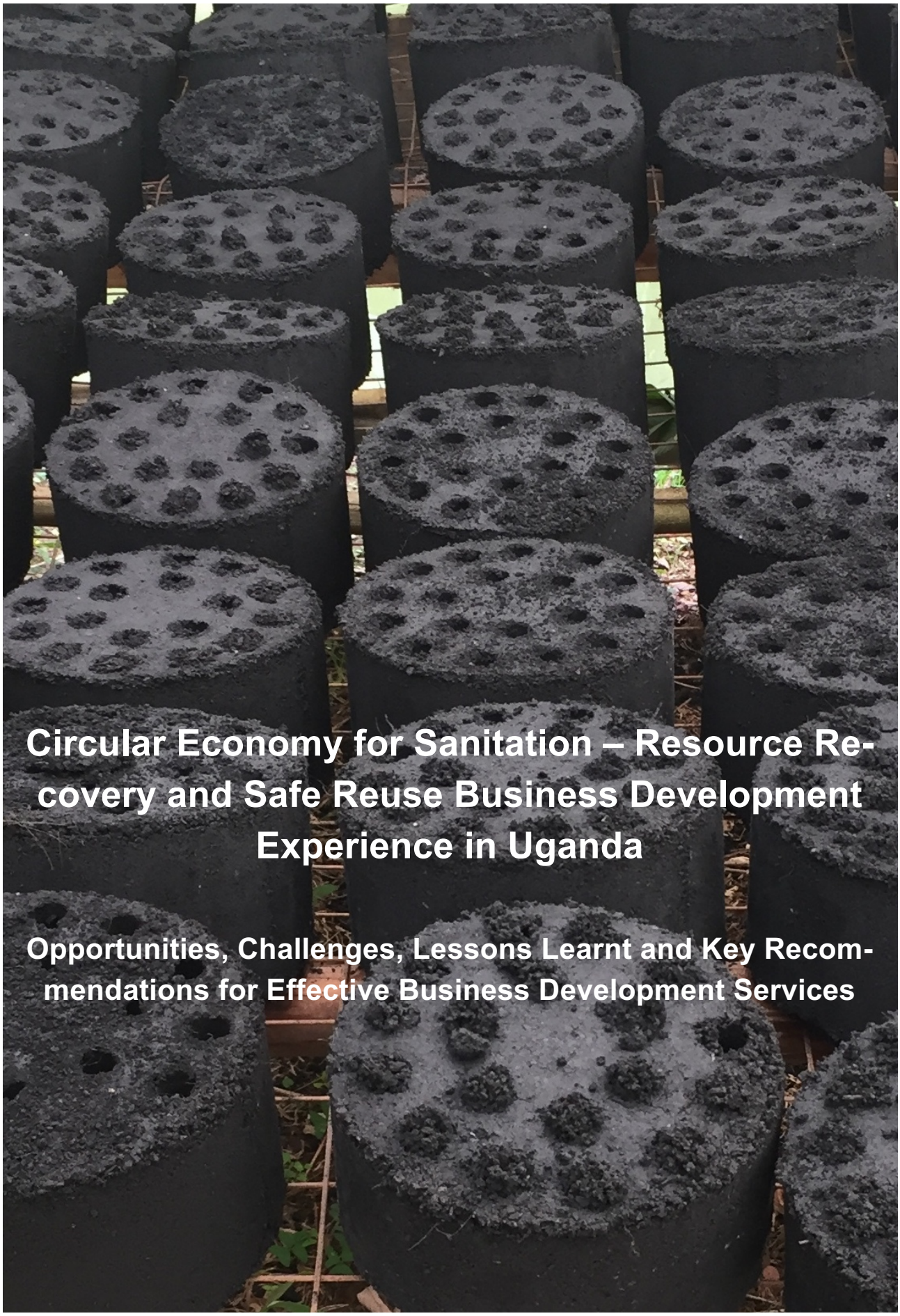
a project of

in cooperation with



Circular Economy for Sanitation – Resource Recovery and Safe Reuse Business Development Experience in Uganda

Opportunities, Challenges, Lessons Learnt and Key Recommendations for Effective Business Development Services

ABOUT THIS REPORT

This report has been compiled by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH's Enhanced Water Security and Sanitation (ENWASS) Programme, Water for People - Uganda and cewas, the international centre for water management services.

The contents reflect opportunities and common challenges faced by micro-, small- and medium-sized businesses in Resource Recovery and Reuse (RRR) across the sanitation service chain, lessons learnt and key recommendations for future business development support in Uganda.

The contents do not necessarily represent the position of the Swiss Agency for Development and Cooperation (SDC), the Kampala Capital City Authority (KCCA) and the National Environment Management Authority (NEMA).

GIZ Enhanced Water Security and Sanitation Programme

GIZ ENWASS works with KCCA, the Ministry of Water and Environment (MWE) and its Directorate of Water Development (DWD), NWSC and other key stakeholders on improving the sanitation sector of Kampala, Uganda. One of the focus areas lies in Faecal Sludge Management (FSM) in the capital city, while at the same time promoting private sector engagement in the sector through the support of Resource Recovery and Safe Reuse (RRR) business models that deal with faecal sludge (FS) as well as complementary waste streams.

Water for People

Water for People is a USA-based non-profit organization that aims at improving people's quality of life by supporting the development of locally sustainable drinking water resources, sanitation facilities, and health and hygiene education programs. In Uganda, Water for People plays a facilitatory role in the Water, Sanitation and Hygiene (WASH) sector through research and development, and Sanitation As A Business (SAAB) aimed at creating commercially viable sanitation businesses.

cewas

cewas is a Swiss-based competence centre linking sustainable water, sanitation and resource management with business development. cewas is a non-profit association managed by seecon international offering professional training, coaching, networking and consulting to bring sustainable business ideas into reality.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

AFSRT ..... Agency for Sustainable Rural Transfomation

B2B ..... Business to Business

B2C ..... Business to Customer

BoW ..... Best of Waste Ltd. (briquette making business supported during implementation of RRR project phases III in Uganda)

CapEx ..... Capital Expense

CBO ..... Community Based Organisation

CEDAT ..... College of Engineering, Design, Art and Technology at Makerere University

CREEC ..... Centre of Research in Energy and Energy Conservation

DEFAST ..... Decentralized Faecal Sludge Treatment

DWD ..... Directorate of Water Development (under the Ministry of Water and Environment)

EASE ..... Engage in Action for Safe Environment (CBO)

Eawag ..... Swiss Federal Institute of Aquatic Science and Technology

EUR ..... Euro (currency, UGX 1.000 ≈ EUR 0,24 as per November 2019)

Ext. RRR-II ..... Extension of 2nd phase of RRR project in Uganda (Aug. 2018 to Nov. 2019)

FS ..... Faecal Sludge

FSM ..... Faecal Sludge Management

GIZ ..... Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH

GIZ-ENWASS .. GIZ Enhanced Water Security and Sanitation Programme

GIZ-RUWASS .. GIZ Reform of the Urban Water and Sanitation Sector Programm

ICCO ..... Interchurch Organization for Development Cooperation

INRM ..... Integrated Natural Resources Management

IWMI ..... International Water Management Institute

KALOCODE .... Kasubi Parish Local Community Development Initiative (CBO)

KCCA..... Kampala Capital City Authority

KEEP..... Kyebando Energy and Environment Project (predecessor organization of SEACO)

KEG..... Kasanvu Environmental Group (briquette making business supported during implementation of RRR project phases II & II in Uganda)

kg..... Kilogram

LPG ..... Liquefied Petroleum Gas

Ltd. ..... Limited

LUCHACOS..... Lubaga Charcoal Briquettes Cooperative Society Limited (briquette making business supported during implementation of RRR project phases II & II in Uganda)

LWF ..... Lutheran World Federation

m^3 ..... cubic metre

MEMD..... Ministry of Energy and Mineral Development (Uganda)

MoU ..... Memorandum of Understanding

MUBS ..... Makerere University Business School

MVP..... Minimum Viable Product

MWE..... Ministry of Water and Environment

NEMA ..... National Environment Management Authority

NGO ..... Non-Governmental Organisation

NO_2..... Nitrogen dioxide (chemical compound)

NWSC..... National Water and Sewerage Corporation

P_2O_5..... Phosphorus pentoxide (chemical compound with molecular formula P_4O_{10} with its common name derived from its empirical formula P_2O_5)

PCB ..... Polychlorinated biphenyls (group of synthetic organic chemicals known as chlorinated hydrocarbons)

REBI ..... Renewable Energy Business Incubator

RRR..... Resource Recovery & Safe Reuse

RRR-I..... Research dominated 1st phase of RRR project (December 2011 to November 2014)

RRR-II..... Implementation dominated 2nd phase of RRR project (October 2015 to July 2017)

RULNUC..... Restoration of Agricultural Livelihoods Northern Uganda

SAAB..... Sanitation as a Business

SAWA..... Saniwaste Solution (Ugandan business)

SDC..... Swiss Agency for Development and Cooperation

SEACO..... Sustainable Energy Answers Co-operative Limited (briquette making business supported during implementation of RRR project phases II & II in Uganda)

SME..... Small and medium-sized enterprise

SO_2..... Sulfur dioxide (chemical compound)

SO_3..... Sulfur trioxide (chemical compound)

SOWAS..... Solid Waste Systems Ltd.

SSP..... Sanitation Safety Plan

SY4Din..... Strong Youth for Development International Ltd. (briquette making business trained and supported during implementation of RRR project phase II in Uganda)

t/y..... tonnes per year

UBOS..... Uganda Bureau of Statistics

UGX..... Ugandan Shilling (currency, UGX 1.000 ≈ USD 0,27 as per November 2019)

UMA..... Uganda Manufacturers Association

UNBS..... Uganda National Bureau of Standard

UNHCR..... United Nations High Commissioner for Refugees

USA..... United States of America

USD..... United States Dollar (currency)

WASH..... Water, Sanitation and Hygiene

WCL..... Wash Consult Limited

WHO..... World Health Organization

LIST OF FIGURES

LIST OF TABLES

LIST OF BOXES

1 BACKGROUND

The Enhanced Water Security and Sanitation (ENWASS) Programme implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH works with the Kampala Capital City Authority (KCCA), the Ministry of Water and Environment (MWE) and its Directorate of Water Development (DWD), the National Water and Sewerage Corporation (NWSC) and other key stakeholders on improving the sanitation sector of Kampala, Uganda. One of the focus areas lies in Faecal Sludge Management (FSM) in the capital city, while at the same time promoting private sector engagement in the sector through the support of Resource Recovery and Safe Reuse (RRR) business models that deal with faecal sludge (FS) as well as complementary waste streams.

2 RESOURCE RECOVERY AND SAFE REUSE ACROSS THE SANITATION SERVICE CHAIN

A fundamental pillar of Integrated Natural Resources Management (INRM) is the resource recovery and reuse of nutrients, water, organic matter and energy from otherwise wasted resources. RRR promotes a paradigm shift in solid and liquid waste management from treatment for disposal to treatment for reuse based on research on generic RRR Business Models at different scales. Recovering nutrients, water and energy from domestic and agro-industrial waste streams is gaining momentum in low-income countries where the sanitation sector is traditionally heavily subsidized and continuously struggles with the provision of basic sanitation services. However, RRR offers significant value beyond “ecological benefits” by offering viable options for cost recovery acros the sanitation service chain (capture & containment → collection & transport → treatment → recovery & reuse → disposal) (see Figure 1) and business opportunities that attract private capital. Both processes can be game changers in the sanitation-agriculture interface if the underlying business models are sustainable and can be scaled up [adapted from WAFLER 2018].

Figure 1: Considering the entire sanitation service and value chain from containment through collection & transport, treatment, recovery & reuse or disposal. [Source: GIZ-ENWASS]

3 ENABLING ENVIRONMENT

Establishing an enabling environment for private sector engagement in FSM One of the key deliverables for the RRR project Phase II was to support KCCA in strengthening the legal and institional frameworks for FSM and creating an enabling environment for private sector engagement in the sanitation sector. This meant, setting up systems that ensure that:

a) Faecal sludge (FS) is safely captured and contained,

b) FS safely collected and transported to the treatment plant

c) FS is treated

d) Safely disposed of or reused

Different interventions were piloted in 5 pilot wards in Kampala which were aimed at deriving learnings for scaling a regulated private sector led sanitation service delivery. For Kampala's case, the regulator (KCCA) was very supportive of the private sector engagement because they needed their support in meeting the delivery of sanitation service in the city. Additionally, the private sector was also willing to discuss openly with the regulator about business potential, challenges and opportunities in the hope of being supported to break even in their businesses. As a result of the pilot and these regulator-service provider engagements, the following systems have been put in place to leverage regulated private sector engagement:

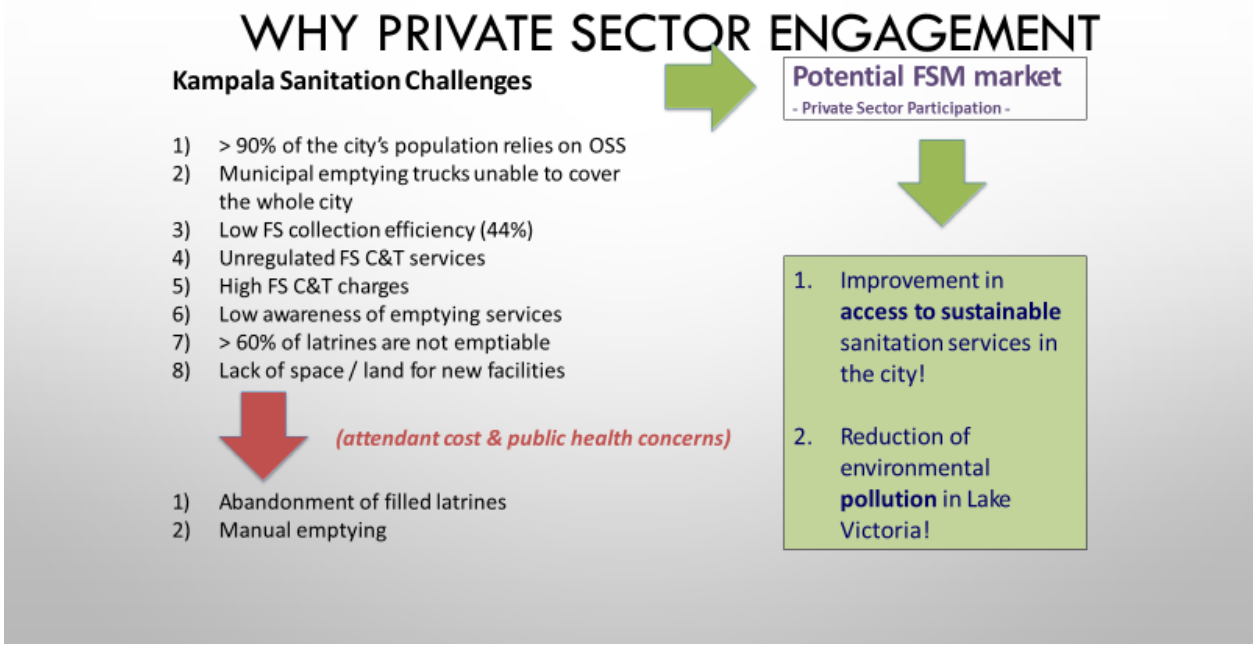


Figure 2: A case for the private emptiers

An FSM call center was established at KCCA which now serves as a channel for the public to request for sanitation services and these are then refered to private operator companies.

Minimum infrastructural standards for onsite sanitation facilities have been established to ensure FS is safely captured and contained protecting the environment, and ensuring safe pit emptying operations by the private emptiers.

Private emptier companies are linked to customers needing the emptying service through the call centre at KCCA.

The process for acquiring FS transport licences have also been well structured and regulatory Authorities prioritize the awarding of these licences to interested private companies thus making their operations legal.

The gulper technology operators were also supported introduction of the FS transfer stations which helps reduce costs of emptying (increased demand in informal settlements) making them affordable for the poor citzens in the informal settlements where empting with vacuum tanks is close to impossible. The private RRR businesses in Kampala resuing FS a resource, though still very scarce in Kampala, were also supported by KCCA (Regulator) through business development trainings facilited by business and technical experts, to achieve circular economy benefits. Market test have been conducted and promotional materials developed to support the small RRR businesses and their ideas.

Inconclusion, we can say that in Kampala, the private sector at any point of the sanition chain can thrive on sanitation as a business (containment, transport, treatment and reuse) provided the set standards, laws and regulations are adhered too.

4 BUSINESS DEVELOPMENT SUPPORT IN RESOURCE RECOVERY AND REUSE

Business development support in Resource Recovery and Reuse was implemented in two distinct phases in Uganda:

1. RRR Phase I (RRR-I): research dominated phase aimed at identifying extisting reuse cases and developing RRR business models and Sanitation Safety Plans (December 2011 to November 2014), co-led by World Health Organization (WHO) and International Water Management Institute (IWMI) with co-funding from the Swiss Agency for Development and Cooperation (SDC)
2. RRR Phase II (RRR-II): RRR business training and coaching dominated phase (October 2015 to July 2017), implemented by GIZ Reform of the Urban Water and Sanitation Sector Programm (RUWASS) and co-funding from SDC

3. Extension of RRR Phase II (RRR-II): continued implementation and follow-up of business development activities, communication and dissemination of RRR project experiences and lessons learned on a national and international level (August 2018 to November 2019), implemented by GIZ- ENWASS and co-funded by SDC

4.1 Resource Recover and Reuse Phase I

The Resource Recover and Reuse project was based on the realisation that a lack of business models in the sanitation-agriculture interface is a key gap limiting development. Another gap concerned applied options to safeguard public health where waste resources are reused, especially those with potential faecal contamination.

The research dominated first phase of the RRR project, which was implemented from December 2011 to November 2014, in Bangalore (India), Hanoi (Vietnam), Kampala (Uganda) and Lima (Peru) consisted of several steps progressively interlinking IWMI- and WHO-led initiatives. The IWMI-led part aimed at identifying existing or emerging reuse cases of water, nutrients, organic matter and energy from domestic and agro-industrial waste streams in Asia, Africa and Latin America to learn about their performance and analyze in depth the most promising and/or scalable cases. Under the aegis of IWMI a compendium on resource recovery from organic municipal, agro-industrial and food waste, wastewater and fecal sludge, supporting a diverse range of business models with potential for large-scale out- and up-scaling was compiled.

Chosen from about 150 public and private RRR projects and enterprises, of which over 60 were analysed in detail, the compendium presents a selection of 47 empirical business cases from around the world. From the empirical business cases that are described and evaluated in a systematic way, 24 generic business models for energy, nutrient and water reuse in low- and middle-income countries were extracted. To pilot text the resource recovery from waste business models, cewas - the international centre for water management services - carried out one RRR Business Model Development Training in each of the 4 feasibility study cities between October 2014 and January 2015. The trainings were designed for entrepreneurs and intrapreneurs of established public or private businesses and trainers/coaches in the emerging water, sanitation and resource management sector. The goal of the trainings was to support entrepreneurs in the expansion of their business´ portfolios to include products and services in the recovery of resources from solid and liquid waste streams. The trainings were attended by a total number of 63 people from 31 different businesses, organisations and institutions.

In tandem with identifying and analyzing reuse business models, during this phase, a Sanitation Safety Plan (SSP) Manual was developed to safeguard public health in the context of rapidly expanding use of wastewater, excreta and greywater in agriculture and aquaculture and protect vulnerable groups from specific health risks associated with this pattern of agricultural development. This manual is intended for the practical application of the

WHO guidelines in the context of low-income, often peri-urban farming communities that rely on wastewater, excreta and greywater as a resource for their water and nutrient needs.

4.2 Resource Recover and Reuse Phase II, Uganda

The aim of the second phase of the RRR Project (RRR-II) in Uganda, which was running from October 2015 to July 2017, was to ensure that "*safe and financially sustainable RRR business pilots are established in Kampala*" with a special focus on "*coaching 2 - 3 start-up entrepreneurs to establish a RRR business*". RRR-II in Uganda was implemented by GIZ-RUWASS and KCCA and co-funded by SDC.

Implementation of activities and achievement of results was a team effort on the part of professionals from the College of Engineering, Design, Art and Technology at Makerere University (CEDAT), cewas, the Swiss Federal Institute of Aquatic Science and Technology (Eawag) and Makerere University Business School (MUBS).

Figure 3: Outline of RRR-II Business Development Programme (Component 2b). [Source: own graphic by cewas]

To support entrepreneurs in establishing RRR businesses, the following key activities were prepared, implemented and documented (Figure 3):

1. 2 Business Model Development Ateliers
2. 2 Smart Start-Up Programmes
3. a Business Ideas Competition
4. Technical and Business Development Coaching

Two full-day RRR Business Model Development Ateliers were held in December 2015 and March 2016. These workshops were designed for professionals who wished to expand their proficiency in promising business models for the safe resource recovery from liquid and solid waste and had the overall aim of identifying a critical number of potential beneficiaries for the project. Because of these Ateliers, over 60 participants have been introduced to the Business Model Canvas, an entrepreneurial tool for describing, analysing, and designing business models. Participants were encouraged to present their own business ideas in RRR in the workshop and to invite other participants to work together with them on the business model.

Two RRR Smart Start-Up Programmes were held in the first-half of 2016. RRR Smart Start-Up Programmes are an in-depth business model and business plan training that is facilitated by means of 2 modules (A & B), which must be considered as one training-cum-coaching package. Interested participants (entrepreneurs) had to apply for this programme with a short explanation of why they were interested to participate. Most of the applicants were drawn from the preceding Ateliers. A total number of 16 Start-Ups/SMEs successfully completed the training, learned and applied to (amongst others) …

… minimise failure by analysing the external business environment,

… describe their customer segments,

… design, test, and build value propositions in a structured and thoughtful way,

… consolidate their business model,

… identify and mitigate health risks in RRR,

… tell persuasive business stories,

… develop a Minimum Viable Product (MVP),

… use strategic management tools,

… understand key financial management tools, define costs and pricing strategies,

… identify and mitigate business risks, and

… know how to write an excellent and convincing business plan

The RRR Business Ideas Competition was meant to support the project team in selecting the most promising start-up entrepreneurs out of the 16 that had undergone the RRR Smart Start-Up Programme in a transparent process for further support and coaching. 14 out of the 16 Start-Ups/SMEs, that successfully completed the RRR Smart Start-Up Programmes, submitted documents for the RRR Business Ideas Competition. After a pre-screening process based on a scroring sheet, which had been developed by the project team, presentation of selected ideas in front of an audience and expert panel, and award ceremony happened in August 2016. The expert panel comprised of representatives of GIZ, MUBS, CEDAT, KCCA, National Environment Management Authority (NEMA) and Uganda Manufacturers Association (UMA).

Four successful Start-Ups/SMEs (i.e. Solid Waste Systems Ltd. - SOWAS, De-Waste, GreenTrac and Strong Youth for Development International Ltd. - SY4Din) emerged as winners of the competition and favourable for continued support in kick starting their RRR business, under the project, in terms of:

1. free advisory services, coaching, mentorship and support by KCCA, GIZ-RUWASS, MUBS, CEDAT, Eawag and cewas,
2. support in acquiring licenses, and
3. procurement of needed equipment

4.3 Extension of Resource Recover and Reuse Phase II, Uganda

The general objectives of the extension of the second phase of the RRR Project (Extension RRR-II) in Uganda, which was implemented from August 2018 to November 2019, were to strengthen business capacitities (profitability, business planning, licensing, FS product development and marketing) and technical capacities (skills, knowledge) of relevant RRR entrepreneurs reusing and recovering resources from faecal sludge in close collaboration with NWSC, and have at least two RRR pilots reusing and recovering resources from faecal sludge waste streams implemented in Kampala and functioning safely and financially profitable.

To achieve these objectives, the scope of key activities entailed:

- Determination of the market through a thorough market resarch for FS briquettes in Kam-pala, this provided leads into the market for FS briquettes.
- Training of RRR businesses in FS briquette production as an alternative product in addi-ton to charcoal briquettes.
- Training on market pitching and understanding what the market says about one's prod-uct, and to follow the market trends.
- Training on money management (including saving for future investment).

- Mentorship and handholding on record keeping, target setting, sales and marketing of sanitation products.
- performing financial analysis of selected micro- and small-sized briquette businesses and a carbonisation plant for FS in Kampala as well as Decentralized Faecal Sludge Treatment (DEFAST) and Reuse plants at Kole and Kitgum.

5 CONTEXT

Biomass is the predominant type of energy used in Uganda. Charcoal is mainly used in the urban areas while firewood, agro-residues and wood wastes are widely used in sub urban and rural areas with firewood at 78,6%, charcoal at 5,6% and crop residues at 4,7% [MEMD 2014].

According to the 2016/17 Uganda National Household Survey [UBOS 2017], almost two thirds of households in Uganda (64%) used firewood for cooking, three in every ten households (30%) used charcoal. Other sources of energy for cooking such as electricity, kerosene, gas, etc. accounted for only six percent (6%).

In Kampala, eight in every ten households (ca. 80%) used charcoal and two in every ten households (20%) used other sources of energy for cooking.

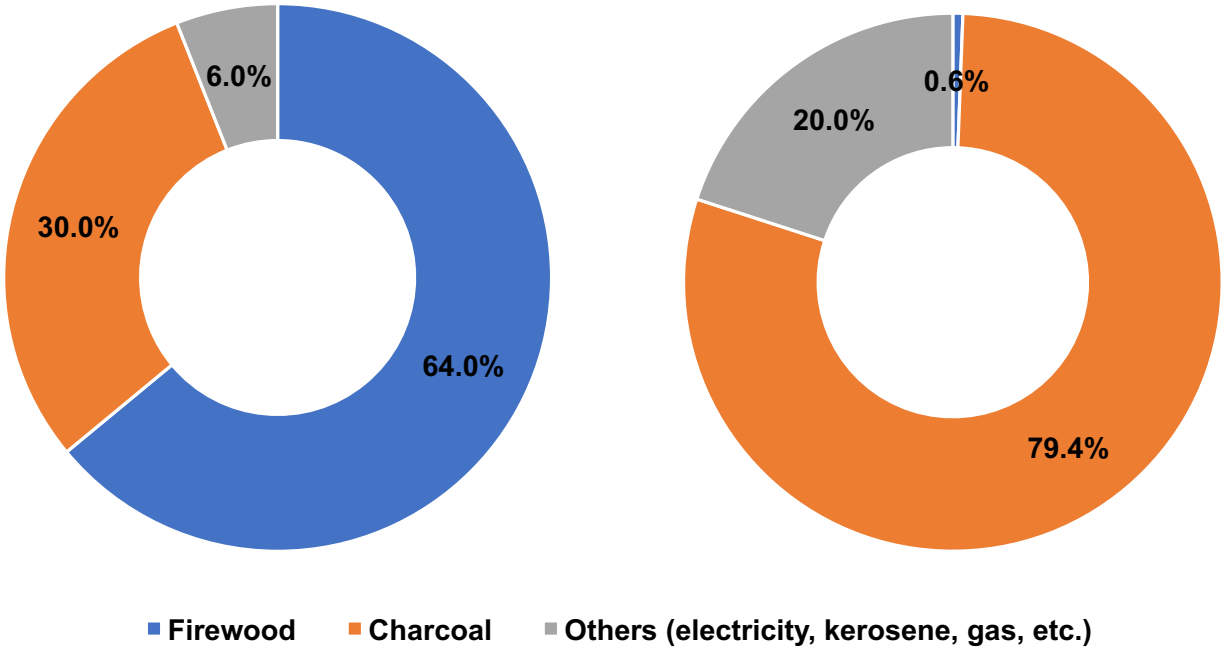


Figure 4: Percentage share of households by type of cooking fuel in Uganda (left) and Kampala (right). [Source: graphic by cewas based on UBOS 2017]

In Uganda, fire wood is sold in trucks (for large buyers) or heaps and by most retailers by pieces. Its pricing is largely subjective.

Charcoal, at large, is sold in sacks that are measured by size and level of filling. Common retail measures are basins, tins (that are not standard themselves), heaps, etc. In beginning 2019, the price ranged from Ugandan Shilling (UGX) 4.000 to 5.000 per basin (depending on location, level of filling, etc.). A basin is estimated to weigh about 5 kg (UGX 800 to 900/kg). UGX 1.500 to 2.000 per tin (discarded 1 - 2 litres paint tins), and heaps ranging from UGX 500 to 1.000. And UGX 100,000 per ca. 50kg sack.

On the other hand, the price range for briquettes is UGX 1.000 to 1.500 per kilogram or an estimated heap of about that weight.

Largely subjective in pricing (sold in truck loads, heaps or by pieces)

USD 22,00 per sack (UGX 80.000, 70 - 80 kg/sack)
USD 1,10 - 1,40 per basin (UGX 4 - 5.000, 5 kg/basin)
USD 0,40 - 0,55 per tin (UGX 1.500 - 2.000, 1 - 2 litres)
USD 0,15 - 0,30 per heap (UGX 500 - 1.000)

USD (0,15 -) 0,30 - 0,40 per kg (UGX 600 - 1.500)

Figure 5: Market price ranges for cooking fuels such as fire wood, charcoal and briquettes in Kampala, Uganda (as per February 2019).
[Source: graphic by Martin Wafler]

The determination of market prices in Uganda, is not so structured. However, it is heavily dependent on the type of tree used for fire wood and or charcoal, as well as on the distance from the point of production to the point of sale. Charcoal from strong tree species usually cost higher than those from lighter species and those that have to be moved a longer distance into Kampala or other urban centres will cost more for reasons of transport costs being factored into the final price. The most common tree species used for charcoal in Uganda are; Terminalia glaucescens (Muyati), Abizia zygia (Mulongo), Acacia sieberiama (Mweramenyo), Acacia seyal (Mugano) and Acacia hockii (Musana).

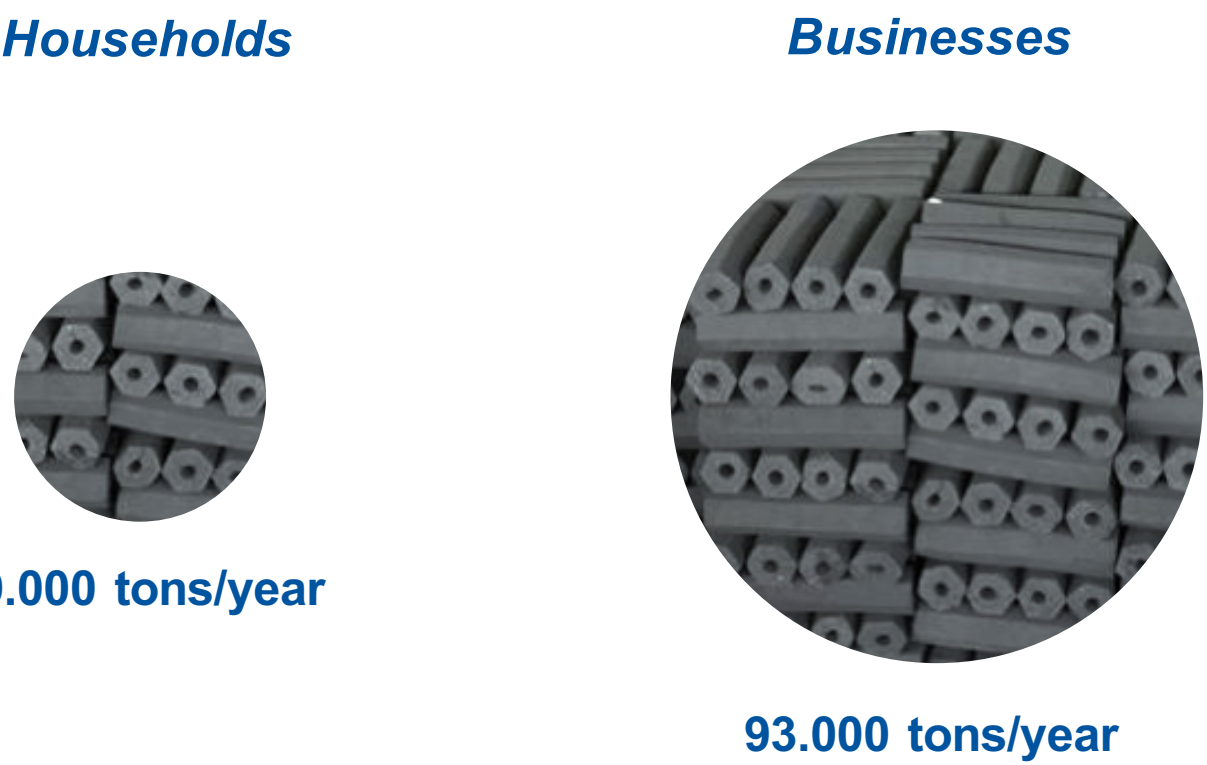


Figure 6: Estimated market demand for briquettes in Kampala, Uganda. [Source: IWMI 2015]

Driven by population growth, urbanization, increasing incomes, and changing tastes, briquette business has raised rapidly over the past decade. The potential market demand for briquettes from households and businesses (that is restaurants, agricultural industries, hospitals, schools and universities) in Kampala is estimated at ca. 19.000 and 93.000 tons per year, respectively [IWMI 2015].

Briquette producers in Uganda fall into distinct scales of operation characterised mainly by their type of briquette machine [FERGUSON 2012]:

There are hundreds of micro-scale producers in operation who use primitive equipment and are largely engaged in income supplementing ventures. Most are making briquettes by hand in quantities of less than 2 tonnes per year and for their own consumption as well as to sell in their local neighbourhood. Many of the more enterprising of these, often with support from national programmes, Non-Governmental Organisations (NGOs), etc. purchased manual machines to enable them to produce up to 20 tonnes per year.

Motorised machines fabricated by skilled artisans are capable of manufacturing up to 200 tonnes of briquettes per year. This is a typical entry point for entrepreneurs to enter the market with powered machinery that they can purchase locally. However, this capability is yet to be attained due to limiting factors as discussed further below.

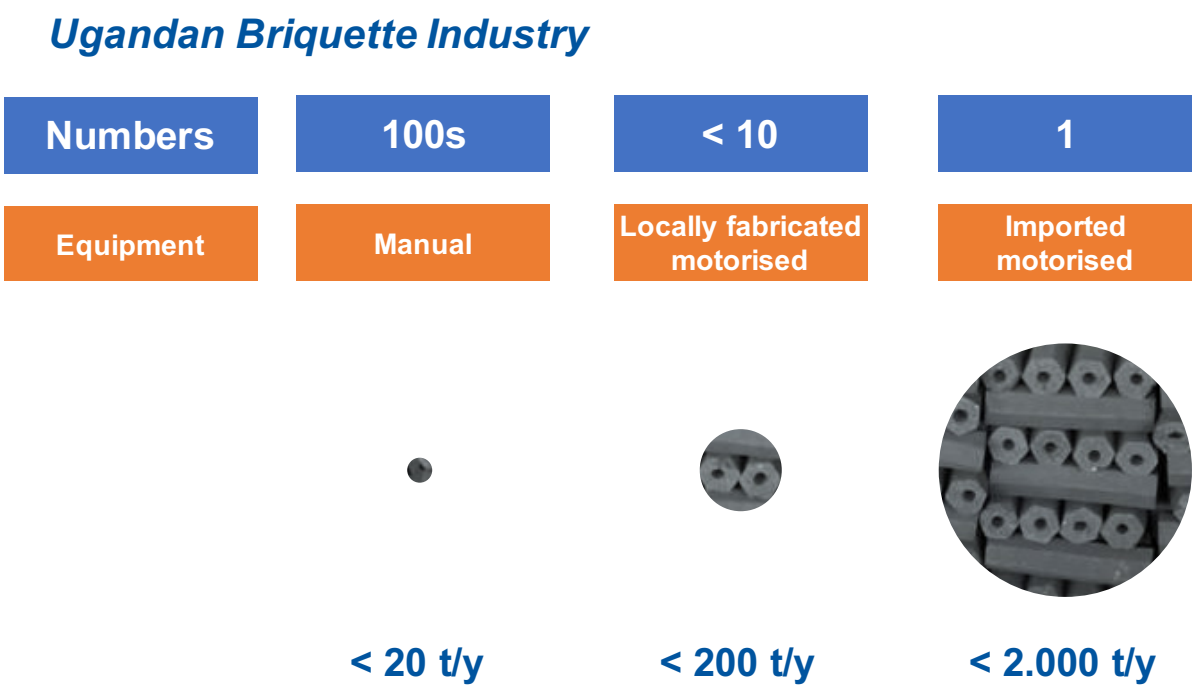


Figure 7: Overview on briquette businesses.
[Source: own graphic based on FERGUSON 2012], Key: t/y … tonnes per year

Almost all of the "2.000 tonnes-per-year businesses" in East Africa have benefited from grant funding to get them started and 3 out of the 4 largest have been set up by foreign participants.

There are opportunities of growth at multiple scales of operation. Micro-entrepreneurs can be grown into small to medium scale producers (20 - 200 tonnes per year) using locally available machinery. By attracting suitable investment, opportunities also exist for new entrants to open medium to large scale production facilities (200 – 2.000+ tonnes per year), using imported equipment.

6 STORIES OF SELECTED RESOURCE RECOVERY AND SAFE REUSE BUSINESSES ACROSS THE SANITATION SERVICE CHAIN

RRR allows for an immense, largely untapped opportunities for provision of products and services across the sanitation service and value chain such as empyting of pits, transportation and treatment of FS and the recovery of water, nutrients, energy and organic compounds. Figure 8 provides an overview of the position of selected RRR businesses and interventions in Uganda across the sanitation management chain.

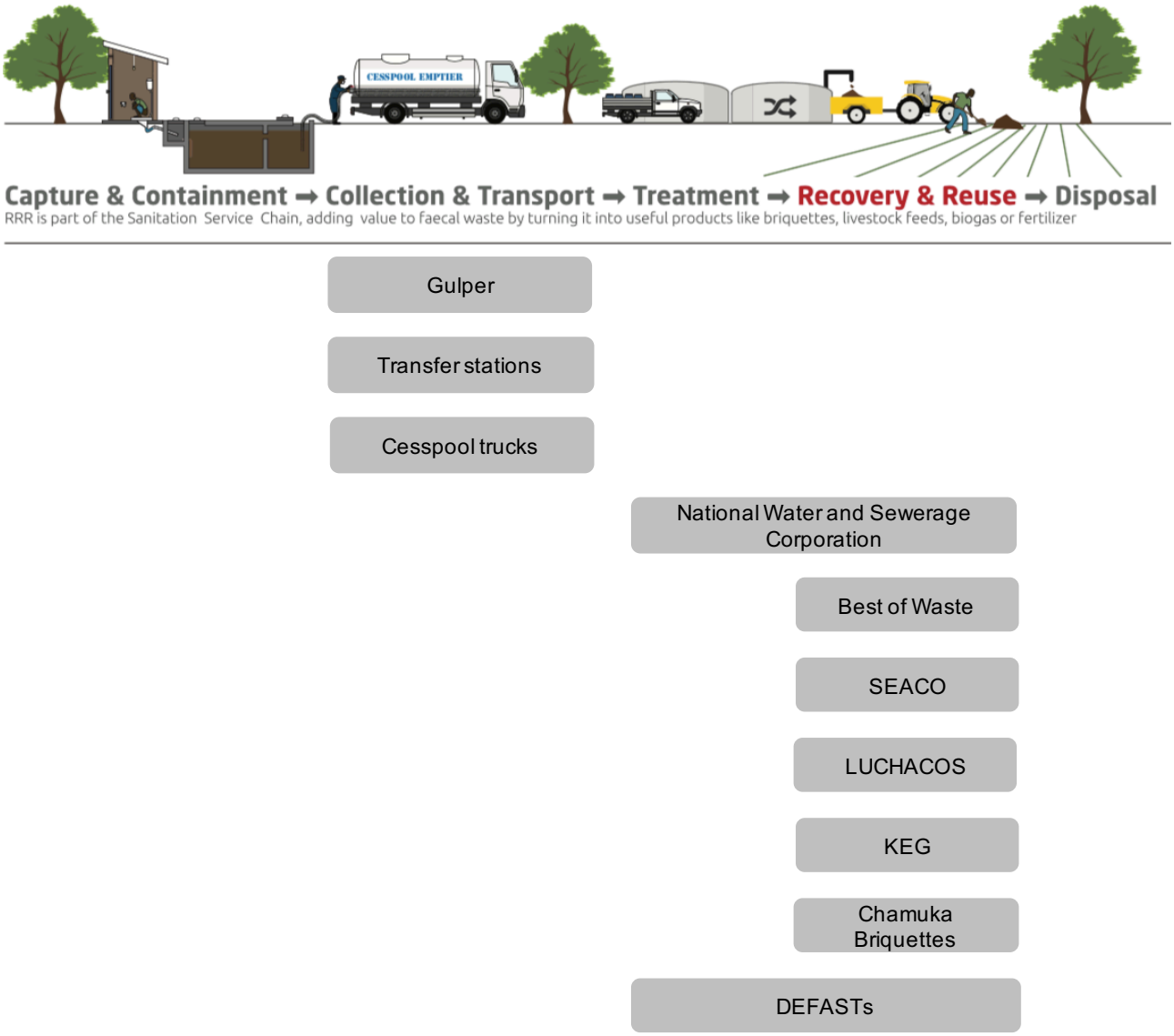


Figure 8: Overview on the position of selected RRR businesses/interventions across the sanitation chain.

Detailed information on the individual businesses/interventions is provided in the following chapters.

6.1 Gulper

The Gulper is a simple direct lift pump which operates in a similar way to a borehole pump. It is designed to partially empty existing pit latrines of the supernatant layer at the top of the pit. The standard gulper will reach 1m-1.5m in to the pit and the Extendable Gulper will reach up to 2m in to the pit. The cost to an entrepreneur is a few hundred dol-lars which will fluctuate depending on the fabricator.

In Uganda, the technology was first piloted by Water for People and has since been associated with pit emptiers similarly known as Gulper entreprenuers. The technology has

evolved from the intial Gulper 1 to the current Gulper 4 that is still under development. Of these gulper technologies, Gulper 1 has been the most widely used and most successful.

The Gulper was developed to meet the demand for low cost pit emptying services in unplanned urban areas. It can be manufactured by many fabricators found in urban areas but it is useful to test the ability of the fabricator by getting them to produce one prototype first as some do not possess the required skill to make the butterfly valves to a high enough standard. But it is a simple technology to operate by a non-skilled workforce, once a short training session has been conducted.

Box 1: Gulper operations

Gulper operations:

When the plunger is pushed down the valve opens to allow sludge to flow up past it. When the plunger is raised the valve closes and the sludge is lifted up the rising pipe. As this happens, sludge floods in to the base of the rising pipe through the bottom valve. The repetition of this action drags sludge further and further up the rising pipe to the 45 T junction where it pours out in to a barrel.

6.2 Transfer stations

Water for People in 2013 partnered with GIZ to increase access to sanitation coverage through promotion of sustainable sanitation technologies and scaling up the pit emptying business in 3 parishes; i.e., Bwaise I, Bwaise II and Nateete.

Among the achievements of this engagement was the recruitment of 6 entrepreneurs and development of business plans for the entrepreneurs. The entrepreneurs could empty over 400 pit latrines by the end of the project period. One of the hindrences to the proliferation of the business and clientele during the 2013 project was the high costs of gulping. The business model implemented was deemed to be more expensive for some communities particularly due to transportation costs that are factored into the cost per trip made to the dumping site, and thus borne by the client. The project recommended the need to have a system that will ensure affordable collection costs incurred by the client.

A pilot test of a small fixed transfer tank system which would allow transport cost savings for manual pit latrine emptying businesses was initiated. However, the project failed due to land issues that are common in Kampala. Some land owners were not authentic; in other areas, the development plans would not allow permanent transfer tanks, while hiring private land or buying is not only expensive but unsustainable. Moreover, the fixed station would not eliminate the cost of primary transport and secondary transport. It is with this background that an idea of mobile sludge transfer tanks was conceived.

The mobile transfer tank consists of a tractor and a detachable 5.000 litre trailer tank. The detachable trailer consists of a 10-tonne walking beam axle and tires of size 12.5/80. The loading mechanism consists of a 200 litres trough suspended in fixed rail guides along one side of the tank body. The trough is connected to a 1 tonne winch by a cable that rans along two fixed pulleys on the tank body. During operation, the trough is lifted and lowered by operation and alternating of the winch functions. Performance

TRIPS IN 2019												
PERIOD	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
01st								2		6	5	
02nd								4	8	6		
03rd								7	4	9		
04th								2	6	6		
05th								6	5	5		
06th									9			
07th									9			
08th												
09th									9			
10th									7			
11th									9			
12th									8			
13th									12			
14th									6			
15th									8	6		
16th										7		
17th										1		
18th									13	4		
19th									7	10		
20th									8			
21st									6	5		
22nd										6		
23rd									1	6		
24th							10		7	5		
25th							6		4	5		
26th							6		4	10		
27th									7			
28th									7	5		
29th							2			9		
30th							2		4	6		
31st							3			9		
Total Trips							29	21	168	126	5	
Average Pm							4.8	4.5	7	6.3	5	
Average Pa												5.52

Table 1: Performance of the transfer tank in 2019

6.3 National Water and Sewerage Corporation

Established in 1972, National Water and Sewerage Corporation (NWSC) is a public utility company and state-owned corporation mandated to operate and provide water and sewerage services.

At present, NWSC's Sewerage Services Department (SSD) operates two Sewage Treatment Plants (STP) in Bugolobi and Lubigi, Kampala.

Commissioned in 2014, NWSC's Lubigi Faecal Sludge and Wastewater Treatment Plant is located on Lubigi wetland in Kawempe division, Kampala district along the northern by-pass road. The plant receives and treats wastewater from a piped network as well as faecal sludge brought by private cesspool emptier trucks. It has the capacity to treat 400 m^3 of FS and 5000 m^3 of wastewater per day. Treatment is based on waste stabilisation ponds and unplanted sludge drying beds (see Figure 9).

Figure 9: Unplanted drying beds at Lubigi STP [Photo credit: Lars Schoebitz]

Treated FS (that is after drying on sludge drying beds) is sold to farmers as a soil amendment with no further processing.

NWSC generates a revenue of about UGX 6.000.000 per month from selling about 300 tonnes of dried FS (@ UGX 20.000 per ton).

6.4 Lubaga Charcoal Briquettes Cooperative Society Ltd.

LUCHACOS - Lubaga Charcoal Briquettes Cooperative Society Limited - is a Cooperative Society by business form operating in the city division of Lubaga. The executive committee comprises of nine officials, who form the management team. LUCHACOS produces stick-type briquettes as affordable and effective source of energy for cooking to institutions (poultry farms, schools, etc.) and low-income households. Their briquettes can be used in any type of cooking stove. In addition, they planned to provide consultancy and training.

LUCHACOS grew slowly within the community and gradually registered as a cooperative organization. They depended on both, waste from the community as well as their market

consisting of households and small firms in fast growing urban centres such as Kasubi and Nakulabye in Lubaga Division (Kampala District of Uganda). As LUCHACOS grew in size and business, they linked up and formed a partnership with Kasubi Parish Local Community Development Initiative (KALOCODE), which offered a bigger space in Nansana Village (Nansana Parish of Nabweru Subcounty in Wakiso District of Uganda) where briquette production was to be undertaken. Upon agreeing on rent, leadership and sharing of proceeds and inputs, LUCHACOS closed their already squezzed work space, moved and set-up their briquette making equipment in the new spacious work station that was to be their new home and to work well with KALOCODE. The RRR-II Project Team emphasized issues of working together, trust and the need to document some of the decisions and agreements.

However, as time went on, disagreements arose and mistrust grew between the new business partners: the key issue being harmonization of expectations. In June 2019, production at the new site was suspended due to disputes amongst the partners. The family that owns the land where LUCHACOS' briquette making machinery was installed and production was due to commence are the leaders of KALOCODE. They were unsure of what LUCHACOS made of their offer of the work space and how both would mutually benefit from the joint material and expense investments. Therefore, LUCHACOS team finally decided to relocate to their own 8-acre land in Bulima Village (Kakiri Parish of Kakiri Subcounty in Wakiso District of Uganda). However, the new location is far from their orginal work station within Rubaga Division of the city district that had become congested.

On the other hand, KALOCODE determined to go on with briquette business. They recruited 5 people distributed at the different sites on part-time basis, by start of August 2019 and were trying to raise working capital for production to kick off.

The challenges for both groups remain working capital, lack of suitable equipment, of course costs of set up like LUCHACOS' new home being outside the city, transportation and construction of shelters to house the equipment is required in addition, to reaching out and discussing with Kakiri Town Council on possibilities of delivering the inputs (waste) at the site in Bulima, Kakiri. For KALOCODE, while the leadership and members are in Rubaga Division, the work space that they had agreed to share with LUCHACOS is in Nansana Town Council and thus have issues with municipal authorities on licensing among others.

Within the scope of the extension phase of RRR-II, Water for People, an international NGO operating in Uganda, engaged with the company towards technical support to scale up integration of faecal sludge in their briquttee production. Water for People reached out to LUCHACOS and later KALOCODE. Discussions were commenced, mobilization done and technical guidance given in production.

Figure 10: Training on FS inclusion as an input conducted by Water for People with LUCHACOS. [Photo credit: Water for People - Uganda]

Luchacos post training was availed a marketing training which resulted in market the segmentation of the target audience.

Box 2: Costs of carbonized faecal sludge impacts on profit margin

Costs of carbonized faecal sludge impacts on profit margin

"We have tried out use of faecal sludge as an ingredient production from a sample obtain from Water for People and agree that it can be used in briquette production. However, the cost for carbonized faecal sludge is high and drives our sale price for our briquette there by impacting greatly on our profit margin. We had initiated a conversation with our partners at Water for People revolving on coming up with a price for the sludge that works for them and us in this regard"

Nevertheless, the future for faecal sludge briquettes is bright if the bottlenecks could be undone. Especially the price for the carbonized faecal sludge (material) need to be lowered to enable the producers to breakeven, consistence in availing the material at all-time were the material could be accessed instantly. I foresee faecal sludge becoming one of the major ingredients in briquette production in near future.

6.5 Sustainable Energy Answers Co-operative Ltd.

Sustainable Energy Answers Co-operative (SEACO) Limited was registered as company limited by shares in December 2016. It was among the firms supported in RRR Phase II. Located in Kiteezi Parish (Nangabo Subcounty in Wakiso District of Uganda), a few kilometres outside of Kampala City boundaries, SEACO is a small enterprise owned by four entrepreneurs. SEACO manufactures briquettes from biomass waste providing a compact,

smokeless, long-burning and low-cost source of energy suitable for households, restaurants, institutions, bakers and poultry breeders as substitute to traditional sources of energy such as firewood, charcoal, kerosene, LPG (Liquefied Petroleum Gas) and electricity.

What became known as SEACO has grown from a very small initiative and unregistered business association of five persons that handled community wastes that were readily available. The group originally operated informally as friends collecting rubbish and turning it into usable products. Following KCCA's advise, a Community Based Organization (CBO) was formed that was later called by the name Kyebando Energy and Environment Project (KEEP). Some members dropped out along the way due to discouragements such as lack of machinery, slow market growth and working with dirty materials. Following KCCA enforcement policy of clearing unplanned structures from the city and its suburbs, the facilities that KEEP had set up were all brought down. Four of the original over 15 CBO members remained, reshaped the business idea and through some old acquaintances got a piece of farm land to rent just outside the boundaries of Kampala City in Kiteezi adjacent to the KCCA landfill in Nangabo Subcounty and became the founders of SEACO with equal shares.

Figure 11: SEACO's production shed (left) and briquette drying shed (right) at Kiteezi in beginning-May 2017.
[Photo credit: Martin Wafler]

Currently, SEACO is in production fo their old product line. Wate for People has worked with them in the production of prototypes of briquettes using the 40% FS and 60% charcoal sludge compositions.

Their recent opinion was that the tests were promising and gradually a suitable formula would be attained. Water for People has further supported SEACO to open and operate a market stall at the neigbouring Kalerwe market. Results indicate slow market growth in sales from the stall. In July 2019, a market show was conducted with Water for People and cewas involving SEACO team with mega phones in busy market locations at Kalerwe (Kyebando Parish of Kawempe Division in Kampala District of Uganda) and Busega (Rubaga Parish of Rubaga Division in Kampala District of Uganda). The enthusiasm of the public was encouraging.

Through the money market training that was conducted by Water for People, SEACO increased their sale price from UGX 1.300 to 1.500 upon realisation that their monthly budget was not being met adequately.

Water for People further supported the SEACO team with a sales training which training focused on the sales cycle. SEACO was tasked to set sales targets and is now set increase production from 1.000 honeycombs to producing 1.500 honeycombs and selling all at UGX 2.000 to enable a profit.

Figure 12: SEACO team being trained in FS inclusion as a briquette input. [Photo credit: Water for People - Uganda]

Figure 13: SEACO conducting a market activation/ pitching in Kalerwe Market [Photo credit: Water for People - Uganda]

Figure 14: Charles Kyamanywa holds one of his 'honeycomb' fecal sludge briquettes. [Photo credit: Water for People]

Figure 15: Charles Kyamanywa received machinery. [Photo credit: Water for People - Uganda]

Figure 16: Charles Kyamanywa sells his briquettes at UGX1500 a piece. [Photo credit: Water for People]

Box 3: Bringing back the rain: Charles Kyamanywa's entrepreneurship story

Bringing back the rain: Charles Kyamanywa's entrepreneurship story

One morning in 2008 while Charles Kyamanywa was getting ready for work, he had a sudden realization. It had not been raining in his town of Kiteezi for the past several days. Yet it was the rainy season.

"I saw the weather patterns changing, and the rainfall was uneven. People's crops were drying up, and we were going hungry."

Charles, a fifty-eight year old father of seven, turned to the internet to find out why this was happening. He learned that the problem was climate change, made worse by the deforestation occurring in the area.

At the time, Charles, was creating briquettes made out of silt, water and charcoal dust obtained from the cutting down of trees and burning of firewood. He soon realized that his charcoal briquette business was contributing to the rainfall problem in Kiteezi.

At the same time, customers were starting to consider charcoal briquettes old fashioned. "Customers would look at my charcoal briquettes and ask, 'Why do you want to take us back to the village? Those are our grandmothers' ways. We have moved on!'"

The environmental hazards and dwindling charcoal market spurred Charles to start pro-ducing a different type of briquette.

"I started making briquettes, so that we could stop using firewood."

In 2018, GIZ in partnership with Water for People began providing support to increase the business and technical capacity of Charles' briquette company SEACO, and similar businesses including LUCHACOS and Best of Waste.

Water for People has trained the entrepreneurs on how to use carbonized fecal sludge as a 40% substitute to charcoal in briquette-making. Business wise, Charles and his team have received training in marketing and sales. Water for People also supports Charles with supply of carbonized fecal sludge to boost his production. Charles mentions that he has been given machinery to boost his technical capacity on the previous RRR program under GIZ that ended in early 2018.

"GIZ and Water for People frequently arrange for us to showcase our fecal sludge briquettes at trade exhibitions around the capital city Kampala. Water for People sometimes sells my products for me, such as my brooding kits."

Many of Charles' customers are poultry-breeders who are moving away from using electricity to warm their chicks during the brooding stage.

Before the trainings, Charles was creating around 300 fecal sludge briquettes a month, using his own hands, while desperately searching for a market.

Bringing back the rain: Charles Kyamanywa's entrepreneurship story (contd.)

Currently, Charles' company manufactures 1.000 briquettes every fortnight using the machinery he was given. Due to the training he received in marketing, finding customers has become much easier.

He sells his fecal sludge 'honeycomb' briquettes at UGX 1.500 a piece, and resells briquette stoves that he buys from another manufacturer, at the same price.

Charles believes that selling briquettes has boosted his economic status.

"The fecal sludge briquette business has given me a constant cash flow in my retirement years."

He also believes that the opportunities are endless.

"The market for fecal sludge briquettes is growing, and we have not even scratched the surface yet."

Charles attributes the rising demand for fecal sludge briquettes not only to increased environmental awareness among the general populace, but also the sheer practicality of the briquettes.

"Each briquette can burn for eight hours on average, compared to charcoal which burns for an hour. You can have a good night's sleep while brooding your chicks with the fecal sludge briquettes, and wake up when it the briquettes are still burning."

As with all business ventures, Charles faces some challenges. There are some customers who are not yet convinced about the advantages of using fecal sludge briquettes over charcoal. Also, higher-income households largely use electricity and gas.

"These upper-class customers would be acting as role models encouraging others to use briquettes, but they are still using electricity and gas."

The customers who do buy his briquettes are usually hoping to replace charcoal usage with an equally cheap alternative. Their positive feedback only motivates Charles further.

"They love my briquettes. They say they burn for a long time compared to charcoal."

Charles plans to move his business nearer to open farmland, where he can get a constant supply of biomass and other components for the briquettes. The move will also allow him to expand his business.

"A larger space will allow me to produce more fecal sludge briquettes."

It will also allow him to continue fulfilling his original goal of taking action against cli-

6.6 Kasanvu Environmental Group

Kasanvu Environmental Group (KEG) is a registered company promoting clean energy cooking technology solutions aimed at conserving the environment and at the same time providing affordable efficient cooking practices. KEG, that started as a CBO known as Community Initiative for Sustainable Development (CISD), is located in Namuwongo Village (Kisugu Parish), a rather informal settlement just outside the central business district of Kampala. KEG is a business organization comprising of eight members all residents of Kisugu Parish of Makindye Division in Kampala District of Uganda. The group is under registration of KCCA and recognized by local council. Generally, the group seeks to provide an intervention in waste management by re-using wastes into producing an alternative to firewood, charcoal or kerosene. KEG produces briquettes out of biomass wastes and charcoal dust, trying to solve an immediate household problem of unaffordable fuel.

KEG benefitted from the GIZ supported equipment supply in RRR phase II. However, they indicate that the machinery has not been used today due to high running costs, and being power run, could not afford to extend a power line. They however, hope to utilize it one day, soon.

In course of their operations with the Namuwongo slums and indeed doing well, KEG came into contact with another group called Engage in Action for Safe Environment (EASE). They quickly agree to run joint businesses although remaining separate entities. The latter had an office room in which their joint operations continued. KEG had also had new leadership that embraced the unwritten partnership. The RRR-II Team, amongst others, advised on written agreement on their joint busineses, the need to scale production, and strengthening management.

By their background, EASE was focused at providing opportunities to youth and women through training and skilling in vocational skills aimed at making briquettes; while by their foundation, KEG started off with two founders, now the enterprise employs more than 10 youth and women working as causal workers on part time basis, involved in briquette production and energy saving cook stove making. The partnership did not last long however. The reasons were around trust and not understanding each other's business model and how mutual inputs and benefits would be accrued. KEG terminated the contract and returned to their base to continue with the business.

Currently, the company works throughout the week with an average production of 198 honeycomb briquettes per week making an average of 792 briquettes per month.

Monthly expenditure of the company, incurs on basis is UGX 440.000 putting in consideration labour costs, transport and raw materials.

Market for briquettes and cook stoves exists in Entebbe and Kampala suburbs, and is among household individuals, institutions and retail outlets. There has been increasing

demand for briquettes as an alternative for charcoal and firewood through social media adverts and consumer awareness.

Like any other business, marketing of briquettes is a common challenge they encountered since it's a new product, so customers have to change from relying on wood and charcoal.

Another challenge KEG encountered is the use of manual machine which is tiresome and break now and then, therefore slowing down production.

NB; the current machine broke down since May 2019, and now are in process of buying another one which we have deposited on UGX 300.000 hope to resume work in September 2019.

Water for People has since trained KEGI on the inclusion of faecal sludge as an input intyo their briquette. KEG attended the sales training for RRR businesses that was organised by Water for People in July 2019

Box 4: Statements by Kasanvu Environmental Group

Statements by Kasanvu Environmental Group

„Todate, we have managed to penetrate market and have loyal customers and improved the briquettes to international standard."

„Through this work we have partnered with other organizations like Enterprise Uganda, Water for People, schools like Spring Time Kindergarten. Currently we are lobbying for support from climate launchpard and the Renewable Energy Business Incubator (REBI)."

„Now that we have resumed production, our focus is now on transportation. With support from Water for People we may take on small financing to help us acquire a vehicle or tricycle."

6.7 Chamuka Briquettes

Water for People is working in Uganda with KCCA and NWSC to provide sanitation solutions for non-sewered areas of the city. The goal is increase access to pit emptying services for approximately 0.5 million people that use 100.000 pit latrines in the informal settlements, safely manage their waste, repurpose the treated waste into marketable products, and create business opportunities wherever possible. Water for People will soon incorporate a business in Uganda (New Co.) to manufacture and sell sludge reuse products (briquettes and biochar) in partnership with NWSC.

Following the success of setting up a faecal sludge briquette production plant in collaboration with Saniwaste Solution (SAWA) in Kole District at the Decentralised Faecal Sludge Treatment Plant in 2018, it was proposed to have the briquettes transported to Kampala

given that it is a bigger market. However, with challenges of transport and packaging, it was agreed to support setting up a FS briquette production facility in Kampala to cater for the ever-increasing fuel demand in the city as well as combat the challenge of deforestation in the city.

Research was carried on two types of sludge that is top scum and bottom settled and the briquettes made from these with different compositions of charcoal dust. The compositions tested were 100%, 80%, 60%, 50% and 40% FS and these briquettes were made in partnership with SEACO. Fuel properties, emission and pathogen tests were carried out on the briquettes at the Centre of Research in Energy and Energy Conservation (CREEC), Central Government Laboratory, Wandegeya aand College of Veterinary Medicine, Animal Resources and Biosecurity Microbiology Laboratory. The results indicated that the top scum briquettes performed better than bottom sludge briquettes (less sand) with the organic emissions such as Polychlorinated Biphenyls (PCBs), Furans and Dioxins at non-detectable levels. Sulfur dioxide (SO_2), sulfur trioxide (SO_3) levels were at below 5%, nitrogen dioxide (NO_2) levels at below 1% and phosphorus pentoxide (P_2O_5) levels at below 10% reducing with decreasing FS composition. The briquettes tested negative for Faecal Coliforms, E.Coli and Ascaris.

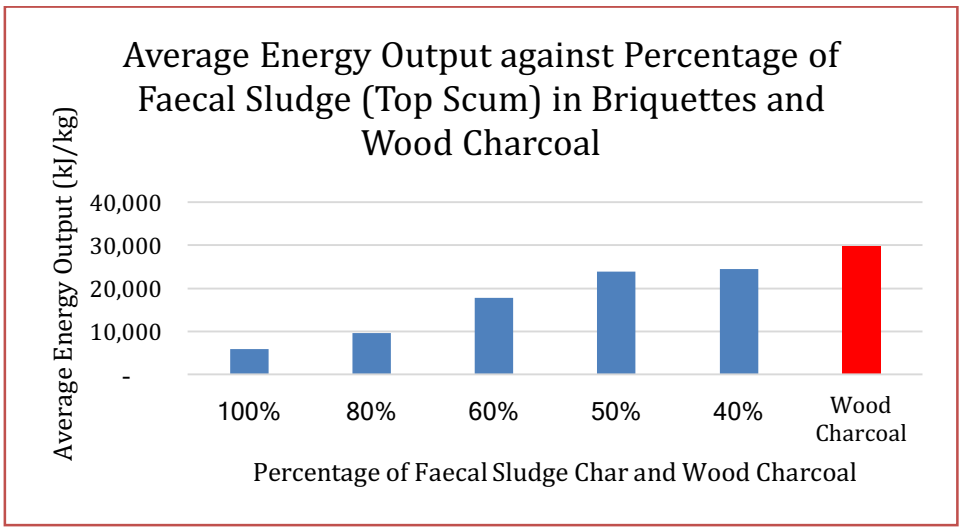


Figure 17: Average energy output against percentage of FS in briquettes and wood charcoal. [Source: Water for People, 2018]

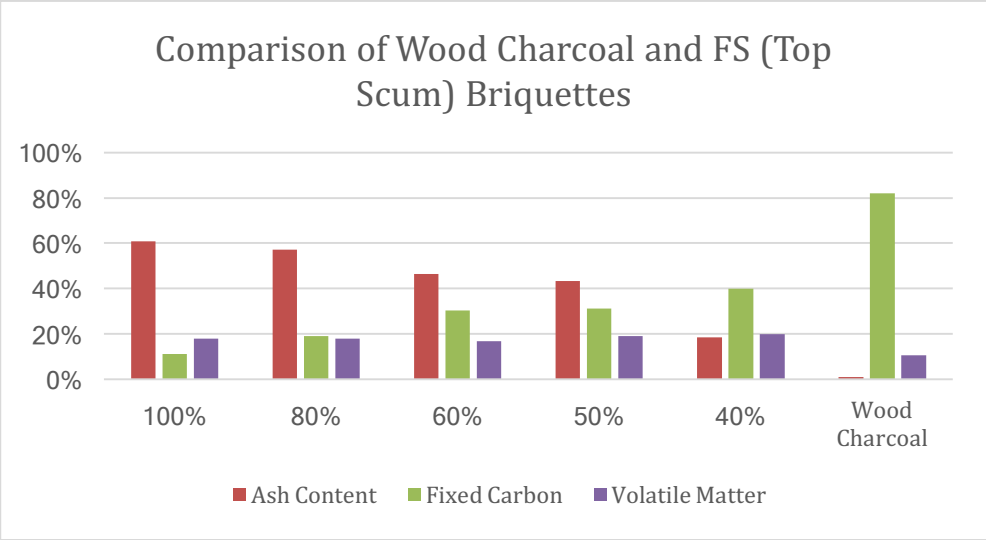


Figure 18: Comparison of wood charcoal and FS briquettes. [Source: Water for People, 2018]

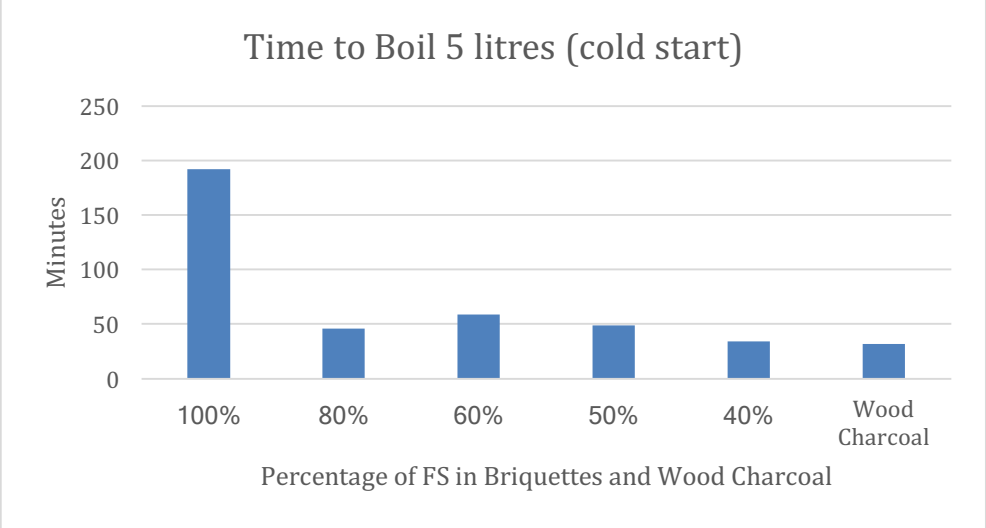


Figure 19: Time to boil 5 litres of water (cold start) depending on percentage of FS in briquettes. [Source: Water for People, 2019]

With a Memorandum of Understanding (MoU) signed between Water for People and NWSC to provide sludge, a briquette production facility was set up in October 2018 at Nyanama. The production facility was producing both stick and honey comb briquettes with composition of 60% charcoal dust and 40% faecal sludge. Additionally, a carbonizer and sludge drying green house were set up at the treatment plant in Lubigi. To date, more than 10 tonnes of briquettes have been produced and more than 3 tonnes sold during market testing with current production averaging 1.5 tonnes per week and a staff of six employees. A market assessment study was carried out on faecal sludge briquettes in Kampala by Whitten Roy and Partnership which indicated that the potential market for eco-briquettes using fecal sludge as a component ingredient is large enough to accommo-

date any volume Chamuka Briquettes could produce in the near-term if not long-term. Both business and consumer markets appeared willing to adopt the product

The target market identified was B2B (Business to Business) market (chicken farmers) and one key B2C (Business to Customer) market (middle-class consumers purchasing in supermarkets) to start with.

Water for People has been involved in technical and marketing training of the RRR entrepreneurs with the production facility providing the cabonized sludge for the other entrepreneurs. The biggest challenge and bottleneck in the production of FS briquettes has been the carbonization process and a lot of research is still ongoing to make the process more effective and efficient as well as cost effective so that carbonized sludge can be another source of char for other briquette manufacturers.

Water for People has over the past 9 months operated 2 business model cycles that involve production and sale of briquettes and carbonisation and sale of carbonised sludge to RRR businesses. The model that is centered on carbonisation was developed to support RRR businesses that lack the capacity to carbonise. The supply of carbonised sludge has led to adoption of FS inclusion by SEACO, KEG, LUCHACOS and Best of Waste Ltd.

Figure 20: Carbonisation unit at Lubigi NWSC and carbonised sludge on the right. [Photo credit: Water for People - Uganda]

Carbonised sludge is currently sold at UGX 27.000 per 50 kg however over the past 8 months, RRR businesses were availed the sludge at no cost to test the distribution chain and develop RRR business confidence in the use of FS.

There is great opportunity in FS briquettes with the market testing indicating a growing demand for a charcoal alternative. Chamuka Briquettes intends to grow its production rates to 10 tonnes per week and this will involve investments in new machinery, infrastructure such as more drying and carbonizer units as well as growing distributor and sales channels for the targeted market.

6.8 Best of Waste

Best of Waste Limited (BoW) was established in 2012 by Ms. Betty Kaddu to transform her community in Kiteezi. BoW mobilised women and youths to sort, dry and treat waste in their area which was then brought to the factory for recycling into briquettes. Currently Best of Waste produces 1 tonne of briquettes weekly and sells to households through an outlet in Wandegeya market and poultry farmers through linkages attained over the years. Best of Waste operates mechanised extruders that are powered by electricity. BoW production is steady and quality consistent which has enabled the company to grow in market share. To supplement the briquettes revenue stream, BoW also produces institutional stoves, household stoves and partners with SEACO where brooding kits are concerned. Best of Waste has invested in sales and marketing and currently has a sales force of 3 persons.

Water for People identified Best of Waste in July 2019 and has since conducted the technical training on inclusion of faecal sludge as an input with 5 staff. Best of Waste team was further trained in sales with a focus on the sales cycle in August 2019 by Water for People.

Box 5: Statement by Ms. Betty Kaddu (Best of Waste)

Statement by Ms. Betty Kaddu (Best of Waste)

„I am most interested in the research that Water for People is conducting which research may lead to a breakthrough in replacing charcoal with other materials in the briquettes that we are making. I look forward to that day!“

6.9 Decentralised Faecal Sludge Treatment Plants

Context and background

In 2013, Water for People Uganda partnered with ICCO (Interchurch Organization for Development Cooperation) to scale up Sanitation as a Business (SAAB) programme in Kitgum and Kole districts of Northern Uganda. The programme has been working with sanitation entrepreneurs and microfinance institutions as key drivers for ensuring sustainable sanitation services in their communities.

The SAAB vision was to implement a sustainable sanitation process where the sanitation value chain is supported, and all participants incentivized, to provide a variety of affordable sanitation products and services so that lower income households and communities are able to maintain 100% coverage over a prolonged period of time without ongoing external grant support. Water for People has been supporting the programme by promoting gulping technology in Kitgum Town Council. During the process of promoting gulping technology, Water for People also realized that most of the pit latrines in Kitgum Town Council had

poor structures with majority having squat hole open and very close to the household hence not proving effective barrier to faecal contamination.

Decentralised Faecal Sludge Treatment Plant at Kole

The idea of the DEFAST project started from the research that was conducted by Bosco Odyek who developed the idea from his class research in his bio-systems engineering degree at Gulu University majoring in household waste management. In his research, he found that 97% of the town dwellers were not connected to the central sewer system. He wrote a proposal to Water for People and it was founded with Ugandan Shilling 60,000,000 for start-up. Especially the double extruder which he acquired from local fabricators. Later, Water for People in partnership with the Agency for Sustainable Rural Transformation (AFSRT), ICCO and Kole District Local Government on September 7, 2016 commissioned a faecal sludge treatment plant to improve sanitation and create business opportunities especially for youth in the district.

It started with a capacity of 10 m^3 of faecal sludge per day and capital expense (CapEx) of USD 20,000. The plan was to attract private sector actors to invest in low cost faecal sludge management systems like gulping of pits as well as transportation, treatment and reuse of faecal sludge to make briquettes, manure and animal feeds. Subsequently, the DEFAST plant in Kole was expected to yield a number of benefits as indicated in Figure 21:

Figure 21: Major benefits of DEFAST plant.

Decentralised Faecal Sludge Treatment Plant at Kitgum

The Kitgum plant is managed by Wash Consult Limited (WCL); a private registered company that deals in water sanitation and hygiene. WCL signed a Memorandum of Understanding with Kitgum Municipal Council in February 2018 to manage sanitation facilities and the faecal sludge treatment plant. WCL was mandated to provide services for waste (faecal waste) management and disposal.

The main activities are to collect, manage and maintain a decentralised faecal sludge treatment plant, and collection of fees by working with gulper operators. By the time of the visit, WCL had three active groups these groups are registered groups they are; Warib Cingwa, youth gulping group and water access they used barrels, gulping machine and tricycle respectively to carry out their business for the last one year they have been in operation, they have so far emptied over 100 households in Kitgum municipality and neighbouring districts. WCL is collaborating with Water for People and Non-Governmental Organisations (NGOs) like the Lutheran World Federation (LWF), Restoration of Agricultural Livelihoods Northern Uganda Component (RULNUCs') extension workers to attract a demand for compost in Kitgum district and neighbouring districts like Lamwo because the demand for compost is almost zero.

7 FINANCIAL ASSESSMENT TOOLS

7.1 Profit-Loss Analysis

An EXCEL tool allowing to perform broad-brush Profit-Loss-Analysis of micro-, small- and medium-sized businesses in RRR (with a special focus on briquette making businesses) based upon readily available financial and production related data collected from surveyed companies, was developed and tested. The tool has deliberately been kept simple and geared to the abilities and needs of both, businesses and institutions, organisations and/or individuals supporting them to allow an easy and quick application.

Application of and filling in the tool is demonstrated using the example of a fictitious Ugandan small-scale fuel briquette business called *Simply Briquettes! Ltd.*

Comparing revenues, costs and expenses incurred during a specified period provides information about a company's ability or inability to generate profit. The tool uses actual monthly production and sales data, revenues earned from selling briquettes, fixed and variable operating costs and applicable costs towards depreciation, interests on loans and income tax (see Figure 22) the calculate the monthly and average profit/loss of a business.

Entering the desired values for percentage changes in sales, fixed costs, raw material costs, other direct costs and revenues allows to deterime the impact on net profit/loss by change in assumptions (see Figure 24).

Financial Analysis

Set local currency UGX … Uganda Shilling

Production & sales	#	Particulars	Unit	Average	April 2019	May 2019	June 2019	July 2019
	1	Amount of honeycomb briquettes produced	[numbers per month]	**1.462**	1.360	1.600	1.550	1.280
	2	Actual amount of honeycomb briquettes sold	[numbers per month]	**1.428**	1.280	1.430	1.250	1.330
	3	Sales price of honeycomb briquettes	[UGX per piece]	**2.000,00**	2.000,00	2.000,00	2.000,00	2.000,00
	4	Amount of other types of briquettes produced	[kilogram per month]	**465**	470	430	500	480
	5	Actual amount of other types of briquettes sold	[kilogram per month]	**462**	320	390	650	370
	6	Sales price of other type of briquettes	[UGX per kilogram]	**1.000,00**	1.000,00	1.000,00	1.000,00	1.000,00

Revenues	#	Particulars	Unit	Average	April 2019	May 2019	June 2019	July 2019
	1	Revenues from honeycomb briquettes	[UGX per month]	2.856.670	2.560.000	2.860.000	2.500.000	2.660.000
	2	Revenues from other types of briquettes	[UGX per month]	461.670	320.000	390.000	650.000	370.000
	3	Other revenues	[UGX per month]	0				
		Total monthly revenues	**[UGX per month]**	**3.318.340**	**2.880.000**	**3.250.000**	**3.150.000**	**3.030.000**

Raw material costs	#	Particulars	Unit	Average	April 2019	May 2019	June 2019	July 2019
	1	Charcoal dust	[UGX per month]	182.000	170.000	198.000	194.000	160.000
	2	Carbonised material	[UGX per month]	274.830	257.000	297.000	293.000	243.000
	3	Clay	[UGX per month]	2.830	3.000	3.000	3.000	2.000
	4	Water	[UGX per month]	9.330	9.000	10.000	10.000	8.000
	5	Molasses	[UGX per month]	85.000	90.000	90.000	90.000	60.000
		Total monthly cost of raw material	**[UGX per month]**	**553.990**	**529.000**	**598.000**	**590.000**	**473.000**

Fixed operating costs	#	Particulars	Unit	Average	April 2019	May 2019	June 2019	July 2019
	1	Rent for land	[UGX per month]	600.000	600.000	600.000	600.000	600.000
	2	Salaries of permanent staff	[UGX per month]	900.000	900.000	900.000	900.000	900.000
	3	Safety equipment (Gloves, overalls, boots, etc.)	[UGX per month]	25.670	34.000	18.000	33.000	22.000
	4	Repair and maintenace cost	[UGX per month]	18.830	23.000	18.000	22.000	13.000
	5	Selling costs	[UGX per month]	77.670	74.000	82.000	82.000	71.000
	6	Stationary and supplies	[UGX per month]	15.330	60.000	5.000	6.000	6.000
	7	Subscription fees	[UGX per month]	10.000	10.000	10.000	10.000	10.000
		Total monthly fixed operating cost	**[UGX per month]**	**1.647.500**	**1.701.000**	**1.633.000**	**1.653.000**	**1.622.000**

Variable operating costs	#	Particulars	Unit	Average	April 2019	May 2019	June 2019	July 2019
	1	Wages - honeycomb briquettes	[UGX per month]	292.330	272.000	320.000	310.000	256.000
	2	Wages - stick briquetttes	[UGX per month]	102.670	104.000	95.000	110.000	106.000
	3	Packaging cost	[UGX per month]	39.000	37.000	41.000	41.000	36.000
	4	Transportation costs (distribution briquettes)	[UGX per month]	49.330	56.000	59.000	63.000	26.000
		Total monthly variable operating costs	**[UGX per month]**	**483.330**	**469.000**	**515.000**	**524.000**	**424.000**

Depreciation	#	Particulars	Unit	Average	April 2019	May 2019	June 2019	July 2019
	1	Depreciation - buidlings	[UGX per month]	42.000	42.000	42.000	42.000	42.000
	2	Depreciation - equipment	[UGX per month]	15.000	15.000	15.000	15.000	15.000
		Total monthly costs of depreciation	**[UGX per month]**	**57.000**	**57.000**	**57.000**	**57.000**	**57.000**

Interest on loan & income tax	#	Particulars	Unit	Average	April 2019	May 2019	June 2019	July 2019
	1	Corporate income tax (UGX 550.000 per year)	[UGX per month]	46.000	46.000	46.000	46.000	46.000
		Total monthly costs of interest on loan & income tax	**[UGX per month]**	**46.000**	**46.000**	**46.000**	**46.000**	**46.000**

Gross profit/ loss	#	Particulars	Unit	Average	April 2019	May 2019	June 2019	July 2019
	1	Monthly total revenues	[UGX per month]	3.318.340	2.880.000	3.250.000	3.150.000	3.030.000
	2	Monthly total cost of raw material	[UGX per month]	553.990	529.000	598.000	590.000	473.000
		Monthly gross profit/loss	**[UGX per month]**	**2.764.350**	**2.351.000**	**2.652.000**	**2.560.000**	**2.557.000**

Operating profit/ loss	#	Particulars	Unit	Average	April 2019	May 2019	June 2019	July 2019
	1	Monthly gross profit/loss	[UGX per month]	2.764.350	2.351.000	2.652.000	2.560.000	2.557.000
	2	Total operating costs	[UGX per month]	2.130.830	2.170.000	2.148.000	2.177.000	2.046.000
		Monthly operating profit/loss	**[UGX per month]**	**633.520**	**181.000**	**504.000**	**383.000**	**511.000**

Profit/loss before interest & tax	#	Particulars	Unit	Average	April 2019	May 2019	June 2019	July 2019
	1	Monthly operating profit/loss	[UGX per month]	633.520	181.000	504.000	383.000	511.000
	2	Depreciation	[UGX per month]	57.000	57.000	57.000	57.000	57.000
		Monthly profit/loss before interest and tax (EBIT)	**[UGX per month]**	**576.520**	**124.000**	**447.000**	**326.000**	**454.000**

Net profit/loss	#	Particulars	Unit	Average	April 2019	May 2019	June 2019	July 2019
	1	Monthly profit/loss before interest and tax (EBIT)	[UGX per month]	576.520	124.000	447.000	326.000	454.000
	2	Interest on loan & income tax	[UGX per month]	46.000	46.000	46.000	46.000	46.000
		Monthly net profit/loss	**[UGX per month]**	**530.520**	**78.000**	**401.000**	**280.000**	**408.000**

Figure 22: Screenshot of a section of the form used for perfoming the Profit-Loss Statement for Simply Briquettes! Ltd.

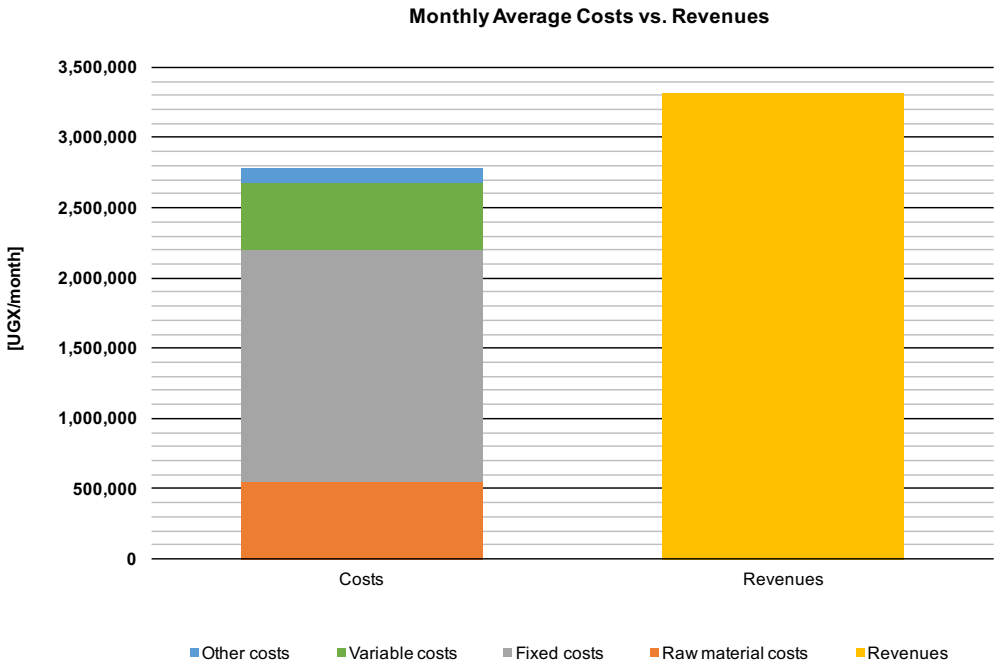


Figure 23: Graphical comparison of Simply Briquettes! Ltd.'s monthly average costs associated to the production and revenues earned from the sales of briquettes.

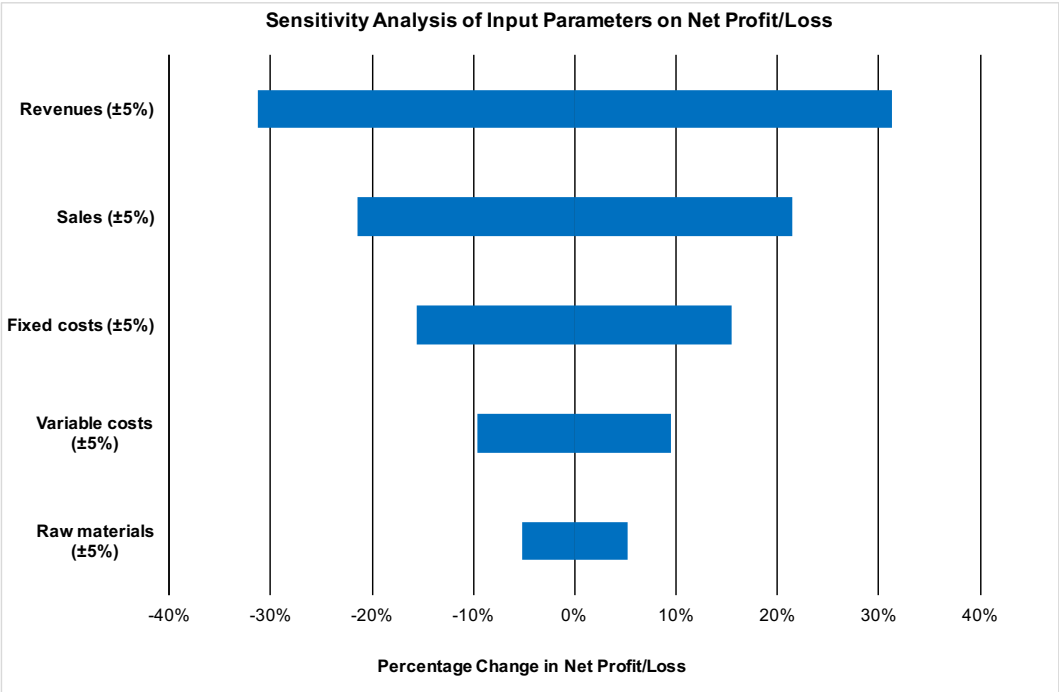


Figure 24: Graphical representation of a sensitivit analysis of input parameters on net profit/loss carried out for Simply Briquettes! Ltd.

7.2 Contribution Margin Analysis

Another EXCEL tool developed, tested and applied allows investigation of the difference between sale revenues (of a product) and the variable costs associated with its production

and sales process. Sales revenues are the amount realised by a business from the sale of goods or services. Variable costs are costs that vary in direct proportion of the quantity of goods or services that a business produces (e.g. raw material costs, labor directly involved in the manufacturing process, packaging, etc.). The contribution margin represents the portion of sales revenues that is not used up by variable costs, and so contributes to covering fixed costs and to generate a potential profit.

For the briquette businesses Chamuka Briquettes, LUCHACOS and SEACOS contribution margin analysis were performed to inform businesses on the amount that each of their products actually contributes to covering their monthly fixed costs and potentially generating profit. This information can be used by the businesses to pursue strategies to reduce variable costs or explore possibilities of increasing unit prices to increase the contribution margin.

8 OPPORTUNITIES AND COMMON CHALLENGES FACED BY EMERGING UGANDAN MICRO-, SMALL- AND MEDIUM-SIZED BUSINESSES IN RESOURCE RECOVERY AND REUSE

This chapter makes available information concerning opportunities and common challenges faced by emerging Ugandan micro-, small- and medium-sized businesses working in the Ugandan RRR sector across the entire sanitation management chain.

8.1 Opportunities

Market

Market for fuel briquettes in Kampala is huge; there is increasing pressure to abandon charcoal and fire wood as they are direct products contribution to the worsening decline in forect cover countrywide. Environmental advocates have come up in arms to stop charcoal burning. Government has also expressed the same sentiment.

Expansion to new markets

Many briquette businesses focus primarily on household consumer and poultry farmers. This is in line with results of a market assessment conducted by Water for People that identified two main initial opportunities including the chicken farmer market and supermarkets catering to middle-class consumers. These two markets represent primary target opportunities because they are:

1. easy to identify,
2. sufficiently large,
3. can experience immediate and tangible benefits by shifting to briquettes,

4. can generate repetitive business and word of mouth-generated growth, and
5. ones that provide a foothold in both the B2B and B2C spaces.

Aside of the above-mentioned market spaces, there is an opportunity to expand to bulk consumers such as commercial enterprise and factories who are large energy consumers for process heat production or institutions such as schools that require energy for daily preparation of meals, etc.

Decreasing quantity and quality of charcoal

The quality of charcoal is decreasing and charcoal dust is no more freely available. The point would therefore be to the use faecal sludge as a binder and ingredient in briquettes production. This has not been achieved - at large-scale - yet, as technical processes are requied to ensure safety of the users and community.

Technological innovations

Local adoption of technologies and innovatons will lead to easier development of products and markets for faecal sludge and for the briquettes businesses.

Business streams

RRR business models involve quite a number of business streams, including but not limited to collection, transportation, sorting, new product innovations, marketing, among others. All these are welcome as they contribute to government's push for fighting household poverty.

Funding for climate change

Funding for climate change can be a great opportunity with a clear business modelthat indicates how RRR addresses the challenge of environmentaldegradation and Water, Sanitation and Hygiene (WASH).

Product configuration

Product configuration (quantity, size, appearance, quality) must be appropriate in function and appearance for effective transport, storage and market segment attraction. It is one of the key executable tactics that enables organizations to capture all the opportunities across the different customer segments.

Honeycombs are the largest unit size accepted in the market currently. They burn longer and have a cost advantage. The downside is the size for certain stoves. They are appropriate for B2B customers and large households. The most common size adopted by the

market is the 2.5kg honeycomb. Sticks briquettes are used for smaller stoves and consumers who cannot or will not purchase large quantities (lower income, lower usage).

Technological advancements in Gulper technology and transfer stations

Water for People together with Gulpers Association of Uganda are constantly improving the gulping technology that has seen four generations now with feedback from the field trials on effectiveness of pumping thick sludge, distance it can pump and ease of work.

Transfer station has also undergone further improvements such as automation and further simplify the design through its loading mechanism.

Scaling up of Gulping technology and Transfer Stations

With the boost and growth of these business, there is an opportunity for scaling up into other towns with gulping and having more transfer stations to meet the growing demand.

Community engagement

The DEFAST experience shows that the community, when mobilized, can be active participants in the business model that involves waste management; there are different value chains that they can participate in.

Sanitation awareness

The DEFAST projects will attract communities to be part of their community sanitation. When sensized they have potential to collect, sort, transport.

Policy direction

The insights frm the DEFASTs provide policy directions for Local governments and even at the entral.

Innovations

Innovations in faecal sludge treatment can be conducted better on the small treatment plants.

Research opportunities

Research in RRR and Scientific inquiry on different aspects of waste as business can use the DEFASTs to determine market and product development perspectives

8.2 Challenges

Competition

Competition in the briquette making business is stiff and margins tight. Many informal firms are nowadays getting involved and without standardization everyone producing by his own requirements of the customer base.

Low profit margins

Small profits earned from selling rather small quantities of briquettes limit acquisition of modern equipment that could step up production and consequently increase sales.

Product standardisation

RRR businesses vary in size with the larger businesses having more controlled production processes, the quality of briquettes among small scale producers varies greatly from one entrepreneur to the next. This is due to the differing methods of production, and an absence of standardisation within the industry

Carbonisation process

The carbonisation process has not yet reached 100% efficency which process is still under testing.

Lack of adequate equipment

Majority of small-scale briquette making businesses are still heavily reliant on manually operated equipment which is a limiting factor to production at scale.

There is heavy reliance on locally fabricated briquette machines which have not proved durable. This machinery is also not efficient in compacting non-carbonised materials.

Customer awareness

Briquettes though present in the market for the past couple of years still has high knowledge gap in what briquettes are and how they differ from charcoal. The lack of awreness and acceptance is predominat with household consumers

Product quality

Often, briquettes are still of low quality. There is a need to stabilise with supplies, market leads and production model (quantity, packaging and frequency) to guarantee constant product quality.

Certification
Lack of certification from Uganda National Bureau of Standard (UNBS) limits companies to sell in supermarkets and to curious individual potential buyers.

Working capital
The firms are greatly strained without cash to meet short term liquidity requiremnets like operational expenses and ordering for material requirements. This kept them onlookers in a space that they see great business opportunities in.

Market potential
While the buyers are obvious and institutional buyers as well, the firms are not sure of whether these can be relied upon for market growth and sustainability of business.

Cultural hinderances
There are recorded sentiments from the community, principally individuals who have sworn that they will not use faecal sludge briquettes in preparing their family meals; it is assumed a ‘dirty’ energy source. There is fear of likely infections and detested perceived smell.

Regulation and certification
There are a number of regulatory agencies to which briquettes produers are expected to comply or get certification. These include KCCA, NEMA, UNBS among others. Many of the micro and small businesses supported in this project do not have the capacity to meet the standards and the costs involved in getting certified.

Environmental concerns
Many people are unwilling to not only use but also work closely with briquette businesss on issue fo their unhygienic working conditions, health hazards etc. in handling waste, production and even products.

Pricing
Each RRR business has its own pricing strategy which has led to price confusion. Honeycombs by the smaller RRR businesses cost UGX 1.300 - 1.500 while the more established businesses charge a higher price UGX 2.000 - 2.500. Some customers have failed to purchase because of the large disparity in pricing.

Regulation

The gulper and gulping businesses are yet to be accepted by legislation especially national Environmental Authory. Most have managed to acquire permission to dump by National Water and Sewerage Corporation and business licences to operate in Kampala by Kampala Capital City Authority.

Gulper technology

The gulper still has challenges with reaching the entire span of the pit latrine depth especially for unlined pit latrines. This is the reason for continuos research and develop-ment to improve the business

Limited number of tractors

There are only two transfer stations that are being ferried by a single tractor. These are too few to meet the growing demand for pit emptying especially in the transfer station coupled with the limited room in informal settlements for the manuevering of the tractor.

Sustainable business models

The business model for the transfer tank had to be altered several times to suit the emptiers so as to make it popular and to encourage its utilisation. This affected the profitability of the business and the tractor operator had to be sustained with external finances.

Lack of Synergies

The business players in the faecal sludge are still scaterred; with each undertaking a small portion of the business, they would otherwise benefit from synergies if they were brought together.

9 LESSONS LEARNT, EMERGING RECOMMENDATIONS FROM FOR EFFECTIVE RRR TECHNICAL AND BUSINESS DEVELOPMENT SERVICES

This chapter summarises lessons learnt, key recommendations emerging from and considerations for organisations aiming to offer effective technical and business development services to micro-, small- and medium-sized businesses in RRR across the entire sanitation chain.

9.1 Key lessons learnt

Landownership

The challenge with many micro- and small-sized briquette making businesses in Kampala and its surroundings is lack of proper space to operate. For any business venture costs of acquiring own land coud be untenable. Businesses might be advised to work with government authorities to be supported in acquiring land, even when on lease. Where there is no leaseland for the business, there is need to develop strong market systems where there is production from distant places without affecting distribution. This can best be done through establishing joint points of sale under an umbrella brand to avoid unnecessary competition whilst benefiting from marketing economies of scale.

Product development

While this has been encouraging, from briquettes to honey combs and the accompanying stoves, process is slow and care is needed to avoid hazardous effects.

Working capital needs have hampered business; most of these firms expected direct financial support alongside the business development support. There is need for further engagement on this aspect with GIZ. Particularly, there is need for more appealing products (prema facie) and fast-tracking UNBS approaval for quality. GiZ on top of supporting with infrastructure such as a simple but effective laboratory to develop and test FS products can provide more technical support for continuous improvement of the productsto accelerate market acceptance.

It is important to keep the research and development active as we look to improving the gulper and transfer tank technologies to meet the growing demands and needs of the businesses and the clients.

Partnership

We have learnt that the parterships tried by firms under this study did not work out. There could have been gaps that were not addressed or several issues being taken for granted. This is a big lesson for policy people, policy makers and academics; that simple community agreements of running joint potential businesses did not hold up. One best way to develop voluntarty yet effective partnertships is to develop an attractive entrepreneurial ecosystem of sanitation businesses. This will impove their negotiation power both formaketsand resources with potential clients such as the United Nations High Commissioner for Refugees (UNHR) which has emerged strategic because of their volumes of purchases for the refugees.

Growth potential

Companies must have reached a certain company size to break even and or continue in production. They need to grow slowly using the lean model, and where possible joint busineeses would enable them growing the potential. They have the potential to grow butare slow to take advantage of their opportunities

Management

Companies need to have an established accounting system in place, basic management pratices, etc. this is a lesson for firms that must come up, sustain their operations and growth.

Hiring and training sales persons to lead with a problem led sales approach which focuses on helping customers discover, define and deepen the understanding of the problem and what it's costing the customer not to solve it will enable actualisation of profits. This is a missing component with all the sanitation businesses and once adopted, there will be growth within the businesses.

Capacity Building

With the work with gulping businesses, there is need for sufficient time to build the capacity and leadership of the businesses by organising them into an association. An association helps the authority build trust in the businesses and keeps them accountable.

Occupational Safety and Health

Gulpers make pit emptying easier and more hygienic due to the limited contact between the operator and feacal sludge.

Durability

The Gulper undergoes harsh abuse by low skill labourers and therefore needs to be of a very robust and extremely strong design for the daily use.

At present the use of plastic parts leads to cracking and failure. The original design incorporates a twist fit for the bottom valve that require an inverted L shape cut to be made on either side of the end of the pipe. This provided an area of weakness which quickly failed, leading to the valve dropping in to the pit. This has been solved by using a clamp to affix the valve to the pipe.

Workforce

Unskilled labourers are prone to heavy drinking and poor health. This leads to entrepreneurs not being able to conduct business because their labourers are not available. Therefore Water for People trains a pool of labourers that can be called upon by various entrepreneurs when needed.

Cost advantages

The transfer tank technology reduced the charge per barrel from 30,000 UGX to 20,000 UGX in the communities where it was utilised by Gulper entrepreneurs. This also created an opportunity to serve and provide a quality service at a subsidised rate to many community members/ customers at one ago.

With the growing number of gulper pit emptying entreprenuers in Kampala, the two-transfer tanks could not sustain the demand, as such some pit emptiers maintained other transportation means which caused non-uniform rates charged per barrel by the emptiers.

Creation an enabling environment

For achieve up to scale private sector engagement in the sanitation sector, you need:

- Strong and committed local partner needed
- Collaboration with private sector crucial
- Coordination of stakeholders
- Learn from good experiences

9.2 Recommendations and considerations

- Government agencies to subsidize or even waive off registration, certification and licensing fees to enable these small businesses to save and invest in their growth.
- Entrepreneurs and business founders to put emphasis on basic management principles.
- Banking institution to provide affordable business loans to micro and small enterprises.
- Academic institutions should scale up research in the sector so as to identify and document business opportunities to enable business growth.
- Faecal sludge potential in briquette making is high; but there are serious concerns with its collection, transportation and handling to the production spaces, as well as the products. We recommend government heavy investment in liquid waste treatment beyond the one NWSC plant at Lubigi. Small plants be built in sub-urbs and other parts of the country.

- Active enforcement of existing forestry and charcoal regulations to boost the uptake of briquettes.
- Establish mechanisms in the sanitation and climate change sub-sectors for financing emerging SME integrating FS in briquettes production as success in their business is milestone in the ecosystem of enhancing environmental preservation.
- More transfer stations across the country are needed to encourage pit emptying and safe management of faecal sludge
- Develop policy guidelines and localgovernment ordinaces on faecal sludge treatment at local levels to enhance community engagement in health manner but also develop business among them for revenue streams
- Sensitize the business communities countrywide of the business opportunities in RRR in various value chains as noted from collection, sorting, transporting, recycling etc.

10 REFERENCES

FERGUSON, H. (2012): Briquette Businesses in Uganda. The Potential for Briquette Enterprises to Ad-dress the Sustainability of the Ugandan Biomass Fuel Market. Page 21. URL: http://wastetowealth.livingearth.org.uk/wp-content/uploads/2013/10/briquette_businesses_in_uganda.pdf

INTERNATIONAL WATER MANAGEMENT INSTITUTE (2015): Market Assessment of RRR Business Models – Kampala City Report. Page 32f. URL: http://publications.iwmi.org/pdf/H048076.pdf

MINISTRY OF ENERGY AND MINERALS DEVELOPMENT (2014): Strategic Investment Plan 2014/15 - 2018/19.

UGANDA BUREAU OF STATISTICS (2017): Uganda National Household Survey 2016/17. URL: https://www.ubos.org/onlinefiles/uploads/ubos/pdf%20documents/UNHS_VI_2017_Version_I_%2027th_September_2017.pdf

WAFLER, M. (2018): The RRR Approach. URL: https://sswm.info/node/8022 In: Conradin, K., Kropac, M., Spuhler, D. (Eds.) (2010): The SSWM Toolbox