



**Sanitation**  
**MATTERS**  
A Magazine for Southern Africa

ISSUE 4 – MARCH 2013

# FAECAL SLUDGE MANAGEMENT IN AFRICA

## Developments, Research & Innovations



Sanitation Matters is a knowledge sharing publication of the Southern Africa Knowledge Node on Sustainable Sanitation (SAKNNS). The purpose of the publication is to share information and knowledge on sustainable sanitation within and outside the Southern Africa region.

# In this issue

We bring you an update on developments, research and innovations in Faecal Sludge Management (FSM) in Africa, as presented at the recently held 2nd International Faecal Sludge Management Conference (October 2012).

The conference attracted both continental and global speakers, an indication that there is a lot of knowledge and experience to be shared in this critical area of Faecal Sludge Management.

Topical themes shared at the conference included:

- Technology and Innovation
- Understanding On-site Sanitation
- On-site Sanitation as a Business
- Socio-political Aspects of On-site Sanitation
- Toilet Design for FSM Optimisation
- Pit Emptying – What are the Options?
- The 'How' of Faecal Sludge Treatment
- Waste Not Want Not - Beneficial Use of Faecal Sludges
- Health Aspects of Faecal Sludges

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# The Impact of Prices and Tariffs on Faecal Sludge Management in Africa

Ujah Oliver Chinedu\*, JeanMarc Yofe\*\*, Lucia Henry\*\*, Joseph Wethe\*\*, Gilles Djagoun\*\*, Idrissa Doucoure\*\* and Mansoor Ali\*\*\*

The MDGs identified sanitation services as key factor in lifting people out of poverty. However, despite all efforts (human, material and financial), Africa is off-track. Sanitation is a complex and multi-faceted sector with a wide range of service providers, technologies and approaches interwoven with distinct cultural, institutional and sectoral environments. These variants can be viewed as being comprised of three main components; supply chain, user demand and policy environment.

The social and economic benefits of providing quality sanitation to the poor are colossal, but such benefits are realised at very high costs to investments or utilities. Tariffs and prices/charges are the means by which private and public utilities achieve fiscal sustainability. Just like in most sectors, cost recovery is crucial for investments in the sanitation sector. African utilities (both private and public) operate in a high-cost environment. These high costs, occasioned by the need to recover investments and cover at least partial operation and maintenance costs, make sanitation prices and tariffs higher in the continent.

How do these high or low prices and tariffs affect faecal sludge management in Africa? This project investigated this issue based on a recent urban sanitation price and tariff benchmarking case study carried out in six countries of Africa by WSA and other partners, namely Senegal, Burkina Faso, Ghana, Cameroon, Kenya and Mozambique. The countries were selected on the based on the following criteria:

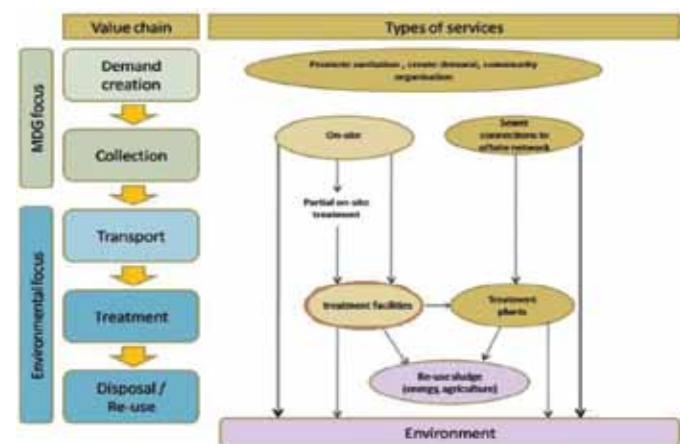
- A country where evidence is available that tariffs played a role in improving access to the sanitation service, especially in reaching the previously un-reached households through water utilities (Senegal)
- A country with a well-functioning utility exists and has made some progress in improving access to water, but it has not achieved higher sanitation targets, especially in reaching the un-reached (Kenya)
- A country/cases within countries where other actors, such as informal and small scale providers could provide good principles in getting users charges (Mozambique),
- A country where utilities and local governments have not been successful due to poor tariff and pricing structures (Cameroon).
- A country where a successful model of setting and implementing sanitation charges exist through non-state provision, such as through NGOs in partnership with local governments and utilities (Burkina Faso)
- Countries where a successful government model through local government provision exist (Ghana)

The research process involved five major stages, including development of data collection tools, preliminary exchange meetings, field data collection and analysis, national validation workshops, and report writing.

The impact of prices and tariffs were examined using five major criteria: equity, economic efficiency, fairness, affordability, cost recovery and incentives for scale up.

From their analysis, the project team made the following policy conclusions:

- Well-structured and clearly defined tariff structures for urban sanitation services are in their infancy;
- Parts of the value chain are missing in the study locations;
- Ineffective managerial and regulatory frameworks hinder the realization of economies of scale; and
- Sound and affordable tariff structures offer a key means to achieving sustainable urban sanitation; unblocking the barriers to achieving greater economies of scale will help to realize this.



Sanitation services framework (Adapted by the Author from OBA Working Paper Series Paper No. 10, September 2010)

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# The Sustainable Sanitation Design Concept for Sludge Treatment for Cities in Africa

Karsten Gjefle



Sustainable Sanitation Design (SuSan Design) is a business minded organisation which aims to:

- Develop and deliver innovative service concepts and products to form a sustainable sanitation value chain assuring schools, high density cities and refugee camps with quality sanitation systems,
- Create incentives and turnover by enabling return of the nutrients from human excreta as safe agricultural inputs for farmers and flower exporters.

The organisation has developed an innovation - the Susan Design Secondary Treatment Unit (2nd TU), in which sludge is handled with a methodology developed in cooperation with the Swedish University of Agricultural Sciences. The treatment methodology is science based, thoroughly tested and certified by SLU researchers. It has proved to be a robust and cost effective method for up-cycling human excreta to a safe natural fertiliser and soil conditioner. Through local entrepreneurs the potential exists to change the view on human excreta from community cost driver to value creator.

The treatment process is low-tech, cheap, and suitable for decentralisation. The intention is to create a network of entrepreneur-managed treatment units, organised within the framework of national franchises or local cooperatives.

The treatment methodology, if scaled up across Africa, can potentially bring enormous volumes of safe fertilizer and soil improvement products to agriculture, resulting in flower export and fodder production to sustain the growing urban populations who depend on locally

produced food. In addition to the fertilizer aspects, our units will replace pollution with green economic growth.

The main advantages of our treatment system are:

- It can become an integral part of the mix of existing sanitation systems
- It creates incentives for low water use and safe nutrient recovery
- There are no bottlenecks in scaling up to units serving millions of users with decentralised treatment units in cities across Africa
- No external energy is needed to run the process
- The nutrients in the sludge are well suited for conservation/low till/sustainable agriculture

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# Clean Team: An Affordable Sanitation Service With Soul

## The Uniloo Approach to Sanitation in Kumasi, Ghana

Andy Narracott

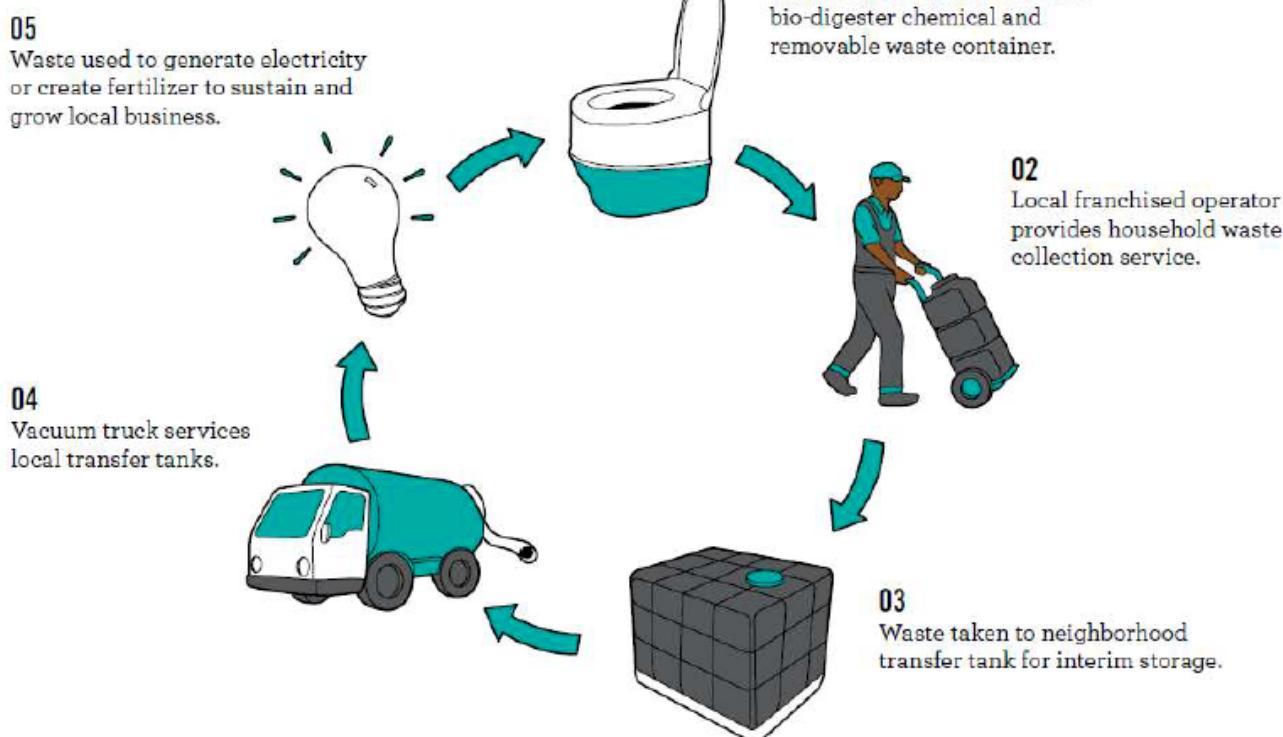
**C**lean Team is an end-to-end sanitation solution. The company's mission is to do sanitation right for the consumer, introducing comfort and convenience into in-home sanitation. It is Clean Team's objective to see the demise of long walks and long lines, and put an end to unpleasant experiences inside uncomfortable facilities.

Clean Team is a smart in-home toilet service that is not only a sanitation business, but also a social business. It is the result of a collaborative partnership between WSP and Unilever that began exploring opportunities for urban sanitation in September 2010, and started a 6 month pilot in July 2011 serving 100 households in Kumasi, Ghana. It has fused sanitation and branding expertise to create a desirable market-based sanitation service that people want and can afford. Customers are provided with the engaged, reliable, and polished service we call Clean Team: a sanitation solution set on redefining the status quo.

When the waste leaves the household, it is disposed of responsibly; when employees are recruited, they are trained in customer service as well as hygiene and personal safety; when business is conducted,

it is done for public health as well as profit; and where opportunities exist, economic value is created from human waste.

The Clean Team toilet is supplied to customers free of charge in return for a regular service charge. The toilet is emptied 2-3 times per week by trained operators, and a Service Associate visits the household regularly to collect service charges and sell hygiene and cleaning products. The waste is taken to a site in the local area for emptying and onward transport to municipal treatment sites by vacuum trucks. Following a successful pilot, the business will soon be serving over 1000 toilets in three low-income neighbourhoods of Kumasi.



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# Fortified Excreta Pellets For Agriculture

J Nikiema, O Cofie , R Impraim, P Drechsel

Clean Of Ghana's 24.2 Million inhabitants, 95% depend on on-site sanitation.

A number of studies on the pelletisation process of faecal sludge-based fertilizers have been undertaken in Ghana. The project aims at pelletisation of FS based materials to:

- increase the marketability
- Increase general acceptability
- Increase the ease of handling and placement
- Improve fertilizer use efficiency

The equipment used for the process was fabricated in Ghana using local expertise. Each fertilizer product was individually used for the production of cylindrical pellets (particle diameter: 7.5–7.7 mm, length: usually 10–20 mm). From the current study, the binding material type (cassava starch, either pregelatinized or pretreated by gamma irradiation, or kaolin clay) and concentration (0 to 10 % in mass) as well as moisture content (20–35%) appeared to be the most critical factors during the pellet production. It was noticed that the higher the binding

material concentration, the higher the strength of the pellets, but the variation of pellet's stability following two hours of shaking at 300 motions per minute is usually below 5 %. It was concluded that a starch concentration of 1–3 % could be enough during the pelletisation process, starch being preferred to clay. This is significantly below the 15 % of pregelatinized cornstarch, needed to produce pellets (particle diameter: 13 mm, length: 25 mm) from organic waste compost, recommended from anterior experiments in Nigeria.

- West Africa Office, PMB CT 112, Cantonments, Accra, Ghana; Tel: (+233) 302 784 753; Fax: (+233) 302 784 752



This study confirms that it is possible to produce excreta-based pellets in small and medium size enterprises with local machinery. Upcoming studies will include testing the pellets in a greenhouse to confirm their suitability for different soil types and crops. If successful, such application could help make faecal sludge reuse a clean and safe process for private entrepreneurs as well as farmers.

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## Working small sanitation enterprise for faecal sludge management in peri-urban maputo: the experience of WSUP

Godfrey, Amaka\* Costa, Carla\*\*. Baghirathan, V. R\*\*\*

The Water and Sanitation for the Urban Poor (WSUP) strategy is to support the adoption and replication of sustainable and scalable models of poor urban water and sanitation.

Sanitation in the peri-urban areas of Maputo is generally poor with the pit latrine being the most widespread type of facility used by households. Faecal sludge management (FSM) is ineffective and inadequate, often worsening the sanitation conditions. The widespread lack of appropriate toilets, poor drainage system, unplanned housing and high water table make the management of pit emptying and sludge disposal an almost impossible task. Many latrines are poorly constructed and prone to collapse if emptied completely. Their design also allows groundwater and/or surface water ingress, which contributes to the problem, allowing them to fill up quickly. Past and present latrine construction projects have concentrated on

building latrines without considering how they will be emptied.

WSUP has initiated a pilot project on FSM in Maputo, in collaboration with the Small-Scale Independent Provider (SSIP) UGSM (Uaiene Gama Services Maputo). The pilot aims to trial and develop viable small enterprise led FSM (pit emptying) services as model to replicate in the country. This will be done using tried and tested uncomplicated technology and process to achieve a sustainable chain between service providers and the customers.

The pilot began in May 2011 and is 2-staged:

**Stage 1:** Improved pit emptying services using manual and mechanised pumps

**Stage 2:** Latrine improvement with low-interest credit facility To ensure sustainability, a joint business plan was drawn up

between the WSUP and UGSM with defined repayment amounts and periods.

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# Towards Sustainable Pit Latrine Management in South Africa Through The LaDepa Pelletising Machine

John Harrison, Dave Wilson

The disposal of sludge from urban pit latrines in the developing world is fraught with challenges, particularly in South Africa where some additional institutional challenges have arisen due to its history. eThekini Water and Sanitation (EWS), the municipal entity responsible for providing sanitation services to Durban and its surrounds, has co-invented and piloted an inexpensive, mobile, containerised technology, called LaDePa (for Latrine Dehydration Pasteurisation) that converts stiff, pit latrine and other sludge, into a pasteurised, dry, "handleable" product, that is beneficial for general agricultural use including root crops.

The LeDePa machine offers the following advantages:

- Financial saving
- Environmental Impact
  - Reduced landfill
  - Recycling nutrients
- Social Impact
  - Increased low skills job opportunities
- Potential permanent employment
- Political Benefit
  - Sustainable service delivery

The inexpensive, simple and robust mechanics employed by LaDePa, its mobility and low capital cost, not only address the major technical and institutional challenges of sludge management, but also addresses some socio-economic challenges in the communities where pit latrines are encountered, making outsourcing of the Pit Latrine Service viable.

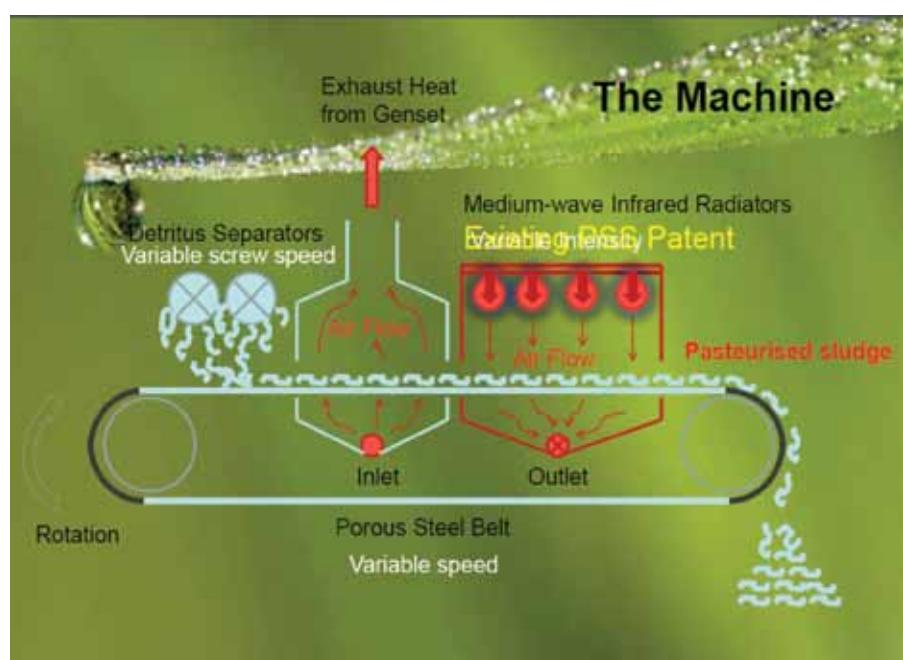
EWS intends privatising its pit emptying program anchored on the LaDePa technology.

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Comparison between Landfill & LaDepa disposal options



How the LaDepa machine works

# Beneficial Use of Faecal Sludge Through Deep Row Entrenchment

D. Still\*; H. Salisbury\*\*; S. Lorentz\*\*; K. Foxon\*\*

The Water Research Commission in South Africa has over the past three years investigated the suitability of deep row entrenchment of faecal sludge as a disposal option.

Faecal sludge contains nutrients (N, P, K) which make them a potential resource and not necessarily a waste, but they also contain pathogens which makes them unsuitable for surface spreading, particularly where edible crops are to be planted. Deep row entrenchment retains the nutrient value and safely contains the pathogens until they die off. The topics of interest to the researchers have been the effect on the growth of trees planted over or close to the entrenched sludge, the fate of the pathogens and the effect on the groundwater.

Buried faecal sludge acts as a slow release fertilizer and makes a marked difference to the growth rate of trees. The difference in tree volume is significant, although the relative difference between experimental trees and controls does seem to be decreasing with time. Regarding the fate of pathogens, *Ascaris lumbricoides* (large roundworm) is used as a marker for parasites because its eggs are very hardy: if treatment leaves no viable *Ascaris* eggs it can be assumed that all other parasites have been eliminated as well. Analysis of sludge extracted at intervals indicates that no viable *Ascaris* will be found after a period of 30 months.

Groundwater near the entrenchment sites is being monitored for a range of determinants which would indicate if the sludge has affected

water quality. At one site, which is flat and sandy with deep soils, no impact has been observed, while at the second site, which is sloping with shallow soils, some increase in NO<sub>3</sub> has been observed. This indicates that sites selected for deep row entrenchment should ideally be flattish and have deep soils. One of the topics of further research work is to determine how nutrients such as NO<sub>3</sub> and P are stored and migrate within the soil.

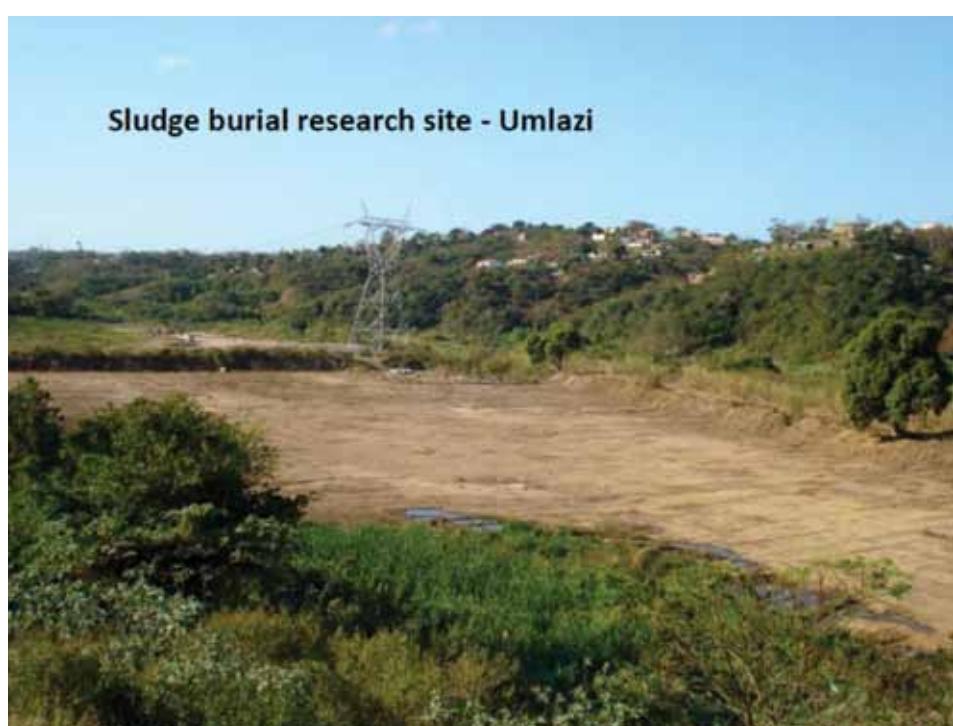
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Sludge burial research site - Umlazi



Sludge burial research site – Umlazi

## Human excreta – a neglected treasure!



N = 2,8 kg  
P = 0,4 kg  
K ~ 1,3 kg  
Per person  
per year



N = 2,8 kg  
P = 0,4 kg  
K ~ 1,3 kg  
Per person  
per year



≈



Urea = 6 kg  
TSP = 2 kg  
KCL ~ 2,6 kg



# Assessing Pollution Risk From Buried Sludge

S Lorentz\* P Adadzi\* D Still\*\* and B Wickham\*

This project compares the impact of buried pit latrine waste and sewage sludge at two distinctly different sites. These two case studies highlight the importance of a clear understanding of the flow pathways and fate mechanisms at disposal sites.

The movement of nutrients and pathogens from sources of buried human excreta has been studied in many controlled experiments and in-situ observations. Controlled experiments have led to some understanding of the fate of nutrients and pathogens in porous media, both in the saturated and unsaturated state. Studies of in situ subsurface sewage sources, whether placed or

from on-site sanitation, however, vary significantly in their conclusions of the distances and impact of nutrient and pathogen movement. While it is clear that distances to groundwater bodies, residence times in unsaturated zones and redox conditions influence the fate of nutrients, specific site conditions, including subsurface soils and geology as well as climate, require careful assessment of their influence on buried sewage impact.

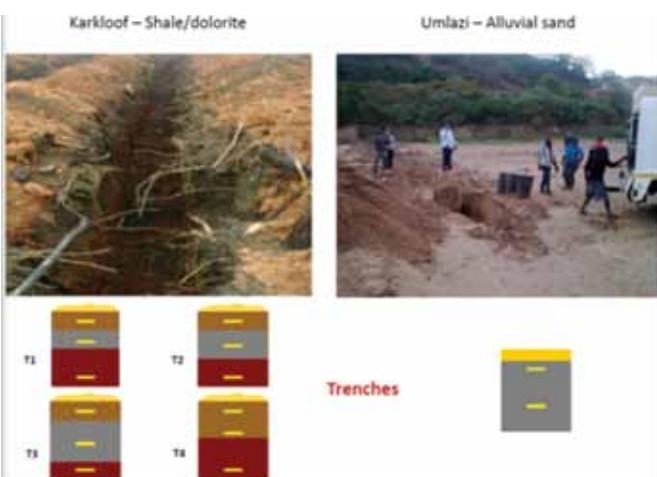
At the trenched pit latrine waste site, the unsaturated zone of the alluvial sandy material seems critical in limiting the impact, while at the sewage sludge trenched disposal site on a shale and dolerite hill slope, near the surface,

lateral flow during the wet season conducts significant nutrient loads downslope.

The project has the following conclusions:

- Rapid response, near surface groundwater transports nutrients;
- Travel time in the unsaturated zone enhances treatment;
- Simple observation methods are being developed to identify subsurface response mechanisms;

The study has been extended to hillslopes of VIP and UD latrines and pathogen observation.



Trenches



Instrumentation

- Wetting front detectors: WFD
- Soil water potential: WaterMark sensors
- Soil water content: TDR
- Near-surface groundwater: piezometers
- Deep groundwater: borehole
- Rainfall/ET: met station
- Nutrient and isotope sampling

## For more information, contact:

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# Fuel Potential Of Faecal Sludge

## Calorific Value Results From Uganda, Ghana and Senegal

T. Nakato\*, L. Strande\*\*, C. Niwagaba\*, H. Dione\*\*\*, N. Baawuh\*\*\*\*, A. Murray\*\*\*\*\*

This research aimed at testing the viability of using Faecal Sludge (FS) as solid fuel – an end use that could unlock an environmentally and financially beneficial replacement for costly, disposal-oriented FS management solutions. Using faecal sludge (FS) as a fuel to provide energy for industry could help to solve both the sanitation challenge and reliance on dirty or expensive fuels.

To determine the average calorific value of FS, and how it varies with source and age, samples were collected in three cities: Dakar, Senegal; Kampala, Uganda; and Kumasi, Ghana. Samples were tested for calorific value, total solids and water content. In Kampala, samples were collected from unlined, fully lined and partially lined pit latrines, septic tanks, and drying beds fed with FS from these systems. In Dakar, samples were collected from septic tanks and drying beds fed with raw FS. In Kumasi, samples were collected from public and private lined pit latrines, septic tanks, and anaerobic ponds to mainly assess the effect of biological treatment on the calorific value.

The total solids of FS from unlined pit latrines was 6% of wet weight, which is higher than that in lined pit latrines at 2.7% of wet weight and septic tanks at 1% of wet weight. This is

attributed to the water in the unlined pit latrine sludge draining into the soil. For industries to derive net energy from FS at 17.2 MJ/kg DS, the sludge must be dried to  $\geq 27\%$  dry solids. Any increase in dry solids above 27% increases the energy requirement to dry the FS, but also increases the benefit to the end user. The total solids of FS from drying beds in Kampala was above 30% of wet weight after two weeks, indicating that additional energy for drying the FS can be harnessed with minimal recurring costs assuming land is available.

Conclusions from the research indicate that:

- The calorific value of FS did not vary significantly with source
- The age of FS was not a predictor of calorific value
- The calorific value of FS is similar to other commonly used biomass fuels
- COD was also not a predictor of CV
- The dryness and form of final FS product is important if it is to be accepted and used as a
- Profitable industrial fuel.

### THE SANITATION CHALLENGE



- ◆ when pits become full, FS is dumped in environment
- ◆ users of these systems cannot afford to pay emptying fees
- ◆ access to sanitation not provided, even with «improved» systems

### SAMPLING METHODS

- ◆ **From trucks:** 1-L composite of samples collected at the beginning, middle and end of emptying
- ◆ **From ponds and drying beds:** 1-L composite of samples from five pre-defined locations



Faecal sludge sampling



Sampling from drying beds

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# Individual Perceptions & the Potential of Urine in Agriculture in eThekewini, South Africa

Natalie Benoit

**C**limate change, environmental degradation and unsustainable consumption of resources are increasingly putting a strain on the Earth's natural wealth. More sustainable behaviour such as using UDDT (Urine Diverting Dry Toilets) can help alleviate the strain on water resources.

This project explored the perceptions and knowledge of farmers and key informants about urine and its use in agriculture. Urine could be used as a fertilizer as it contains nitrogen and phosphorus. Furthermore, with urine as a fertilizer, it would now be free, accessible to all and decrease our need to mine phosphates. The research undertaken seeks to understand whether this practice would be socially acceptable for food security.

To investigate attitudes towards urine, interviews were conducted with farmers who consult with the UmBumbulu Agri-Hub and at the Newlands Mashu Permaculture Learning Centre (NMPLC) in KwaZulu Natal, South Africa. These interviews were done in order to find out their views on urine and the possibility for integrating ecological sanitation, more specifically urine reuse, in their programmes. Preliminary results illustrated that individual perceptions remain a barrier to usage; a lack of knowledge about its potential for fertilizing capabilities was also evident. In Zulu culture urine seems to be utilised in various ways, though respondents have not necessarily experienced those uses first hand. There seems to be a negative perception of urine amongst most respondents, although many farmers expressed curiosity towards the use of urine in agriculture.

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### Newlands Mashu Permaculture Learning Centre (NMPLC)



(NMPLC permaculture gardens; Inanda Coop garden; Ntuzuma nursery)

Newlands Mashu Permaculture Learning Centre (NMPLC) by the eThekewini Municipality Agroecology Programme.

\* Aims to support, appropriate & sustainable agroecology principles among farmers in eThekewini.

The farmers were interviewed from coop gardens in Ntuzuma & Inada townships.

### Umbumbulu Agri-Hub



(Umbumbulu Agri-Hub; Seedlings; Part of Mr. M. farm)

A public-private partnership. Started in September 2010 by the Newlands Mashu Community Development Foundation for the eThekewini municipality.

\*Aims to support small-scale growers through permaculture principles.

# Management Of Faecal Sludge From A Mobile Communal Sanitation Facility

A Case Study Of The MobiSan - C. Muanda, R. Tshibangu and A. Lagardien

**C**limate change, environmental degradation and unsustainable consumption of resources are increasingly putting a strain on the Earth's natural wealth. More sustainable behaviour such as using UDDT (urine diverting dry toilets) can help alleviate the strain on water resources.

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# Direct Mode -Solar Sludge Drier

Joseph Tchangwani Magoya\* and Chifundo Tenthani\*\*

**A**solar sludge drier was designed, fabricated and tested at the Blantyre City Council Sewage in Zingwangwa, Blantyre.

In the peri-urban areas of Malawi, the management and utilisation of sludge from full latrines still remains a challenge to many households without sewer connections. Existing methods for managing this sludge are limited and uneconomical. Latrine sludge is not seen to have economical value in rural and peri-urban areas of Malawi. Emptying the latrines and managing the sludge is also not lucrative as the costs are high and most of the clients are low earners. The emptied sludge is never utilised. If properly utilised the sludge would have an economic value as it can be turned into manure for direct use in agriculture

or for sale to commercial farmers. Preliminary results indicate that a maximum temperature of 57°C was achieved, which is within the range required to kill pathogens and enable the sludge to be converted into manure. The study concludes that a solar drier can be used to treat sludge and convert it into usable manure which is rich in nitrogen and phosphorous. This can then be used in depleted and eroded soils.



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Direct Mode-Solar Sludge Drier

# Experiments on Struvite Precipitation, Application and Economic Analysis in Arba Minch, Ethiopia

Teshale Dalecha\*, Eshetu Assefa\*, Kristina Krasteva\*\*, Günter Langergraber\*\*\*

**C**ollection, storage and transportation of urine is problematic in Arba Minch in Ethiopia. To address this problem and close the loop between sanitation products and agriculture, struvite precipitation is proposed.

This project has the main objectives of struvite precipitation, application for crops, and feasibility analysis. Specifically, it looks at urine quality analysis, process efficiency, evaluation of growth and yield of maize, and feasibility under local conditions.

Source separated urine from UDDTs (Urine-Diversion Dry Toilets) is a potential source of nutrients for use as a substituent of commercial fertilizer. However,

EAWAG's experiences in Nepal revealed that urine hygienization leads to considerable nutrient loss. The aim of the experiments in Arba Minch is to test EAWAG's experiences under Ethiopian conditions. Running the field experiment is essential for Arba Minch because of the availability of UDDTs in the town. It is planned to check the production potential and economic feasibility of struvite and its application in four different ways. The workplan for the experiments is described below:

- Urine quality analysis
- Struvite precipitation
- Application on crop (maize) with best experimental protocols & adaptable combinations in number of trials
- Economic analysis

The work is carried out within the project CLARA (Capacity-Linked water supply and sanitation improvement for Africa's peri-urban and Rural Areas), a collaborative Project funded within the EU 7th Framework Programme, Theme "Environment (including Climate Change)".

The project has made the following conclusions and recommendations so far:

- The recovery efficiency is low
- The response of maize growth to struvite and artificial fertilizer is comparable.
- Process parameters need to be revisited
- There is need for standard filter material
- There is need for improvement in urine quality analysis



Growth status in August 21, 2012      Growth status in August 27, 2012      Growth status in Sept 05, 2012      Growth status in October 12, 2012



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# Pit Emptying and Public Health

Bobbie Louton\*, Colleen Archer\*\*, Nicola Rodda\*\*

The provision of improved sanitation is often viewed as the key to improved health because of the assumption that contact with faeces is reduced. In the case of on-site sanitation, however, an integral part of the cycle of sanitation provision is the emptying of pits. If, during emptying, sanitation workers contaminate the household environment, improvements in health may be affected negatively.

Pit emptiers risk contracting diseases caused by pathogens found in sludge. Diarrhoeal diseases are responsible for a significant share of the burden of disease and of mortalities among children under

the age of five. Intestinal parasites are common in many communities, with infection rates particularly high among children, and can compromise nutrition and development. Infections are preventable if the faecal-oral route of transmission is broken.

Exposure of workers and householders to the pathogens found in sludge can be reduced by examining where current practice may result in unnecessary contact with sludge and improving this practice. While national government may demonstrate an understanding of the hazardous nature of sludge, on the level of management, the handling of

sludge may be viewed as a public works function which can be appropriately handled by unskilled labour. Thus, proper training and stringent protocols for dealing with a hazardous material may not be in place. A careful examination of practices can identify those that carry unnecessary risk and allow for the development of effective interventions.

## The height, breadth and depth of the problem



Pit emptiers need to be trained and protected from diseases caused by pathogens found in sludge

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# Using *Senecio Lyratipartitus* Extracts As Hand Disinfectants After Anal Ablution

A. Maradufu, J. Obey, B.C. Sang, J.E. Khanga'ti

In homes which practice anal ablution after defecation (mostly Muslim communities and some Christian homes) water is kept in pans, pots and buckets and placed in pit latrine facilities. This water may become contaminated with enteropathogenic diarrhoea causing pathogens.

This paper discussed the disinfection of hands after anal ablution, with extracts of the *Senecio lyratipartitus* plant, also known as *Senecio lyratus*.

Ablution water samples from latrines of households practicing anal ablution in two cities, Kisumu in Kenya and Musoma in Tanzania, both located on the eastern shores of Lake Victoria in East Africa, were found to carry *Escherichia coli*, *Salmonella* sp. and *Klebsiella* sp. In the homes visited, there were no facilities

for hand washing with clean water and soap after defecation and anal ablution. This practice is definitely responsible for contaminating drinking water, food and utensils.

An initial Kirby Bauer disk method performed with the extract to show activity using the methanol extract demonstrated zones of inhibition of 15mm for *E. coli*, 14mm for *Salmonella* sp., 14mm for *Enterobacter* and 13 mm for *Klebsiella*. n-Hexane, ethyl acetate and chloroform extracts of dry leaves of *S. lyratus* were able to inhibit growth of *E. coli*, *Salmonella* sp., *Klebsiella* sp and *Enterobacter aerogenes*. The minimum inhibitory concentrations (MIC) obtained for the methanol and ethyl acetate extract were 31.5mg/mL for *E. coli*, 3.9mg/mL for *S. typhimurium*, 31.25mg/mL for *Klebsiella* sp. and

31.25mg/mL for *E. aerogenes*.

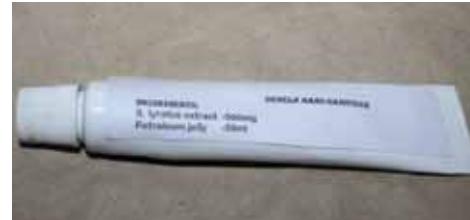
*S.lyratus* grows widely in most parts of East Africa, and is currently not exploited for any commercial use. Since *E. coli* is the indicator organism for water quality, and *S.lyratus* extracts are showing activity against it, the plant has potential for development as a hand sanitiser. Suitable formulation incorporating *S.lyratus* extracts as a hand sanitiser in appropriate packaging are being developed.

Table of countries which practice anal ablution and diarrhea deaths

| WORLD REGION                        | ESTIMATES OF DEATHS | % OF WORLD TOTAL | TOTAL POPULATION (IN MILLION) |
|-------------------------------------|---------------------|------------------|-------------------------------|
| Africa                              | 760,037             | 40               | 1,070                         |
| Americas (Including Western Europe) | 63,403              | 3                | 962                           |
| Eastern Mediterranean               | 567,111             | 25               | 273                           |
| South East Asia                     | 681,457             | 26               | 1,585                         |
| Western Pacific                     | 125,644             | 6                | 644                           |



*Senecio lyratipartitus* plant, also known as *Senecio lyratus*



The Senela Hand Cream

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# Faecal Sludge Management at Decentralised Treatment Systems in Zambia

S. Blume \* and Jackson Mulenga \*\*

The Devolution Trust Fund (DTF), in partnership with BORDA (Bremer Overseas Research and Development Association, a German NGO) and the Water and Sanitation Association of Zambia (WASAZA) have piloted a solid free sewer approach in four Zambian sanitation projects, supplying 15 600 people with improved sanitation services in low income areas.

The underlying principle of the projects is to use biogas digesters as immediate settlers/first treatment step (connecting up to 40 households per digester). This serves to reduce the solid load in the small bore sewer system that connects further to a secondary decentralised treatment step through an Anaerobic Baffled Reactor and Planted Gravel Filter or waste stabilisation pond system. Additionally, biogas is generated that will be used by 108 households. It is assumed that the projects will provide users the convenience of flush systems but will require - a rather non frequent - Faecal Sludge Management for

emptying the biogas digesters (approximately once a year). The emptying and treatment service is a foreseen duty of the Commercial Water Utility or a Community Based Organisation that shall use either vacuum trucks or gulper technology, depending on resources available. The treatment of faecal sludge shall be done in appropriate treatment facilities. Reuse of stabilised sludge is envisaged through application on a nearby banana plantation for one project that applies a full DEWATS system. Altogether, waste water from approximately 3 540 people (590 households) is connected to 15 biogas digesters (ranging from 30 – 40 cubic meters volume each). With an assumed sludge accumulation rate of 60 litres per person and year, 212 400 litres of sludge are to be handled each year. A household sanitation fee shall be applied on the water bill to finance operation and maintenance and faecal sludge management activities. Initial analysis indicates that full operating costs can be recovered applying a sanitation tariff which is between 25% and 78% of the water tariff.



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# Pilot Project on Faecal Sludge Management in Lusaka Zambia

Christopher Kellner\*, Mwanza Nchalu\*\*

The sanitation conditions in peri-urban compounds in Zambia are problematic. The population density increases rapidly and toilets contaminate the underground water, while daily many people fetch their water from shallow wells. Particularly in the rainy season, there are regular outbreaks of cholera and typhoid.

Linking the areas to the sewer network of the town, for instance in the case of Lusaka's outskirts, is not affordable. Partially unplanned structures, the high level of rock outcrops and the poor general drainage are the reasons for this.

In respect of the challenges regarding the achievement of the Millennium Development Goals (MDGs) in the sub sector of sanitation, donors are communicating their willingness to support sanitation measures.

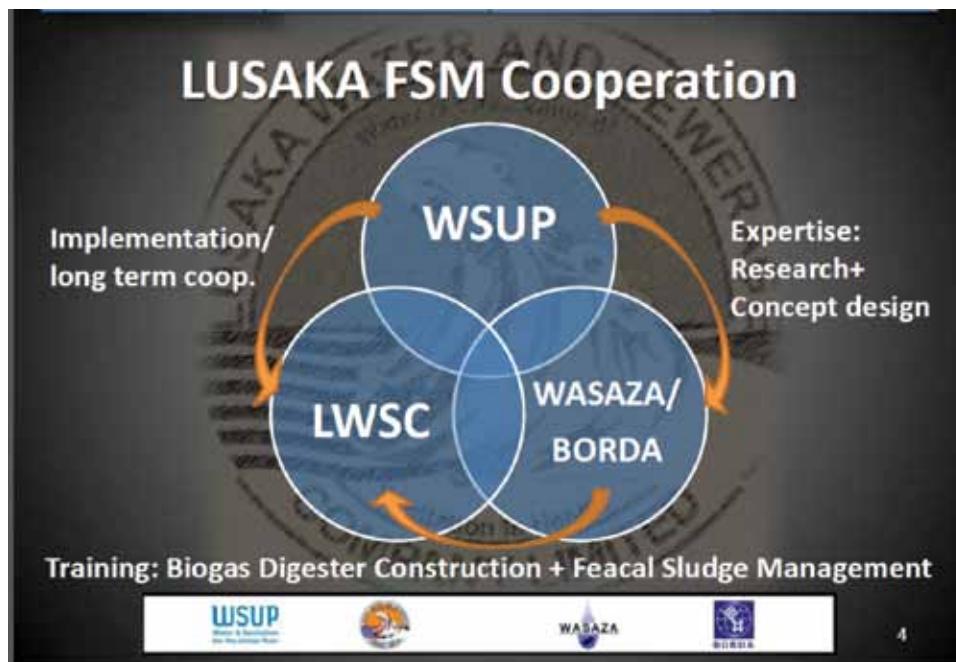
The Water and Sanitation for the Urban Poor (WSUP), together with Water and Sanitation Association of Zambia (WASAZA), Bremer Overseas Research and Development Association (BORDA) and Lusaka Water and Sewerage Company (LWSC) to implement a Faecal Sludge Management Project in three low cost areas around Lusaka, Zambia.

It is the objective of the project to identify and test methods of faecal sludge management which are economically viable. This can be achieved through:

- the emptying service fee,
- the sales of the biogas generated in the (enlarged) transfer station, and
- the sales of the dried digested slurry from drying beds as fertilizer, generate cost covering benefits.



The construction of the pilot installation started in August 2012.



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# From Waste To Resource

## Research on FS Drying Beds in Dakar, Senegal (Dar - de Déchets à Ressources)

Seydou Niang\*, Amadou Gueye \*\*, Alsane Seck \*\*, Hamath Dione \*\*, Mamadou Sonko \*\*, Jean Birane Gning \*\*, Mbaye Mbéguéré \*\*\*, Linda Strande\*\*\*\*

In Senegal, to reach the millennium development goals in 2015 for sanitation, targets are to achieve 92 000 connections to sewerage systems and an additional 453 000 onsite systems in both rural and urban areas. Achieving this goal will also greatly increase the volume of sludge that needs to be managed. To ensure these goals are sustainably implemented, plans for sludge end-use or disposal must be undertaken long before the systems become operational.

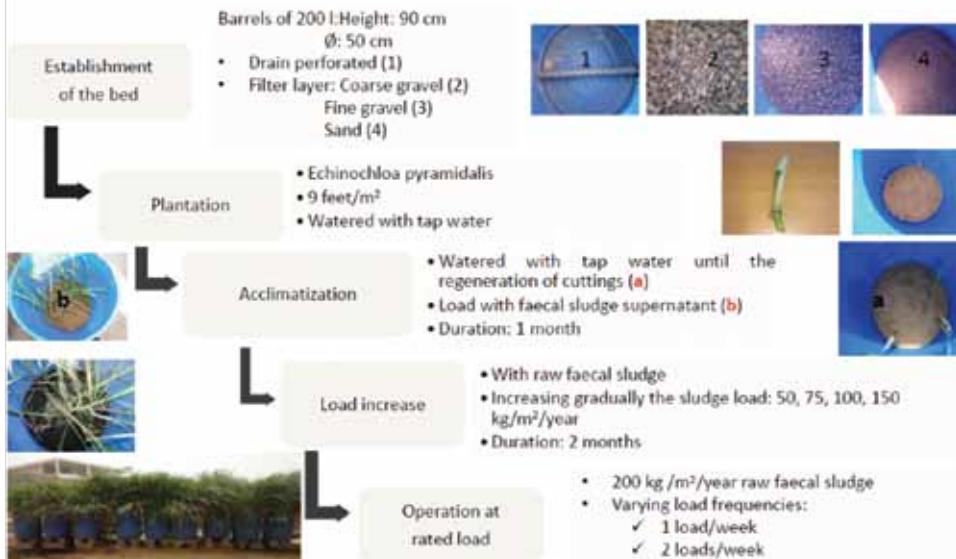
Current strategies that are being researched in Dakar by the DAR research programme include the use of sludge as a fuel in industry, and as a medium to grow fodder plants. Creating added value during the treatment process is expected to help reduce the cost of emptying, transport, and treatment, providing a financial driver to help ensure that the entire faecal sludge service chain is functioning. Initial results from using locally built ventilated greenhouses to enhance drying are promising. Over 14 days, in drying beds covered with greenhouses, 60% dryness was achieved for a load of 300

kgTS/m<sup>2</sup>/Y loads, while during the same time, non-covered beds reached only 40% dryness.

Current trials for growing fodder with faecal sludge have been focused on the optimal selection of local plants. Seven plants that are commonly used for fodder in Senegal were submitted to 12m<sup>3</sup>/m<sup>2</sup>/Y of raw faecal sludge.

Five of them grew well; Echinochloa pyramidalis, Echinochloa crus-galli, Paspalidium geminatum, Echinochloa Colona, Paspalum vaginatum, while two of them; Imperata cylindrica, Eleusine indica did not grow well at all. Currently, tests are being conducted to select three species that show the most potential for use in planted drying beds, and then to further optimise this application.

### System operation



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# Market Demand for End-Products of Faecal Sludge Treatment in Kampala, Accra, and Dakar

S. Semiyaga\*, S. Diener\*\*, C. B. Niwagaba\*, J. B. Gning\*\*\*, J. E. Ennin\*\*\*\*, L. Strande\*\*

This project has developed a model that recognises resources in FS, and can provide a profit motive for on-going collection and transport to treatment facilities. The aim of the study was to identify the market demand for innovative end-products in Kampala (Uganda), Accra (Ghana) and Dakar (Senegal).

Sanitation systems throughout urban areas of Sub-Saharan Africa are characterised by poorly maintained on-site sanitation systems, dysfunctional faecal sludge (FS) collection and transport, and disposal of untreated or inadequately treated FS directly into the environment. The situation could

be improved through the development and implementation of reuse-oriented value chains, changing the focus of FS management from that of disposal problems to generators of valuable end-products.

An iterative method for selecting interview partners was chosen. This included the following approaches: i) focus group discussions, ii) open-ended, semi-structured interviews, and iii) spontaneous enquiries and visits of relevant enterprises/entrepreneurs.

The identified market demand in the three cities include: (i) dried FS as alternative fuel in industries; (ii) dewatered FS as a

feed source for black soldier fly larvae to produce animal protein; (iii) FS as a feedstock for biogas production; and (iv) treated FS as a soil conditioner in agriculture.

Industrial use of FS as a fuel was most promising in Kampala, where 60% of industries are using solid fuels (e.g. wood), compared to Dakar and Accra where the majority of industries are using electricity and liquid fuels (e.g. diesel). In all three cities, treated sludge is already utilised in some form: FS as a soil conditioner and sewage sludge as bio-digester feedstock in Dakar; FS as a soil conditioner in Accra; and treated sewage sludge as a soil conditioner by farmers and landscapers in Kampala. The identified markets provide many promising opportunities for the future sale and resource recovery of FS treatment end-products.

| Designated use of FS                 | Products to be replaced by FS   | Stakeholders   | Interviews conducted |       |         |
|--------------------------------------|---|--|----------------------|-------|---------|
|                                      |   |  | Dakar                | Accra | Kampala |
| Dried FS as fuel in Industries       | <ul style="list-style-type: none"><li>• Solid fuel (wood, coal, etc.)</li><li>• Liquid fuel</li><li>• Electricity</li></ul> | <ul style="list-style-type: none"><li>• Clay/ Brick industries.</li><li>• Cement plants</li><li>• Blacksmiths</li><li>• Industrial boilers</li></ul> | 34                   | 6     | 16      |
| Dried FS as fertilizer               | <ul style="list-style-type: none"><li>• Chemical fertilizer</li><li>• Organic manure</li><li>• Sewage sludge</li></ul>      | <ul style="list-style-type: none"><li>• Urban farmers</li><li>• Horticulturists</li><li>• Landscapers</li></ul>                                      | 34                   | 82    | 50      |
| FS as feedstock in biogas plants     | <ul style="list-style-type: none"><li>• Firewood</li><li>• Electricity</li><li>• LPG</li></ul>                              | <ul style="list-style-type: none"><li>• Households</li><li>• Schools</li><li>• Public markets</li></ul>  | 5                    | -     | 3       |
| FS as a constituent in clay bricks   | <ul style="list-style-type: none"><li>• Clay</li></ul>  | <ul style="list-style-type: none"><li>• Clay industries</li></ul>  | -                    | -     | 3       |
| FS as protein source in animal feeds | <ul style="list-style-type: none"><li>• Fish meal</li><li>• Small dried fish</li></ul>                                      | <ul style="list-style-type: none"><li>• Poultry farmers</li><li>• Fish farmers</li><li>• Animal feed industry</li></ul>                              | 2                    | -     | 7       |

| Summary of existing strong market potential, based on current situation |       |       |         |
|---|-------|-------|---------|
|   | Dakar | Accra | Kampala |
| Fuel  |       |       | x       |
| Biogas  |       | x     | x       |
| Protein source  | x     |       | x       |
| Building material   |       |       |         |
| Soil conditioner  | x     | x     | x       |

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# An overview of FSM research in Durban

Chris Buckley

This project provides an overview of research undertaken on FSM in Durban, South Africa. The Pollution Research Group (PRG) first became involved in dry on-site sanitation in 2004 through an investigation of the drying rate of faeces and cover material in urine diversion toilets in conjunction with the eThekweni Water and Sanitation. In 2005, the PRG received a project from the WRC to investigate urine diversion toilets in eThekweni and a second project to develop a scientific understanding of the design and operation of ventilated pit latrines. In 2007, the PRG was sub-contracted by Partners in Development to provide scientific support to a WRC project entitled What happens when the pits are full? In 2011, further research (commissioned by the WRC) was undertaken in conjunction with Partners in Development to investigate the deep row entrenchment of VIP sludges.

In 2006 the PRG and eThekweni Water and Sanitation formally established a long-term agreement to work together in the field of water and sanitation services. This relationship provided access to data and facilities designed, constructed, owned or serviced by the municipality. Of equal importance was that there was almost continuous direct and personal contact between researchers, operators, designers and planners.

In July 2009, a visit was made to the Bill & Melinda Gates Foundation (BMGF) in Seattle (together with Doulaye Koné and Blanca Jimenez) in order to provide first-hand experience of on-site sanitation to support the presentation of the proposed sanitation strategy to the senior members of the Foundation. In late 2009, Bill Gates travelled to Durban to see first-hand VIP

toilets and urine diversion toilets and the associated difficulties associated with the management of the sludges from each system.

In 2011, the PRG and local partners were one of the successful BMGF Reinvent the Toilet Challenge grantees. In 2012 the PRG received a grant from BMGF to determine the mechanical properties of faecal sludge.

## Smarter Design and Construction



## Newlands –Mashu DEWATS Plant

AMU Centre of Excellence



## On-site Sanitation Systems in Durban

| Level of Service                | Number of Households  |
|---------------------------------|-----------------------|
| Ventilated Improved Pit latrine | 40 000                |
| Urine Diversion toilet          | 80 000                |
| Community Ablution Block        | 200 x 75<br>(=15 000) |

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# Modelling the Filling Rate Of Pit Latrines

C.J. Brouckaert, K.M. Foxon and K. Wood

This project looks at a simple material balance model, which represents faecal sludge as a mixture of biodegradable organic material, un-biodegradable organic material and inorganic material.

Excreta (faeces and urine) that are deposited into a pit latrine are subject to biodegradation, which substantially reduces the volume that remains. However, matter that is not biodegradable also finds its way into pit latrines. The net filling rate is dependent on both the rate of addition of material and its composition.

The model considers material found in a pit to be divided into two main categories; the so-called fine sludge is that portion that is visually approximately homogeneous, with a maximum particle size of about 1 mm; and a component made up of un-biodegradable household coarse refuse that has much larger particle size i.e. plastic bags, discarded cloth and household detritus. Since no biological transformations occur in the coarse refuse fraction, it accumulates with time in the pit and can be considered in isolation from the other material in the pit.

The contents of a VIP have an aerobic surface layer, but anaerobic conditions prevail in deeper layers. Thus the exposed surface of pit contents, especially newly added material, will be subject to aerobic biological processes. As the pit contents are covered over and oxygen supply is limited, conditions in the pit become anaerobic, and anaerobic biological processes dominate.

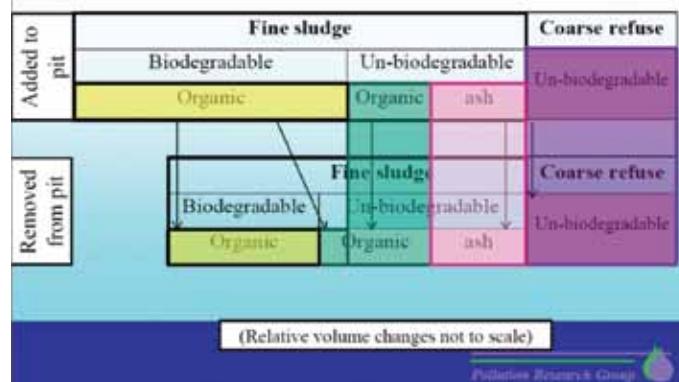
The distribution of material in the pit is determined by the entire history of what was disposed into it. This depends on the history of the users' behaviour, about which we have almost complete ignorance. Modelling the process therefore inevitably involves sweeping assumptions, such as considering the rate of deposition of material into the pit and its characteristics to remain constant for the entire period.

For the pits studied, the model predicts that the filling time could have been extended from 15 y to over 25 y if all solid waste had been excluded from the pit.

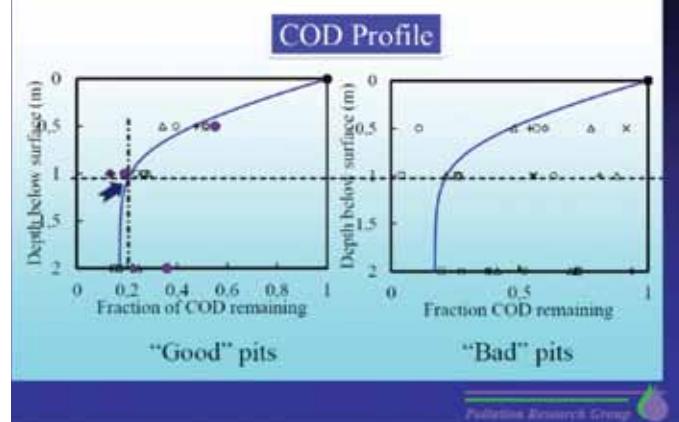
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## Structure of pit filling model



## Calibration: how organics change



# Pour flush

## A New Sanitation Paradigm in Africa, And Implications for FSM

JN Bhagwan \* and D Still \*\*

**P**eople aspire to some form of flush sanitation for reasons of convenience, aesthetics and status.

Experience to date with dry sanitation in South Africa has shown the many challenges which need to be addressed to support sustainability over the long term. User behaviour and attitudes, as well as a lack of understanding of the sanitation environment by planners and designers, has resulted in many interventions being in jeopardy.

Challenges with dry sanitation include:

- pits filling faster than design
- access to pits is a challenge
- pit de-sludging is expensive
- systems seen from a civil engineering and project management perspective
- no holistic management
- focus on superstructure

The enormous cost and high water demand of conventional full flush seweraged sanitation makes this option prohibitive for many communities. However, pour flush does offer much of the convenience of full flush sanitation without the high cost.

Sanitation practice differs fundamentally between South Africa and Asia. In South Africa (as in much of Africa) sitting and not squatting is standard, as is the use of paper (often including newsprint) rather than water for anal cleansing. Until now

it has been assumed that due to these differences pour flush would not work in South Africa.

In 2009 the WRC commissioned a research project to test the validity of that assumption. The study has resulted in the development of a new 1l pour flush pedestal, which was tested according to the internationally accepted MaP (Maximum Performance) protocol and then piloted and demonstrated in 22 households and one crèche. Over a two year period, monitoring has shown that there have been no technical or operational problems with the technology (even when newsprint is used for anal cleansing) and the user satisfaction has been high. This has proven that pour flush can indeed work in Africa, which potentially has major implications for FSM in areas where previously the pit latrine was considered the only sanitation solution (mainly due to the limited availability of either finance, water or both).

The success of the pour flush model designed and piloted in this project indicates that it may provide a viable option for municipalities under pressure to provide waterborne sanitation where laying sewers is not feasible, as well as for dissatisfied householders who would like to bridge the gap between dry on-site systems such as VIP toilets and full

waterborne sanitation. In addition, it provides a sanitation model in which scarce water resources are used responsibly and sustainably, pointing a way forward for changes in standard sanitation which currently relies on freely available water.



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# Ethics and Faecal Sludge Management in Africa

Ujah Oliver Chinedu\*, Mathew Ocholi\*\*, Kabou Kambou\*\*, Ali Dissa\*\*, Katie Spooner\*\*, Rakia Kere\*\*, Joseph Makaya\*\*, Ada-Oko Williams\*\* and Idrissa Doucoure\*\*

Clean Team is an end-to-end sanitation solution. The company's mission is to do sanitation right for the consumer, introducing comfort and convenience into in-home sanitation. It is Clean Team's objective to see the demise of long walks and long lines, and put an end to unpleasant experiences inside uncomfortable facilities.

This study highlights the values/principles that govern the actions and decisions of individuals or groups with regard to sanitation choices and/or services. The logical linkages between sanitation and ethics are critical for achieving dignifying, effective, efficient, scalable and sustainable sanitation services delivery. This linkage, when perfectly established, has the potential to address the challenges of sustainability and scalability of sanitation models being promoted in the continent. Without an ethical understanding of sanitation in the continent, all efforts towards sector sustainability and scalability will continue to be short-term, haphazard, and ephemeral.

WASH supply to poor rural and urban populations has remained a continual problem for Africa and other developing nations. This is despite global consensus that the right to safe WASH is derived from the right to an adequate standard of living, and is inextricably related to the right to the highest attainable standard of physical and mental health, as well as the right to life and human dignity.

While it is universally accepted that it makes economic, social, political and environmental sense to promote adequate sanitation access, it is also important to examine whether the sanitation services being promoted in Africa are adequately dignifying, especially in terms of access quality as against universal access. The first important aspect of faecal sludge management is faecal sludge collection, and a number of low-cost capture technologies, in the name of improved access, are being promoted in the continent. Despite the huge amount of resources spent on promoting and piloting these technologies, more people in rural/urban areas of Africa are still open-defecating.

Feedback from 30 purposively selected respondents was examined to determine whether any form of rights and choices exist in the context of inaccessibility and/or poor accessibility to sanitation services.

The project has concluded that:

- There is need to consider sanitation ethical issue in sanitation practice
- Although access is good, qualitative access is better
- Consensus on minimum and acceptable top-of-the-ladder access standard is important
- Promotion of non-dignifying capture technologies inflames current epidemics
- Globally elevated status for sanitation as accorded HIV/AIDS, Malaria, etc

## Study Results: Desired Quality of Capture Technology

| Quality                                      | Response (%)    |      |                          |      |
|--|-----------------|------|--------------------------|------|
|  | Desired quality |      | Applicable to own toilet |      |
|  | Yes             | No   | Yes                      | No   |
| No smell                                     | 100             | 0.0  | 73.3                     | 26.7 |
| Easy to clean                                | 100             | 0.0  | 96.7                     | 3.3  |
| Easily used by children                      | 96.7            | 3.3  | 33.3                     | 66.7 |
| Privacy                                      | 100             | 0.0  | 100                      | 0.0  |
| Liked by others                              | 100             | 0.0  | 93.3                     | 6.7  |
| Fewer assistance for repairs or low O&M cost | 100             | 0.0  | 93.3                     | 6.7  |
| Within the house                             | 90.0            | 10.0 | 0.0                      | 100  |
| Sitting version                              | 86.7            | 13.3 | 0.0                      | 100  |
| Squatting version                            | 13.3            | 86.7 | 100                      | 0.0  |



30/10/2012

### For more details:

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# The Clara Project

# Capacity-linked water supply and sanitation improvement for Africa's peri-urban and rural areas

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The overall objective of the Clara Project is to strengthen the local capacity in the water supply and sanitation sector which is needed to adopt, implement and operate integrated resource-oriented water supply and sanitation solutions.

There are a large number of small communities and towns in Africa that suffer from severe problems with water supply and sanitation. Small communities in rural areas and peri-urban areas of small towns have comparable settlement structures in which reuse of water and use of sanitation products can be utilised. However, there is only limited local capacity to adopt, implement and operate integrated water supply and sanitation.

From a technological perspective, existing low cost technologies for decentralised water supply and sanitation systems shall be assessed and adapted for African conditions with the focus on reducing risks in use and reuse of water and sanitation products, and providing demand oriented water quality.

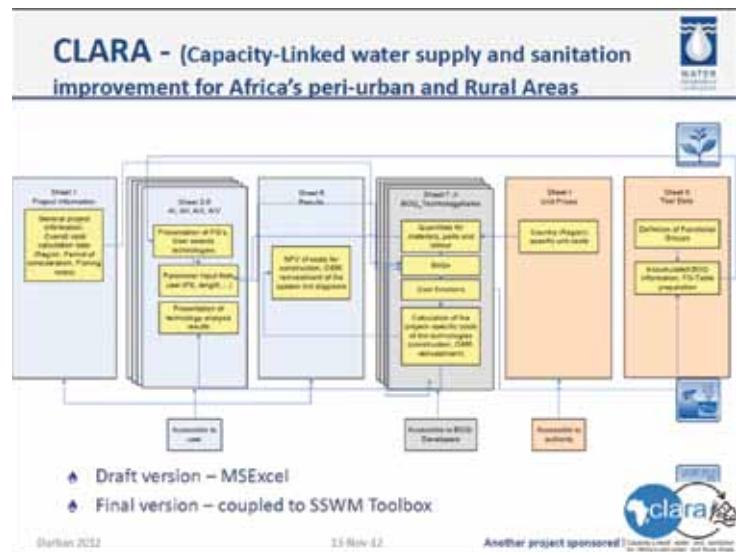
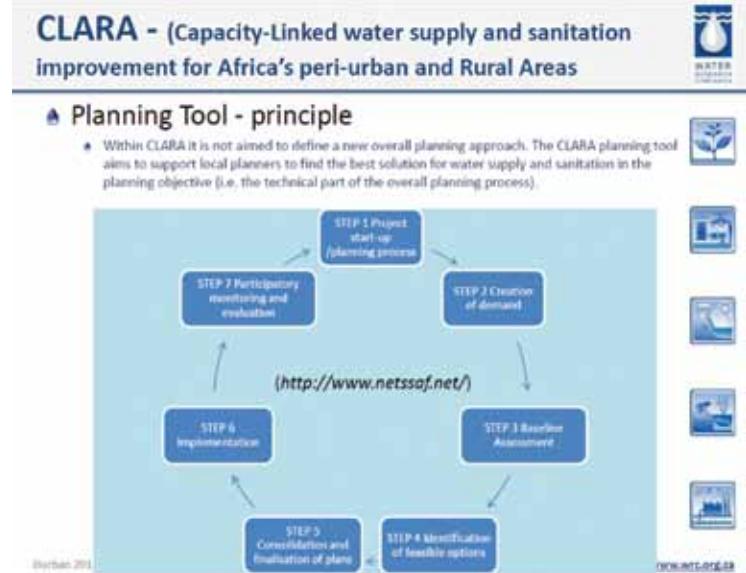
Based on these technological improvements and the experiences from the FP6 projects ROSA (<http://rosa.boku.ac.at/>) and NETSSAF (<http://www.netssaf.net/>), a simplified planning tool for integrated water supply and sanitation systems for small communities and peri-urban areas shall be developed. This planning tool would incorporate the key factors for success (operation and maintenance issues and reuse potential) tailored to available local capacities.

This simplified integrated CLARA planning tool shall then be tested and evaluated in various African regions to incorporate different economic, cultural and social boundary conditions. For the communities participating in the planning process, application documents will be prepared as a final output that serve as a basis to ask for funding of their implementation plans for integrated water supply and sanitation.

## Contact details:

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# In Search Of the Ideal Pit Emptying Technology

D. Still\*; M. O'Riordan\*\*; A. McBride\*\*

ver the last four years, Partners In Development (PID), with assistance from Engineers Without Borders UK volunteers, has been brainstorming, building and testing a series of Pit Emptying Technologies (PETs).

Who would want to be a pit latrine emptier, and if you were, how would you get the job done? That would depend on what the customer was prepared to pay, where the sludge was going to be disposed, the accessibility of the site, and the nature of the sludge itself. Vacuum tankers of various sizes are suitable when the sludge is not too dense or dry, when it is possible to park the truck close enough to the pit for the suction to work, and when there is enough money available to pay for the tanker operation and maintenance. In reality one of these prerequisites is often not met, and then the job gets done manually using buckets on ropes, scoops on poles, long handled rakes and shovels, or even with ordinary shovels.

Is it possible to develop tools and small machines which would make it possible for manual pit emptying to done with greater safety and dignity? Over the past two decades a variety of machines have been developed and tested, including the MAPET, the Vacutug and the Gulper. Each of these works well in certain circumstances.

Some of the PETs have included a chain and scoop device called a Gobbler, a motorised auger called the PSA (for Pit sludge auger), and two portable vacuum pumping machines, the Nanovac and the eVac, all of which seemed like a good idea at the time. Of these the eVac, an electrically powered vane pump driven plug and gulp vacuum system shows the

most promise, but only on wetter sludges. If the sludge is dry and dense, there is still nothing to beat a shovel for cost effectiveness and practicality. However, with intelligent pit design, a pit emptier's job can be made much less difficult and less hazardous.

The conclusions of the project are that:

- There is no ideal pit emptying machine (yet).
- Wet pits – use a vacuum pump, small or large, depending on access. Can also use a trash pump, or a Gulper.
- Dry pits or pits with excessive amounts of trash – there is still no practical alternative to manual emptying.

The research further proposes that to reduce the pit burden, there is need to:

- Build larger pits so that pit life is much longer (e.g. 15 to 20 years) then knock down and rebuild the VIP when full (assumes space for relocation is not a problem).
- Use lightweight robust movable pit structures (ditto re space)
- Use smaller alternating pits designed with better access for emptying
- Use pour flush toilets with alternating pits (easier to access, much less trash, easier to empty)
- Use urine diversion or composting toilets

## Contact details:

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## Human Excreta to Energy and Biochar *In Urban Kenya*

Jason Aramburu\* and Luke Iseman\*\*, \*re:char, 921 Grace Ave, Oakland CA, 94608; Tel: +1(512)6090632;  
\*\*re:char

his project provides an insight into the conversion of solid faeces to biochar, thus offering a novel pathway for low-cost, sanitary waste treatment.

Waste is added to batch pyrolysis reactors, which desiccate and heat the waste to temperatures over 300 C under low-oxygen conditions. Rather than combust into ashes, the waste is converted to an inert, carbon charcoal (biochar). Heat from the pyrolysis process is used to stabilise urine. When added to agricultural soils, biochar has numerous beneficial properties including increasing water/nutrient retention. Biochar may also have long-

term impacts as a carbon sequestration tool. re:char, a biochar company, has developed and is currently testing a simple batch reactor to convert a mixture of human faeces and agricultural waste into biochar. These reactors are designed for deployment in urban and peri-urban areas of East Africa. We have demonstrated 99% complete pathogen destruction via conversion to biochar, as well as 20-40% increases in maize/millet yield through the use of faecal biochar as a soil amendment. We have also demonstrated positive growth impacts by supplementing the biochar with stabilised urine diluted to 15%.

re:char's pyrolysis reactors are targeted

with an operating and capital expense of <\$0.05/user/day. Low capital cost is achieved through distributed manufacturing and use of locally available building materials. The end goal of the project is to incorporate a pyrolysis reactor directly into a freestanding toilet structure, eliminating the need for transport of faecal solids.

## For more details:

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# Social Franchising Principles Do Work:

## The Business Approach to Removal and Disposal of Faecal Sludge - From Pilot to Scale

K Wall\*, O Ive \*\*, J Bhagwan\*\*\*, F Kirwan \*\*\*\*

**S**tudies undertaken by the CSIR and WRC have found that the concept of social franchising partnerships for the routine maintenance of infrastructure could alleviate and address many challenges in the management of water services.

A pilot project, under way in the Eastern Cape since 2009, has drawn to a successful conclusion. This provided selected infrastructure maintenance services to approximately 400 schools in the Butterworth education district. Half a dozen franchisee microbusinesses were created, and of the order of three dozen previously unemployed people were taught workplace skills. Irish Aid funded the concept development, but the franchisees were paid from the normal Department of Education (DoE) schools operation and maintenance budgets.

Despite difficulties arising directly from DoE inefficiencies, the pilot project has proven the value of social franchising partnerships for this kind of work - the DoE now has a model it can roll out to the rest of the more than 4000 schools across the Eastern Cape which have a similar type of infrastructure.

Many opportunities lie in applying the same approach to other operation and/or maintenance activities within the water and sanitation services delivery chain. The time is now ripe to further develop the concept so that it can move up the technology ladder, expanding its range of competencies beyond its current comfort zone.

### For more details:

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### A Typical Franchisee Team



FSM Conference - Durban, 31 Oct 2012

Irish Aid  
CSIR  
Amanz'abantu

### Removal of Sludge by pumping



FSM Conference - Durban, 31 Oct 2012

Irish Aid  
CSIR  
Amanz'abantu

# Building Blocks for Effective Faecal sludge Management in Peri-urban Areas: The Role of Small-Scale Independent Providers (SSIP) in Maputo

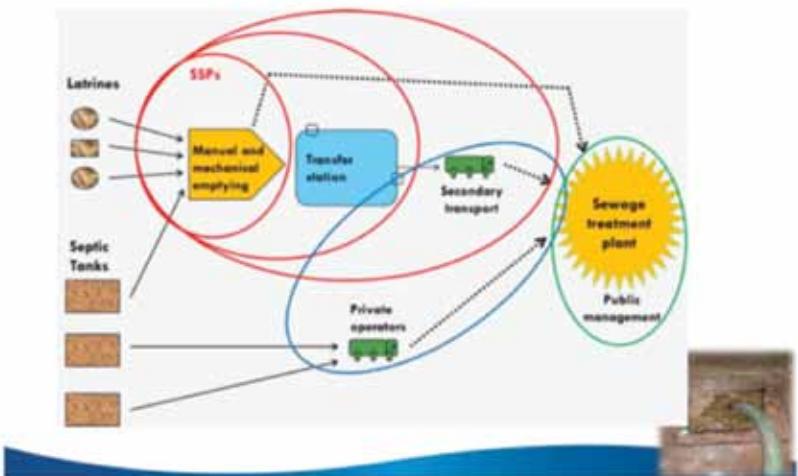
Odeté Muxímpua\*, Peter Hawkins\*

This project analyses the role of the private sector in improving sludge management in peri-urban areas, looking at the options developed and implemented so far, as well as their potential for scaling up in different socio-economic environments.

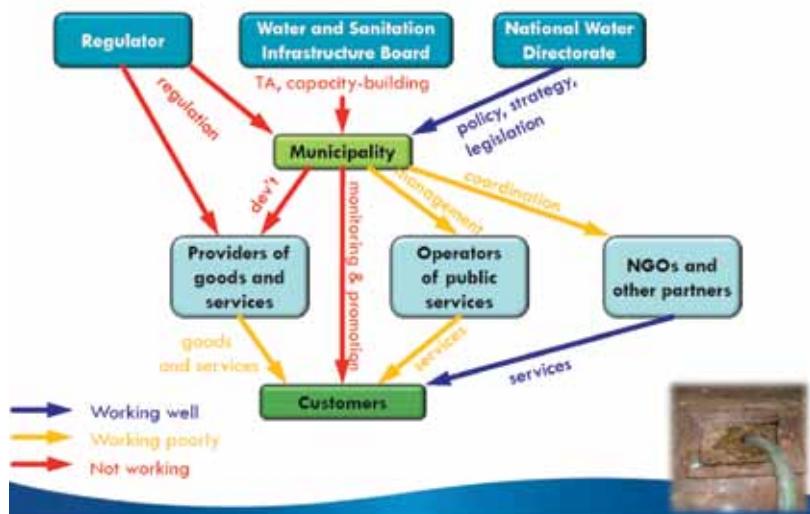
Faecal Sludge Management (FSM) is a major challenge for peri-urban sanitation in the majority of Sub-Saharan African cities. With more than 80% of its population living in peri-urban settlements, and relying on on-site sanitation facilities, Maputo produces on average 150m<sup>3</sup>/day of sludge.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

Findings from the study show a great potential for SSIPs to provide adequate FSM services in the peri-urban settlements. There are however some challenges regarding the quality of sanitation facilities to be emptied, transfer processes, and financing for SSIPs. The study therefore recommends that an integrated approach should be implemented, where all the actors work in a coordinated manner to overcome the challenges identified.

## Options for Integrating the Service Chain



## Who does What?



## For more details:

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# About SAKNSS

The Southern Africa knowledge node on sustainable sanitation aims to fast track and accelerate the delivery of sanitation through sustainable solutions. The node aims to facilitate and coordinate capacity and skills development, knowledge sharing and collaboration.



The website aims to facilitate collaboration and information sharing among stakeholders in the SADC region. It serves as a SADC gateway to sustainable sanitation information. The website is the first regional website with dedicated on sustainable sanitation information. We encourage our stakeholders to register on the website and share with us any documents that will contribute to knowledge sharing and capacity building in the region.

#### The SAKNSS website consists of:

##### Document management system

The SAKNSS document management system is a user friendly component that allows users to search documents by Document Type, theme, country, keyword and advanced search

#### Benefits for members:

- Link and exchange information with peers •
- Access to new information and experience •
- Practical support and capacity building •
- Lessons learned •
- Analysis of policies and sector trends •
- Documentation and sharing of best practice •
- Facilitating platforms for sustainable sanitation dialogue •
- Awareness raising and Networking •

[www.afrisan.org](http://www.afrisan.org)

#### How to access SAKNSS items?

Users should first register their details before they can have full access to the SAKNSS items.

#### Contact management module

The contact management module provides an opportunity for the stakeholders to access their peers, contractors, suppliers, NGOs and government officials. It further allows stakeholders to advertise their own organisations/companies on the website.

#### Links database

The Links database provides access to organisations, private companies and government ministries working with the water and sanitation field.

#### SADC country information on sanitation

The country information page presents the status of sanitation in SADC countries with links to the responsible ministries and their contact details.

