $62 USD, the expected cost recovery per pit serviced is 84% (Table 1). The lack of complete cost recovery is due to indirect operational costs that surfaced after service deployment including high touch marketing and transfer station upkeep.

Increasing cost recovery may involve emptying more pits per day, reducing the labor requirement, or increasing the price per empty. Due to logistical limitations – namely long hauling distances from pit to truck – increasing the number of pits emptied per day requires an improved strategy for identifying geographic clusters of customers to overcome these distance and time constraints. To reduce labor costs (19% of total operating costs), a focus will be placed on developing technical improvements that reduce manual work requirements. To this end, hardware innovations are being prototyped to replace the need for manual handling of barrels with a more efficient solution for moving sludge between the pit and truck. Finally, a better understanding of the price elasticity of demand and willingness to pay for emptying services is needed determine a price point achieves cost recovery but remains pro-poor.

Practical Advances in Pit Latrine Emptying Technology

N.Greene*, D.Still**, L.Stupin*, R.Sklar*, A.Muspratt*

*Pivot Ltd., Kigali, Rwanda
**Partners in Development, Kwazulu-Natal, South Africa

Keywords: eVac; faecal sludge; urban sanitation
Conference Track: Case Studies, Emerging FSM services **Personal Preference:** Oral Presentation

Background

The manual emptying of pit latrines in Kigali, Rwanda is commonplace, yet illegal. Thus for the 60% of Kigali's 1 million population who live in informal settlements, there is no approved or safe process for servicing their primary sanitation facility. Since March 2016, Pit Vidura by Pivot Works has been working to establish a safe, legal, and most importantly, financially sustainable means of emptying pit latrines in the city's informal settlements. This abstract focuses on the technical challenges of implementing this system.

eVac

The eVac is a portable vacuum pump which was developed in South Africa by Partners in Development (PID), with the initial R&D work done as part of a larger WRC study. The design was inspired by the Mapet and the Vacutug, small vacuum pumping machines intended specifically for use in dense settlements. The eVac weighs 60 kg and comprises a 1.5 kW electric motor, a belt driven oil lubricated vane pump, and a moisture trap mounted together on a dolly frame. The machine works with a set of 50 litre capacity portable vacuum tanks, which are then emptied into separate portable barrels or a tanker.

Figure 1: The eVac can be wheeled or carried to any pit location

Figure 2 eVac with sludge barrels in Pit Vidura truck

Pit Vidura has had an eVac in service since May 2016, and in October 2016 this was supplemented by two more in response to the growing demand for the service. Gradual modifications have been made by the team to enhance the suitability of the eVac for use in Kigali (Table 2).

PID has taken this feedback on board and supplied a new eVac, the Mark3, to Pit Vidura, that will be tested in the months to come. The main differences are that the dolly chassis has been replaced with a wheelbarrow like frame for improved manoeuvrability, and a sludge level viewing port has been added to the vacuum tanks to make it easier to avoid overfilling the vacuum drums.

Table 2. eVac modifications by Pit Vidura

Modification	**Purpose**
Decrease dolly base to < $1m^2$	Enhance portability and ease of carrying through dense settlements
Replace vacuum tanks with elevated hopper system	Eliminate personal exposure and spillage of sludge during processes of transferring from vacuum tanks to portable barrels
Add screen to hose	Prevent blockages from large volumes of trash present in pits

The pros and cons of using the eVac are shown in Table 3.

Table 3. Pros and cons of eVac use

Pros	**Cons**
- Can pump to 6 m depth (increases customer satisfaction, manual pumps max out at 2 m) - Easy to operate, clean, and maintain - Easy to unclog when blocked - Customer/operator not exposed to sludge - Can be locally manufactured to a point - Aspirational	- Must continue to 'fish' for trash, thus exposing operators to sludge - High capital cost (~$4000) - Challenge to find suitable pump and replacement hoses (adds to cost and turnaround time for local manufacture).

The eVac has proven operationally successful in emptying pit latrines, in terms of portability and reducing operator exposure to sludge; but more importantly, the professional appearance and operation of the machine add an aspirational aspect to pit emptying for both customers and service providers unattainable through other manual and mobile means.

Outstanding Issues

1. **Trash -** The continued need for manual trash removal is the most significant barrier to operational efficiency and convenience. Fishing for trash continues to be a tedious, one-hour process that removes an average of just 12% of the total mass emptied. Despite the best advances in sludge pumping technology, most cannot handle trash, which therefore remains a major bottleneck. Pit Vidura is developing tools to speed up trash removal.

2. **Sludge Transport -** Once sludge and trash are removed from the pit, carrying the sludge drums to a vehicle is a challenge in Kigali's hilly alleyways, most of which are too steep for hand carts. Currently sludge is carried one barrel at a time over distances of up to 300m. Pivot is investigating a "booster" system of pumps and long hoses to carry the sludge from the pit to the vehicle in order to reduce transport time and effort.

Conclusion

It is difficult to envisage the “perfect pit emptying machine’’ given the vast range of conditions and contents encountered in the pit latrines of Kigali. The eVac has proven a good starting point and adaptations continue to be made week to week to refine it for the local context.

This local and incremental means of technology development is critical to development of practical pit emptying technologies, as it is infeasible to replicate such wide pit variations in a laboratory. The private sector should be actively engaged in the continuing improvement of latrine emptying technologies with field testing included as a continuous part of development.

References

Tsinda A, Abbott P, Pedley S, et al. 2013. hallenges to Achieving Sustainable Sanitation in Informal Settlements of Kigali, Rwanda. *International Journal of Environmental Research and Public Health*. 10(12):6939-6954. doi:10.3390/ijerph10126939.

Still DA, and O’Riordan M. 2012. Tackling the Challenges of Full Pit Latrines - Volume 3: The development of pit emptying technologies; Water Research Commission Report No. 1745/3/12, ISBN 978-1-4312-0293-5.

Support Of Manual Pit Emptiers In Freetown, Sierra Leone

GOAL Sierra Leone, 89s Main Road, Congo Town, Freetown, M. Keller, L. Chingoma, A. Fawzi

Keywords: manual pit emptying; Freetown; Sierra Leone

Conference Track: (2) Case Study Track

Track Topic: *Pilots showing promises*

Personal Preference: O*ral presentation*

Background

Over 90% of the population in Freetown are served by on-site sanitation, depending on some form of fecal sludge management (FSM). Manual emptying of latrine pits and septic tanks is common due to the city's hilly topography, the poor accessibility in densely populated areas, the small number of vacuum trucks available and the generally high content of solid waste in pit latrines making many pits unsuitable for emptying with vacuum trucks. The profession of the Manual Pit Emptiers (MPEs) is highly stigmatized by the public. The MPEs who serve about 36% of Freetown (Forte, 2016), carry out their work mostly during night hours with high levels of substance abuse (to endure the nature of the work, especially the smell) and in very poor hygienic conditions and therefore face serious health hazards.

Support provided

GOAL has worked to improve the capacity and support 5-10 MPE groups since 2010. This included the provision of protective gear, the trialing of improved emptying equipment and the organizing of training sessions to build their capacity as identified through a needs assessment (e.g. use of protective gear, O&M of equipment and basic financial management). In order to first understand where support is needed, to then promote their work, reduce their stigmatization and create an association of MPE groups, numerous community activities and focus group discussions were organized with the support of GOAL. Additionally, three transfer stations for FS (to be used by MPEs) were constructed in 2012. Unfortunately, these aren't operational yet due to a lack of political commitment, a lack of legal frameworks, problems with local community acceptance and unclear proposed management structures for the stations.

Research activities

The testing of the diaphragm pump (2012-2015) by MPEs showed that it is not suitable for the thick sludge of pit latrines; it was only adequate for the thin sludge of septic tanks. Furthermore, the MPEs were not willing to use it on a regular basis (outside of contracts paid by GOAL) due to a more time-consuming emptying process compared to the traditional unhygienic bucket method.

In April 2016, GOAL carried out a comprehensive desk review of all MPE equipment available globally (GOAL, 2016a). The most promising equipment was identified as the Gulper II as well as modified long-handled tools (such as the ''sludge digger''). Local

manufacturing and field-testing of these tools is currently on-going and the initial results seem promising.

Planned support activities

A detailed capacity gap assessment of all MPE groups was completed in July 2016 (GOAL, 2016b), and the support approach for capacity building activities is currently being drafted. A comprehensive support package to improve the skills and capacity of the MPEs will be implemented in 2016/2017, which will include efforts to strengthen the MPE association.

Two sites have been identified to put in place transfer stations for FS. One site is an existing station that was built in 2012 and will be made operational, the other site is a public toilet that will be transformed into a combined transfer station with public toilet. Transfer stations will be equipped with improved manual emptying equipment and with transport equipment to transport the FS to the transfer station. The private operator of the transfer station will make the equipment available to the MPEs and charge a small nominal fee.

Lessons learned and conclusions

The work of the past few years by GOAL Sierra Leone helped to identify some key challenges and lessons learned related to the support of MPEs in Freetown:

- If the support focuses on manual pit emptying only, a large part of the sanitation chain is left out completely (e.g. capture/storage, transport, disposal and treatment of FS) and a holistic approach of the issue is lacking. It is therefore advisable to consider the comprehensive sanitation chain from all relevant angles (private sector actors, local authorities and the public) in order to have a significant impact.
- During the identification and testing phase of the diaphragm pump, the MPE groups were not always adequately involved in the selection process, which resulted in the equipment not being suitable for their purposes. In order to make emptying equipment acceptable and ensure that it is attractive to be used by MPEs, GOAL revised their approach to include MPEs in the selection and decision-making process and consider their point of views was paramount.
- If the institutional support for the implementation of activities is very low or almost non-existent (as was the case for Freetown) it is extremely difficult to set up structures that can operate sustainably. In such cases it is required to think of direct institutional capacity building support as well as advocacy to the relevant institution.
- For initiatives affecting the public and especially for new FSM infrastructures (e.g. transfer stations), the engagement of the public, community groups, local leaders as well as politicians is paramount in order to achieve acceptability of the facility or support for the implementation of activities. The experience of GOAL (construction of transfer stations in 2012) has shown that even with strong engagement of the local communities there is no guarantee that the facility will be accepted until it is in place.
- Coordination among all stakeholders (local government, ministries, NGOs, UN agencies, etc.) is crucial to achieve sustainable objectives and to avoid duplication of efforts.

References:

Forte, J.D.C. (2016) Baseline establishment for Sustained Environmental Health Improvements in Freetown, GOAL Sierra Leone. GOAL Sierra Leone project document shared widely online and via e-mail.

GOAL (2016a) Review of Manual Pit Emptying Equipment currently in use and available in Freetown and globally. GOAL Sierra Leone project document shared widely online and via e-mail.

GOAL (2016b) Strengthening of the Private Sector Entities in the Collection and Transport of Faecal Sludge in Freetown. Consultancy Report for GOAL Sierra Leone by WSUP-Advisory.

Lesson Learned on Fecal Sludge Treatment Plant Over Passive Landfill Site

Md.Sahidul islam[1], Dr.Khondoker Mahbub Hassan[2], Rajeev Munankami[3], Dr.Muhammed Alamgir5[4], Nawatch Surinkul[5]
[1,3]SNV Netherlands Development Organisation, Bangladesh;
[2,4]Khulna University of Engineering & Technology, Bangladesh;
[5] Department of Civil and Environment engineering, Faculty of Engineering, Mahidol University, Salaya, Nakorn Pathom 73170, Thailand

Keywords: Fecal sludge treatment plant, Constructed wetland, HDPE, Passive land fill site,
Conference Track: (2) Case Study Track
Track Topic: *Practical pilots which show promise for future scaling up*
Personal Preference: *oral presentation*

Introduction

Khulna is the third largest city in Bangladesh with a land area of 45.65 square km. Major part of Khulna is under the coastal belt of the country and lies within 4 m of mean sea level (MSL). The population of Khulna City Corporation is about 1.5 million and the estimated annual volume of fecal sludge generation is 710,000 cubic meter (FTP Design, 2015). Mostly, sweepers have been employed to provide manual emptying around 81% of total desludging services and recently mechanical emptying is brought together using vacutugs. There was no designated disposal site but two small u-trenches at Rajbandh. Following the feasibility study, constructed wetland (CW) was selected for the FS treatment system. Available land of 4,000 m2 on passive landfill site was designed for the construction area. This paper presents the considerations of CW construction on passive landfill site.

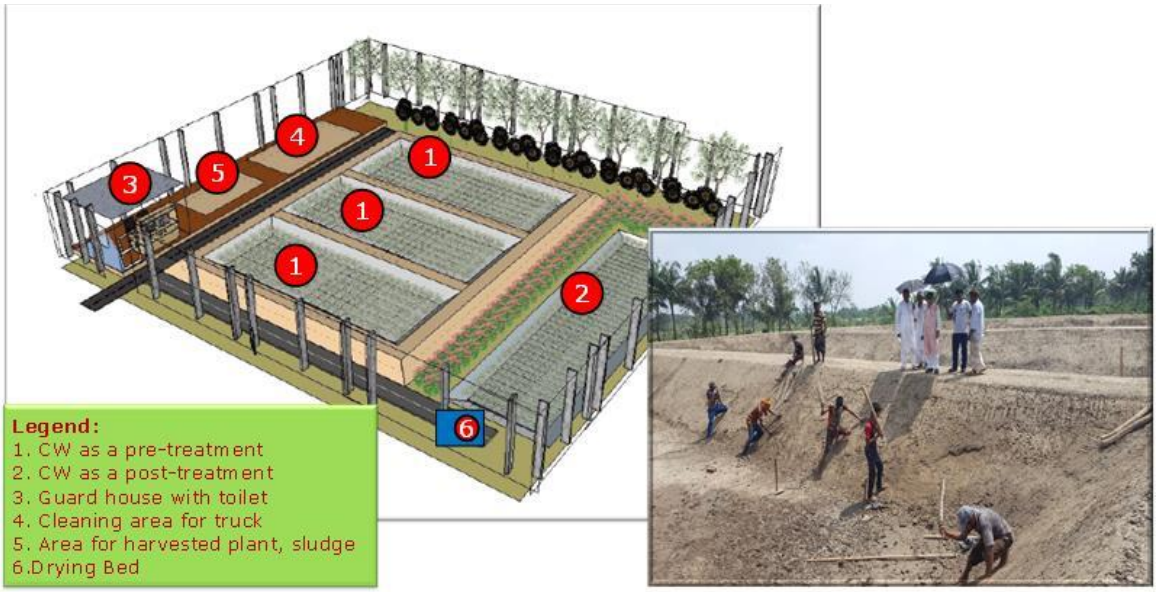


Figure 1 Fecal sludge treatment plant construction over passive landfill site in Khulna

Approaching and solution

As this was a passive landfill site, there might have risks for construction of civil infrastructures. Thus, earthen embankments with High Density Polyethylene (HDPE) and Geotextile have been proposed for the construction of wetland system. Compacted soil embankment is also expected to hold the CW ponding settlement, combustible gas migration and generation. Liners will usually be subjected to gravel and sand under high liquid weights or pressures and are exposed to indentation action. Membranes must have relatively high surface hardness to resist these pressures and puncturing. HDPE combines high surface

hardness together with other mechanical properties that enable it to move smoothly when exposed to sand and gravel. HDPE under stress may undergo elastic (reversible) or plastic (irreversible) deformation. The limit of the elastic performance is typically reached for HDPE at a deformation of 15-20% of the original length (elongation at yield). For earth works at bed and embankments, field compaction was done using mechanical roller as well as manual compactor. However, the existing ground level was found to be unusually compressed at load application and then expanded instantly at load withdrawal. This instability in field compaction was observed possibly due to the underneath loose and spongy landfill contents. In such instance, the lower value of degree of compaction (lower than 95%) as achieved practically in this site might be safe for the construction of FTP in this site. The application of high degree of compaction also required to use for transportation on that embankment, however, the embankment in this case is not for vehicle. Nevertheless, HDPE sheet will be laid over the whole top surface of FTP bed as well as embankments which could provide additional strength (approximately 20-30%) through reinforcing effect for holding the filter bed materials and accumulated sludge. Furthermore, HDPE sheet would provide additional resistance against the slope failure of embankment as well as differential settlement of FTP beds.

Conclusion

Application of flexible structure like holding pond can be used for FTP approaching on passive landfill site. The reinforcing effects of HDPE sheet laid continuously over the whole surface and embankments could be overcome the low degree of compaction on bed and embankment.

Acknowledgement

This project is developed by SNV Netherlands Development Organisation under the leadership of Khulna City Corporation (KCC) with funding from Bill & Melinda Gates Foundation (BMGF) and Department for International Development (DFID).

Reference:

1. Basic information of KCC, 2016
2. Baseline Survey Report, 2014 FSM Program, KCC
3. FTP design, 2015 KUET
4. Estimation of Jhenaidah FTP, 2016
5. Robert Spencer, Landfill space reuse, (http://infohouse.p2ric.org/ref/33/32514.pdf accessed on 11 October 2016)
6. Properties of HDPE sheet, (http://www.channelseepage.org.au/4_2_16_flexMembrane.html accessed on 9 October 2016)
7. Use of Old Landfill site, (http://www.waste360.com/mag/waste_landfill_reuse_rises accessed on 30 Sep

Faecal Sludge Treatment and Reuse in Emergencies: A Case Study from Mahalaxmi Municipality, Nepal

Rajbhandari, R.*, Dangol, B.*, Shrestha, R.*, Gautam, R.**
* Environment and Public Health Organization (ENPHO) Adarsha Marg, New Baneshwor, Kathmandu, Nepal;
** Leibniz Universität Hannover, Hannover, Germany

Keywords: Faecal Sludge Treatment in emergencies; Wastewater Reuse; Biogas and Compost Production

Conference Track: Case Study Track
Track Topic: Pilots Showing Promise
Personal Preferences: Oral Presentation

Background and Context

After the devastating earthquake in April 25, 2015, number of temporary emergency latrines were established to improve the sanitation practices and safeguard the health conditions of the people residing in the relief camps. Lubhu situated in recently Open Defecation Free declared Mahalaxmi Municipality of Kathmandu Valley was one of those areas where 10 such camps with emergency latrines were set.

Problem Statement

The intensive use of emergency latrines in the camp setup and settlements resulted the problem of overflowing Blackwater from the pits. The unsafe disposal of faecal sludge after the desludging, due to lack of appropriate FS treatment system in Kathmandu Valley, was preeminent problem during the emergency situation.

Faecal Sludge Treatment and Reuse System.

Environment and Public Health Organization (ENPHO) with support from the Municipality, Bremen Overseas Research and Development Association Organization (BORDA) and The Consortium for DEWATS Dissemination (CDD) Society established Faecal Sludge Treatment Plant (FSTP) primarily to treat the faecal sludge (FS) generated from the camp sites and earthquake affected households. The pre-fabricated treatment plant was constructed within 45 days in 300 m2 land area provided by the local NGO, Saligram Orphanage. The treatment plant with design capacity of 6 m3 per week is based on gravity flow system and have reuse potential in the existingvegetable farmland.

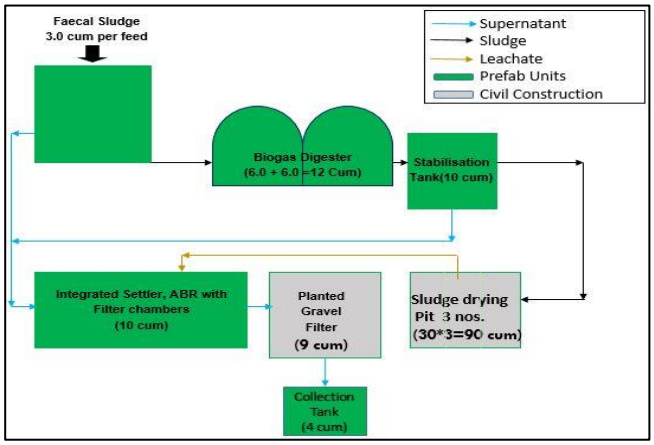


Figure 1 Flow Diagram of Faecal Sludge Treatment Plant, Lubhu

Mechanism:

The FS in the feeding tank gets conveyed into separate sludge and wastewater treatment units (**Fehler! Verweisquelle konnte nicht gefunden werden.**) after retention. The faecal sludge treatment unit includes two bio-gas digesters in series where sludge gets stabilized anaerobically producing biogas

followed by a stabilization tank and three planted sludge drying beds for bio-solids. The wastewater treatment unit includes integrated settler, anaerobic baffle reactor and anaerobic filter for anaerobic degradation of organic load, planted gravel filter for oxygenation and collection tank for treated water.

Treatment efficiency and current status

The sampling of influent and effluent samples were done two times, after 76 days and 152 days of FSTP operation. All the collected samples were analysed in ENPHO laboratory in the same day following standard methods of wastewater analysis. The selected parameters and the results are provided in the Table 1 below.

Table 1 Results of tested parameters:

Parameters	Unit	**After 76 days of operation**			**After 152 days of operation**		
		In	**Out**	**Removal (%)**	**In**	**Out**	**Removal (%)**
pH	-	7.9	8.1	-	7.3	7.5	-
Electrical conductivity	µS/cm	11840	5280	55	8370	2590	69
Total Solids	mg/L	5554	1590	71	4911	1064	78
Volatile Solid		2206	536	76	2172	319	85
Total Alkalinity as CaCO3		4390	2615	40	3730	319	91
Total Phosphorus		107	29	73	93	19	80
Total Nitrogen		1384	612	56	1003	275	73
Total Kjeldahl Nitrogen(TKN)		1384	612	56	1002	274	73
Chemical Oxygen Demand (COD)		5244	492	91	3120	280	91
Potassium (K)		299	200	33	407	141	65
Helminthes	Present/Absent	Absent					
E. coli	CFU/mL	Too Numerous To Count					

The results indicate the FSTP is good in removing organic matters and nutrients. Helminths were not present in the treated effluent, indicating safe to reuse in the farmland. Around 120 m^3 of FS (40 trucks), mainly from emergency camps and settlements, have been fed into the treatment plant. So far, 117 m^3 of biogas and 108 m^3 of treated wastewater was produced which is being used by the operator for cooking and irrigation respectively. Besides the benefits of its end-products, this FSTP is providing facilities to FS private entrepreneurs in legal disposal of FS. Despite the treatment efficiency and the benefits, the limited design feeding capacity has not been able to meet the disposal demand of the municipality. Several learning visits were made by national and international implementers and researchers. Therefore, this FSTP has been established as good demonstration complex showing potential replication in other cities.

Conclusion and Recommendation:

The promising results of the treatment efficiency, the emerging demand and the self-sustaining potential of this type of treatment plant indicates the relevance and hence the importance of scaling up of these types of systems in the rapid and haphazard urbanization context like of Kathmandu. It is recommended to conduct further research and monitoring of financial, institutional, environmental, technical and social aspects on the long term impacts of such treatment plant is essential.

Co-treatment of Septage with Municipal Wastewater in Medium Sized Cities in Vietnam

Sher Singh,* David Robbins**, and Ross Kearton

* Team Leader, Cities Development Initiative in Asia – Vietnam; sher2018@gmail.com>

**Independent septage management consultant; dmrobbins10@gmail.com

Keywords: CDIA, co-treatment, flow equalization, scheduled desludging, septage management

Conference Track: Case Study Track
Track Topic: Pilots showing promise
Personal Preference: *Oral presentation*

Abstract

The Cities Development Initiative for Asia provides technical assistance to local governments for effective planning and implementation of their infrastructure investments. In the Vietnamese cities of Can Tho, Hai Duong and Vinh, city-wide septage management has emerged as a key issue. Programs to improve sanitation through extended sewerage networks and improvements to the existing municipal wastewater treatment plants at each city are under way. These cities utilize combined sewerage systems, which collect sanitary wastewater as well as drainage and stormwater runoff, resulting in large volumes of relatively weak sewage. As these cities look for ways of maximizing their investments, the concept of co-treating septage with municipal wastewater appears to be especially attractive, offering significant benefits for cities. Co-treatment removes the need for finding new sites and assessing the environmental impacts for stand-alone septage treatment plants, as well as the need to relocate people to make way for new infrastructure. It also significantly reduces the costs of new infrastructure for septage treatment and the personnel and energy requirements for operating stand-alone plants. While these potential benefits are attractive, they must be considered along with the possible detriments of co-treatment. Municipal wastewater treatment plants are often located near the terminal end of sewer systems, which might not be convenient locations for the delivery of septage. Extra trucking distances can result in extra expenditures of fuel and wear and tear on trucks which over time can be significant. Municipal treatment plants must also be sized and designed to handle the septage while meeting the stringent water quality parameters that are often required in Vietnam.

Nitrogen in the form of ammonia and nitrate are of special concern and may be limiting factors. Can Tho, Hai Duong and Vinh all employ biological treatment methods at their municipal wastewater plants, which can be effective at removing BOD and suspended solids, but less so at removing nitrogen. To address this issue, specific strategies are proposed to limit the potential for shock loading as well as violations of discharge standards. A specially designed receiving station is employed that accomplishes partial settling and separation of the solids and liquids. The solids fraction is then sent to the sludge digestion process, while the liquids flow to the headworks of the treatment plant. In addition, flow equalization is employed to achieve even dosing of septage throughout the 24-hour day, a methodology that limits peak loading and the potential for organic overloading on the plant. Finally, the septage loading is limited to no more than 2% of the total wastewater flow to the plant, which is still less than the anticipated flow of septage that will be realized as cities implement their scheduled desludging programs.

BORDA

Management of FECAL SLUDGE [FS]

BY PRIVATE ENTREPRENEURS FOR A SUSTAINABLE BUSINESS MODEL

Case study: Kigamboni -Dar es Salaam

PROJECT BACKGROUND

For any sustainability of FSM business project, to have *Professional entrepreneur* is one of the key topics which bring challenge in this business; this paper is about the story of **UMAWA** as an experienced FSM entrepreneur who sustained into the business for a long time. 'UMAWA' is a local organization dealing with FSM business as one of the service they are providing in 3 wards [Kigamboni, Ferry and Vijibweni wards]. The organization is managed by *Mr. Mathias Milinga* as a chairperson who also donated his land for fecal sludge business. Under this organization is a Business Company called *'UMAWA oleaners'* which do similar activities as UMAWA does for profit making.

Figure 1: Transportation of Faecal Sludge

Figure 2: Emptying of Faecal Sludge

In 2010, UMAWA in collaboration with WaterAid-Tanzania established a FSM transfer station on Private land and the business model had the following set up: Sludge was emptied by a Gulper pump, poured into 350L tank by using 50L buckets, the tank was mounted to a three-wheeler motorbike called Toyo for transporting the emptied sludge from the client to the transfer station, that have been 2-semi-tanks with 3,000L each was buried into the ground at the transfer station. When these tanks were full, vacuum trucks have been called to empty the tanks at the transfer station and transport the sludge to the municipal treatment plant [Stabilization ponds].

The financial model set up was, UMAWA collects service fees from the community [100%], 30% of it was used to pay vacuum trucks for secondary transportation of faecal sludge from transfer station to final disposal [stabilization ponds], 30% used for operation expenses and 40% remained as profit.

In 2012 BORDA came up with the idea of building a decentralised Faecal Sludge Treatment Plant [FSTP] on private land as onsite treatment technology, DEWATS [Decentralised Wastewater Treatment System] was constructed on the same site to replace the transfer station for improving previous business model. In this case onsite treatment of faecal sludge saves 30% which was spent for secondary collection by vacuum [money saving], also by having DEWATS plant wastewater are pre-treated before discharged into the environmental. In additional there is production of biogas which is used for cooking

Figure 3: Onsite DEWATS Facility

purpose by the nearby family [Mr. Milinga's family].

Two years later (2014) BORDA in collaboration with a local Tanzanian manufacturer (INTEX) and UMAWA, understand that there is a need of improving pit latrines/septic tank system emptying and the transportation devices for improvement of empting practices and transportation efficiency.

Research on improving pit latrines empting technologies started by assessing limitations of existing empting devices (Gulper and Rammer) and feasibility study of existing pit latrines which had been constructed in poor standard and are in limited accessibility.

Figure 4: Developed means of Emptying & Transporting Faecal Sludge

Finally the research ended by developing technologies [SludgeGo and SIPA] that can overcome most limitations of existing devices. It can empty both watery and thicker sludge quick and in efficiency way. Also by using these devices entrepreneur provides service to many customers even in difficult toilets.

This paper will also inform about income and capex/opex cost to ran the business to be viable and gradual change of income generation from transfer station to on site fecal sludge treatment which is run by private entrepreneur.

Figure 5: Biogas as by product of DEWATS

Emerging Lessons on FSM from Maputo, Mozambique

O. Muximpua*, P. Hawkins**, J. Stricker***, Z. Mugabe****, O. Matendjua*****, A. Madamuge******

*World Bank, Maputo, omuximpua@worldbank.org
**World Bank, phawkins@worldbank.org
***UNICEF, Yangon, julia.stricker@bluewin.ch
****Maputo, zitomugabe@gmail.com
*****Maputo, matendjua86@yahoo.com.br
******Maputo, madamuge@gmail.com

Keywords: Micro-enterprise; Business model; Pit emptying

Conference Track: (2) Case Study Track
Track Topic: *Emerging FSM services*
Personal Preference: *Oral presentation*

Background and Objectives of the Intervention

Maputo has a population of about 1.2 million, of whom 89% use on-site sanitation, 10% have access to sewerage, and an estimated 1% practice open defecation. However, FSM services are limited, especially in unplanned peri-urban areas, where traditional operators and family members empty the majority of the sanitation facilities manually, and dump the faecal sludge into open drains, open spaces, solid waste collection points, or bury it in their backyards – which are now becoming full due to repeated sludge burial and the densification of housing.

Recognizing that on-site sanitation is too important simply to be left to individuals and an unregulated informal sector, Maputo City Council, 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. 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 the city.

Service model

Five "primary" operators were established to collect and deliver faecal sludge to transfer stations (simple underground storage tanks) through the narrow alleyways of Nhlamankulo. They were equipped with hand tools, a Gulper, a trash pump, and a 0.5m^3 plastic tank mounted on a handcart. Three "secondary" operators were additionally provided with a 2m^3 plastic tank that could be taken directly to the wastewater treatment plant (WWTP) on a small truck. Subsequently, they were also equipped with 6m^3 tank trailers, to substitute the transfer stations, which had proved impossible to construct due to community resistance. Responding to this situation, the operators quickly adopted a "joint venture" model, whereby a primary operator would link up with a secondary operator to provide transport. Over time, the primary operators gained more autonomy by buying a 2m^3 plastic tank and hiring a small truck when required for transport to the WWTP, essentially eliminating the distinction between the two types of operator.

Costs and financial data

It should be noted that because the operators were paying a nominal contribution towards the equipment, based on their revenues, 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 two years, 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.

Operator	No. of emptyings: pits	septic tanks	Revenue	Cost	Operating profit	Depre-ciation	Net profit (loss)
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)
Sizema	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

Key lessons learned

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 mechanized 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. Improvements in 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.

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.

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 organizations, 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 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 WWTP, which is the most expensive component of the service. How to subsidize this effectively and sustainably will be the subject of future work.

References

Strande, L., Ronteltap, M. & Brdjanovic, D. (2014) Faecal Sludge Management. Systems Approach for Implementation and Operation. IWA Publishing

Chowdry, S. & Kone, D. D. (2012) Business Analysis of Fecal Sludge Management: Emptying and Transportation Services in Africa and Asia. Bill Melinda Gates Foundation

Hawkins P. & Muximpua, O. (2015) Developing Business Models for Fecal Sludge Management in Maputo, World Bank WSP Technical report

‘It’s not only the technology’: Running a successful pit emptying business in Kampala, Uganda

J. Businge *

* Forever Sanitation Ltd, Kampala, Uganda, eforeversani@gmail.com

Keywords: Pit emptying, fecal sludge management, sludge removal

Conference Track: (1) Case Study Track
Track Topic: Emerging FSM Services
Personal Preference: Oral presentation

Introduction

This paper describes my work as a pit-emptying entrepreneur in Kampala, the capital city of Uganda. I established my business, Forever Sanitation Limited, in 2013, with the help of the NGO Water for People. Since starting operations in March 2013, we have emptied the pits of over 1 250 customers, removing 2 500 000 liters of sludge in 12,500 barrels, and enabled more than 30 000 people to continue using their pit latrines.

I started my business after I received business training and support from the NGO Water for People. They advertised a new business opportunity, Gold Harvest, through their Sanitation Marketers and on the radio. It turned out that Gold Harvest was about using the Gulper to empty latrine pits in low-income areas that are not generally accessible to larger waste removal services or where other methods of waste removal are not affordable. By using the Gulper to remove sludge, latrine pits can be re-used, rather than being abandoned when full.

How we empty pit latrines

In 2011, Water for Africa commissioned a rapid market analysis of Kampala’s sanitation sector, and found that over 70% of Kampala’s population rely on pit latrines, and that six in ten households share their toilets. Those who empty their toilet pits, rather than covering over full pits and building a new toilet, use cesspool emptiers or manual emptiers. Manual emptying is usually done very unhygienically, using a broken jerry can and a rope. This is also labour-intensive and time consuming.

In partnership with Engineers without Borders, Water for People saw this as an opportunity to develop and provide more innovative and suitable equipment for manual pit emptying in Kampala. One of these devices is known as the Gulper, which Water for People has been promoting to empty both lined and unlined pits in Uganda’s towns.

The Gulper reduces the content of filled-up pits, but it cannot empty them completely. Ugandans are happy to use the Gulper, but even the longest Gulper is 3 meters, and our clients’ pits are much deeper than this. They excavate and dig according to the cash they have, as a deep pit will take a long time to fill up. Some pits are over 10 meters deep, but the average is 4 to 6 meters. We have tried to overcome the challenges of this depth by tying a rope on a three-liter jerry can container with part of the top cut away. We scoop the sludge out with a big focus on health and safety, using gloves and protective clothing, and we clean all surfaces frequently as we work. Using the rope, we can scoop as deep as six meters.

We practice safe disposal. The National Water and Sewerage Corporation sludge dumping sites in Kampala are designed for vacuum tanks with hoses, and cannot accept

sludge in barrels. To overcome this problem, we designed a funnel with hosing at one end and a cage screen in the middle to screen out rubbish. This allows us to create a healthier environment with a reduced risk of diseases such as cholera and dysentery that occur in dense settlements not accessible to vacuum tankers.

It is not only the technology that makes our business successful. It is also the commitment of our organized team, which is well trained and complies with the requirements of government and community. At the start we were focusing only on slums in Kampala, but later we found that there is high demand everywhere, in Kampala and in most parts of the country. We are emptying everywhere now and we are serving whoever needs the service, because one of our aims is to improve sanitation in Uganda through pit latrine emptying.

Business strategy

Most households in slum areas of Kampala are situated in low-lying areas with a high water table, and need regular need pit emptying services. The customers pay Forever Sanitation Ltd 30,000/= ($8.6) per 200-liter barrel removed and transported to the treatment plant. This is affordable to the household because they would otherwise have to pay a minimum of 250,000/= ($71.5) per 1,000 liters of sludge using the cesspool truck, and that is only if there is an access road to the pit. For the same quantity of sludge emptied (1,000 liters), Forever Sanitation Ltd customer would only pay about 150,000/= ($42.9) – or less, because the customers decide the number of barrels they can afford.

We add an average of two drums of water per pit to soften the sludge, but not all toilets need that. For some we just need cleaning water only. We first agree with the client if we find that this latrine will need water. We do not charge for water and bring our own in reserve barrels. We using a pick-up truck with a capacity of 10 barrels. For every trip we generate 300,000/= ($85.7). We pay labor, dumping fee, fuel and disinfectants costing a total of 122,000/= ($34.8). After all these expenses, Forever Sanitation Ltd is able to make a profit of 178,000/= ($50.85) on average, and do two trips a day.

There is a lot of demand from customers for pit odour additives that manage odor. We sell Pit Odour Killing, and add good quality Jazzy Fluid to the pit. We would be pleased to learn about other additives that can manage the odor. For every 20 liters we use, Forever Sanitation Ltd is able to make a profit of 300,000/= ($85.7).

Future plans

The company has started saving for a cesspool truck, because we found there is big demand. The existing Cesspool service providers are arrogant. They don't have offices and they have not attended any emptying trainings. They just use their mechanical knowledge so most people do not trust in them. We also plan to construct a treatment plan for our company so we can empty sludge safety after the National Water treatment plant closes at 6 pm. We also plan to construct transfer tanks which will help to us to avoid traffic jam problems in the city. We plan to extend emptying services to other neighboring countries like Kenya, Congo, Rwanda and Tanzania.

Successful Sludge Enterprises in Small Urban Centres in Zimbabwe

Authors: Potter, A; Msamala, J; DeGabriele, J; Harper, M; Mapuranga H

Keywords: mobile desludging units; technology applicability; small scale entrepreneurs
Conference Track: (2) Case Study Track
Track Topic: Pilots showing promises
Personal Preference: Oral presentation

1. Background and context:

Current options for desludging latrines in Zimbabwe are limited. While honeysuckers are available in small urban centres (SUCs), they are mainly found in cities and not well suited to dense settlements because they are too large, require significant investment, and provide low suction and are often not operable. For the most part, Zimbabweans are unaware that latrines can be emptied and instead build new latrines when pits fill up[8], or engage manual labourers to empty full pits and septic tanks. As a result household and institutional toilets with perfectly good infrastructure are often abandoned due to full pits, which is both costly and results in reversion to open defecation. Moreover, in peri-urban areas and small urban centres, where rapid population growth is being experienced, available land is decreasing in proportion to population expansion. The net result of these factors coupled with fiscal constraints on the provision of reticulated sewage systems for rapidly expanding peri-urban populations means that desludging already existing pit latrines may be the only option for sustaining a viable excreta disposal system in line with the sustainable development goals.

The research is trialling a prototype mobile desludging unit (MDU) developed by WASTE-Malawi[9]. The MDU created a viable faecal desludging business in Malawi and improved sanitation services. The Research into Sludge Enterprise (RISE) initiative therefore intends to trial this in Zimbabwe so that the same benefits can be realized.

2. Problem statement

Currently Zimbabwe does not have an appropriate technology for emptying latrines in dense settlements, especially where these latrines have high solid contents and contain rubbish that is often disposed of in pits (diapers, pill boxes etc).

3. Objective/s

The Research into Sludge Enterprise (RISE) initiative is mid-way through trialling the feasibility and applicability of MDUs in small urban centres in Zimbabwe. The initiative aims to assess the potential contribution of this technology to improving sanitation services in this and similar contexts.

4. Methodology

The Technology Applicability Framework (TAF)[10], a decision-support tool to assess the applicability, scalability and sustainability of a specific WASH technology to provide lasting services in a specific context, has been adapted and applied as the primary research tool. Users, operators and local authorities and regulators are engaged as action research

[8] M. Jere, A. Dzotizei and M. Munjoma, 1996. Sustainability of Water and Sanitation Systems: Pit latrine using motorised equipment.
[9] WASTE and NL Red Cross Advisers, 2014. Testing and Developing of Desludging Units for Emptying Pit Latrines and Septic Tanks. Summary of Findings field work in Blantyre, Malawi.
[10] Olschewski A, 2013. TAF Manual, WASHTech Project

participants, using the TAF (a) at the feasibility stage in order to inform the introduction of the MDU; (b) at mid-line in order to inform implementation and (c) at end-line to inform scaling up.

Table 1.1 Expected Changes

• Private sector companies providing clean affordable mobile desludging services to all households and institutions.	• Faecal sludge being treated and disposed according to local authority/national regulations.
• The useful life of onsite latrines will be extended due to cost effective emptying services	• Improved partnerships and better accountability between service providers, consumers (households and schools) and local authorities/ regulators for the provision of desludging and other sanitation services.

5. Pilot areas

The action research project kicked off in April 2015 and will end in March 2017. A private company was selected from 16 applicants and, based on clear actions identified through TAF 1, has introduced the MDU in Norton (a township near Harare) and Zvimba's SUCs. An MoU is in place with the Local Authority (Norton Town Council, NTC), an operating licence is in place, a customer feedback mechanism has been introduced and approximately 100 households have received and paid for the service to date.

6. Cost data

A business model was developed using the Business Model Canvas tool. This process reveals that the MDU has 2 value propositions:

- It can remove difficult sludge more effectively and safely than a honey sucker or manual emptying
- This can be marketed as a cost effective exercise to rehabilitate household and institutional toilets in schools, health centres by NGOs and industrial sites.

Table 1.2 Customer Segments

• Paying households in high density areas should represent around 20% of the revenue – lower charges, and higher operational costs given more dispersed customers.	• Enterprises such as mines, NGOs etc. while numerically a smaller number of clients, they typically have more toilets (over 30) and can pay more. The business should target that they represent 80% of the revenue.

Capital costs for the MDU have been covered by the project for 2 years, operational costs per trip are a total of 20 USD, households are charged 35 USD per trip of $1m^3$, net profit is 15 USD per trip.

At around $20,000 for one imported MDU unit, capital costs are a serious barrier to entry into the business and a barrier to a profitable business. Efforts are now at designing and producing quality local MDUs for around $10,000 with the added advantage of availability and service capacity.

7. Lessons learnt to date

- There is demand and the service is affordable, but it needs to be offered to its niche (high density latrines rather than large septic tanks).
- Commercial customers, NGOs and institutions are crucial for business viability
- Local authorities need to see the value of the service as an extension of their sanitation provision mandate rather than a threat to their service provision or an opportunity for increased income
- Formal agreement is needed between the operators and the local authorities, brokered by an independent agency such as an NGO if needed.
- Customer feedback mechanisms are crucial, as is ongoing, target-oriented, marketing
- Regulatory support is necessary, enforcement of bylaws to reduce illegal manual emptying and disposal crucial

Citywide coordination of the septage management market in Vizag, India

Georges Mikhael*, Akhilesh Gautam**, Sam Drabble***

*WSUP, Fleet House, 8-12 New Bridge Street, London, UK; gmikhael@wsup.com
**WSUP Advisory, 1207 DLF Tower, Jasola District Center, New Delhi; agautam@wsup.com
***WSUP, Fleet House, 8-12 New Bridge Street, London, UK; sdrabble@wsup.com

Keywords: India; PPP; business
Conference Track:(2) Case Study Track
Track Topic: *emerging FSM services*
Personal Preference: *oral presentation*

Context
Visakhapatnam (Vizag) is a city of over 2 million people and the second largest city of Andrar Pradesh. Led by Greater Vizag Municipal Corporation (GVMC), Vizag has already made impressive progress towards achieving open defecation free (ODF) status: the city has advanced from 44th to 5th in the national-level Swach Sarvekshan survey, distinguishing Vizag as one of the cleanest cities in India. A critical next step is to strengthen provision of FSM services to keep pace with rapidly increasing levels of toilet access under Swachh Bharat Mission (SBM). This presentation will outline planned activities to stimulate and coordinate the FSM market at citywide level in Vizag. The overall objectives of these activities are to (a) improve the quality and affordability of faecal sludge emptying services, and (b) provide financially and technically viable decentralized faecal sludge treatment and reuse facilities. The presentation will focus on the results of the supply market assessment and pre-feasibility assessment.

Results of supply market assessment
The first step in improving FSM services was to conduct a rapid assessment of the supply market in Vizag. The assessment looked at trends over the past 15 years (2002-2016). Key findings were as follows:

- Citywide demand for Vacuum Tank Operator (VTO) services had fallen by up to 40% due to an increase in connections to sewers (30% of households are currently connected), and despite substantial population growth.
- Supply of VTO services experienced significant growth (15x) due to greater availability of affordable financing (24% APR) for vacuum tankers and relatively cheap retrofitted vacuum tankers ($15,000).
- Number of jobs completed per vacuum tanker had significantly decreased (by up to 90%) due to the increase in number of VTOs. However prices still increased (50-60%), possibly due to price collusion by the largest union of providers.
- Lack of competition in the market has resulted in low efficiency and lack of affordable services to the urban poor. Very low demand has allegedly resulted in some VTOs using deceptive practices to increase revenue from customers (for example, emptying more loads than is necessary). VTOs have no training on overall health and safety and don't use appropriate safety equipment.
- SBM has created the potential for increased demand and new customers, but this will only materialise if prices become more affordable. If prices remain high, households will resort to manual scavengers who offer cheaper services and are viewed as competition (VTOs claim some of these manual scavengers may be government employees, e.g. waste collectors).

- A majority (55 / 58) of VTOs dump in drains; only 3 have been given informal permission to dump at one pumping station. However all are interested in obtaining a permit from GVMC to dispose of sludge in approved locations.

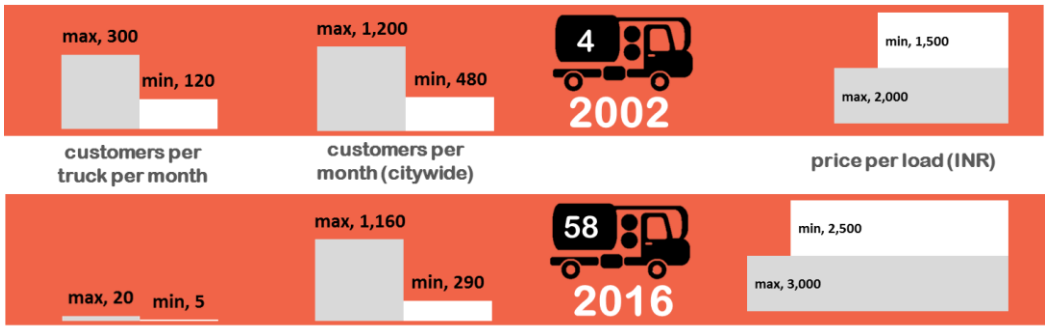


Figure 1: Comparison of VTO market in Visakhapatnam, 2002 – 2016.

Pre-Feasibility assessment

After outlining the supply market assessment, we will present results of the pre-feasibility assessment, planned for October-December 2016. The assessment includes activities in five key areas:

Enabling Environment

- Review of the *Septage Management Guide for Local Governments* (David Robbins), Visakhapatnam SLIP, and other relevant policies and strategies to address institutional and governance issues, as well as case studies of other cities' approach to septage management.
- Assessment of GVMC's institutional capacity to prepare and implement a Citywide Septage Management Plan (cSPM). This assessment will include mapping the available resources and gaps within the mandated departments or roles.

Demand for Emptying Services

- Estimate of historical, current and future percentage of each type of containment system (i.e. pit latrine, septic tanks, sewerage system or surface drains), broken down by ward level (conducted in collaboration with each ward's ODF Coordination Committee (ODFCC) and as part of the process of preparing a Ward Septage Management Plan (wSMP)).
- Estimate of total volume of faecal sludge accumulated (and theoretically requiring emptying) for each ward, using data on design and performance of the different containment systems in India.
- Assessment of ability of low-income customers to pay for safe emptying services; registration of those unable to pay.

Supply of Emptying Services

- Estimate of current citywide demand (e.g. m^3 per month) for manual and mechanical emptying, using written or verbal accounts from service providers of demand for emptying services.
- Registration of manual scavengers and assessment of their ability and interest to seek alternative livelihoods (in collaboration with each ward's ODFCC and as part of the process of preparing a wSMP).
- Evaluation of cost of emptying services and comparison to current prices.
- Assessment of basic supply of services (number of vacuum tankers, vacuum tanker businesses, total / average volume of septic tanks, alliances / unions, number of manual scavengers, etc.)

Existing Disposal Points

- Technical evaluation of disposal points (i.e. pumping stations and sludge treatment plants - STPs), including design and available capacity of each facility (e.g. maximum 20 m^3 per day at pumping station 1).
- Mapping of unsafe disposal hotspots where septage is typically disposed of by VTOs, in collaboration with each ward's ODFCC and as part of the process of preparing a wSMP.

Waste to Resource (W2R)

- Evaluation of the market for faecal sludge by-products, including estimated capacity of the W2R facilities required to address gaps in current and future capacity, and potential siting based on geographic concentration of faecal sludge generation, space availability and location of existing disposal points.
- Landscape assessment of businesses interested in investing and/or operating a W2R facility.

Conclusion and next steps

Efforts to improve FSM services in Vizag are still in their formative stages. Following the pre-feasibility assessment, a feasibility assessment will be conducted, including designing and preparing a pilot plan for the permitting process and disposal scheme; retrofitting of existing disposal points to promote medium-term access to dispoal points; preparing guidelines for ODFCC wSMP; and preparing a business case for W2R facilities. The feasibility assessment is planned for January – March 2017: we will report emerging findings in this presentation where possible. The activities will be followed by implementation of the full pilot from April – September 2017. The citywide septage management plans for Vizag are ambitious; should the project be successful, it could present a model for other Indian cities to replicate as SBM continues to gather pace. We believe it will be of value to conference participants to learn how GVMC and WSUP are approaching this complex task.

Desludging-Operators' Association - Cesspool operator as key stakeholder in FSM policy

Debisha Sharma,
CDD Society
Keywords: Cesspool operators

Conference Track: Case Study Track
Track Topic: Cesspool Operators
Personal Preference: Oral presentation

In India, cities have grown rapidly in the past 2 decades. But as in most cases of rapid and unplanned growth of cities, basic and necessary urban sanitation infrastructure has not grown. Underground drainage systems have not expanded to keep pace with the growth of the city. Hence, various types of decentralized sanitation infrastructure have been adopted across the country in regions where centralized sewerage network is absent. These decentralized systems i.e. septic tanks, pits and decentralised Sewage Treatment Plants (STP) are less resource intensive and more adaptable to local conditions.

Pits and septic tanks accumulate solids in the form a viscous fluid called faecal sludge over time. This faecal sludge needs to be periodically removed from these systems as a part of their required periodic maintenance. This process of removing faecal sludge from on-site sanitation systems and transporting it for treatment or disposal is called **desludging**. Thus, desludging service providers form the crucial link between users of toilets and safe disposal of faecal sludge into the environment.

Despite being such an important link, in most areas, the business of desludging services is not organised. Bangalore is no exception to this. The city has witnessed an exponential growth in the desludging business in recent years owing to a growth of population in unsewered areas in and around the city. However, in the absence of an organised voice speaking for desludging service providers, they have very limited communication with the government. As a result, policies/rules and regulations governing their businesses are passed without any consultation with the service provider and without taking into account the practical issues facing the business.

A prime example of this is the laws regarding disposal of sludge. These laws provide for a penalty mechanism to arrest indiscriminate disposal of waste of any kind without treatment into the open environment (including open water bodies). The availability and accessibility of sludge treatment facilities is extremely limited. In the case of Bangalore, the agencies dealing with sewage and wastewater are Bangalore Water Supply and Sewarage Board (BWSSB) and Karnataka State Pollution Control Board. Currently, only 2 out of the 14 STPs allow sludge to be disposed in their premises and both are located in southern Bangalore. On the other hand the service providers move around the entire city, so it is not practical for them to travel across their area of operation and dispose in these STPs. This lack of safe disposal sites leads to rampant disposal in the open which poses serious environmental and public health repercussions. Since, the law makes dumping in the open illegal, the service providers often face harassment by law enforcement.

Besides this, there is hardly any provision for training and capacity building of organizations and individuals involved in desludging operations. Challenges posed by hardened sludge in old pits and lack of access to pits - when the pit is located below a civil structure (like right below the toilet, storm water drain etc.) - require proper training so as to handle the operations safely.

In many parts of the world, the desludging service providers/ operators' associations fulfill the roles of government liaising, lobbying for favourable policies, providing training and business development. Washington On-site Sanitation Association (WOSSA), North Carolina Septic Tank Association (NCSTA) are examples of such associations. In India, desludging service providers/ operators' associations at Kochi, Trichy and Coimbatore have been instrumental in government liaising, framing licensing regulations and putting pressure on government to provide treatment facilities for the sludge. In the absence of such interest groups/ association, many of these roles remain unfulfilled.

With reference to the problems and limitation faced by the desludging service providers, the project titled “Strengthening the Operation & Maintenance Sector for Servicing Decentralized Urban Sanitation Infrastructure in Karnataka, India” funded by the Bill and Melinda Gates Foundation aims to organise the desludging service provider/ operators. The purpose of bringing the operators together is to create a platform for collective discussion and consideration of all matters pertaining to desludging services, to empower those owning and operating said services and help them improve their business. As a part of this effort, 90 (of the 100+) desludging service providers in Bangalore have been contacted. Meetings have been conducted and 5 zones were created based on the office or base locations of the service providers. Zone-wise representatives were chosen by members for discussion with the government bodies. This desludging service providers' group is informally named Desludging Operators' Association (DOA).

The ultimate goal of DOA is to protect and promote the interest of the members by making the association a key stakeholder in the policy making process. The key to this is to strengthen communication and liaising between the policy makers and the association. Making them part of the policy will also bring focus on the challenges in maintenance of on-site sanitation systems (pits/ septic tanks and decentralised STPs) and factors leading to lack of legal compliance while performing desludging operations, disposal and treatment.

Two major challenges in this process are to bring the desludging service provider/ operators together and to liaise with the government. The desludging service provider/ operators until now have functioned individually and for their own gains. The very idea of an association is not appealing to many who view that being part of such group would mean compromising with their own interest. On the other hand, the government has for long viewed centralized sanitation system as the only way to address sanitation needs. With the increasing emphasis and expansion of on-site sanitation systems owing to rapid construction of toilets under Swachch Bharat Abhiyan, the government has to focus on the rules and regulations pertaining to on-site sanitation systems. Also, the policies of zero-liquid discharge for apartments, commercial and industrial complexes have led to rapid expansion of decentralised STPs. All these interventions require desludging services for maintenance. Therefore, given this favourable policy and political environment, this is the right time to organise the long scattered desludging service providers/ operators and give them a seat at the policy making table.

References

1. Strande, L; Ronteltap, M; and Brdjanovic,D (2014) Faecal Sludge Management Systems Approach for Implementation and Operation. IWA Publishing.
2. Desludging of Septic Tank Service Package. BORDA 2015