

Financial Analysis of Decentralized Faecal Sludge Treatment (DEFAST) Plants

The case of Kole and Kitgum, Uganda



a project of



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ABBREVIATIONS

AFSRT.....	Agency for Sustainable Rural Transformation
DEFAST	Decentralized Faecal Sludge Treatment
FS	Faecal Sludge
GIZ.....	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GIZ-ENWASS	GIZ Enhanced Water Security and Sanitation Programme
ICCO.....	Interchurch Organization for Development Cooperation
KCCA.....	Kampala Capital City Authority
kg	Kilogram
LWF.....	Lutheran World Federation
MoU	Memorandum of Understanding
NPV	Net Present Value
NWSC.....	National Water and Sewerage Corporation
Rol	Return on investment
RRR.....	Resource Recovery and Safe Reuse
RULNUC	Restoration of Agricultural Livelihoods Northern Uganda Component
SAAB	Sanitation as a Business
SDC	Swiss Agency for Development and Cooperation
UGX.....	Ugandan Shilling
UNHCR.....	United Nations High Commissioner for Refugees
USD.....	United States Dollar
WASH	Water, Sanitation and Hygiene
WCL	Wash Consult Limited

1 CONTEXT AND BACKGROUND

1.1 History

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 People¹ 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.

To address this challenge, Water for People introduced Sato Pan² business which has received very positive response from the communities. The gulping technology has been faced with a lot of challenges but majorly disposal options. It is through this challenge that Water for People obtained funding from ICCO to construct a sludge dewatering plant where gulping entrepreneurs could dispose the faecal sludge in an environmentally friendly way.

Figure 1: Sato Pan



¹ Water for People in Uganda supports water and/or sanitation business initiatives in six districts of Kamwenge, Kampala, Kitgum, Lira, Masaka, and Soroti.

² The SaTo pan is a toilet pan that uses mechanical and water seals to close off pit latrines from open air to reduce disease transmission from flying insects that come into contact with human waste.

1.2 Facts about the DEFASTs in Kole and Kitgum

Table 1: Status of the DEFASTs in both districts

Aspect	Narrative
Design capacity	DEFAST plant in Kole is designed for 10 m ³ /day DEFAST plant in Kitgum is designed for 8 m ³ /day
Employment patterns	Kole employs 17 full-time staff Kitgum does not have a specific number of employees. The truck drivers (dumpers) are not staff.
Initial Investment	Kole were Euro 25,000 Kitgum Euro 6,000
Production status	Kole - There is production Kitgum - No production

1.3 Rationale for focusing on DEFASTs in Kole and Kitgum

As a bench mark for the work that was done in Kampala, cewas and GIZ extended the analyses to other regions particularly the Northern Region to understand the context of the work that was done between Water for People, Kitgum Municipality and Lira/Kole on the Decentralized Faecal Sludge Treatment (DEFAST) plants that were launched in 2016 to manage, pit emptying and composting faecal waster. The extended scope also provided useful points of comparative assessment between the companies in Kampala as an urban market and Northern Uganda and a less urban market.

According to Water for People³ (2019), these plants have been essential in providing space for pit emptiers to dump waste to be treated to become pathogen free. The purpose was to create a critical solution for treatment in rural areas where sewage systems do not exist. At the DEFAST plants, after the waste has been treated and is free of pathogens, it is turned into either briquettes for fuel and cooking or fertilizer to be used by local families and farms.

The key focus of business information from Kitgum and Kole was on the set-up and operation costs which included pit emptying, treatment of faecal sludge and processing it for final reuse at the DEFAST plant. This was hoped to give a contextual situation of financial feasibility so that we are able to analyse and explain the conditions under which DEFAST plants can be operated in a financially sustainable way. Thus, we collected data about gate collection and tipping fees (fees charged for the discharge of faecal sludge at the treatment plant) plus any revenues generated from selling the dried sludge as soil conditioner/compost to farmers and/or briquettes, etc.

³ <https://www.waterforpeople.org/turning-waste-into-fuel/>

1.4 Motivation behind the DEFAST Plants

Uganda has been experiencing a big problem of faecal sludge⁴ caused by limited access to the National Water and Sewerage Corporation sewer. This necessitated the need to have decentralised faecal sludge treatment facilities where the majority of the population can access (Eng. Paddy Twesigye, Director Projects at NWSC). This subsequently reduced the health risks associated with uncontrolled faecal waste. It is reported that in Lira town, 97% of people are not connected to the local sewer⁵ and this triggered the need to establish DEFASTs for the plant and pit-emptying services (Bosco Odyek, chairman of the organization operating the DEFAST plants). It is also reported by Water for People that in addition to providing solutions to safe waste disposal, the DEFAST plants have also created job opportunities and a sustainable business model for local entrepreneurs and particularly the youth.

2 DEFAST IN KOLE

2.1 Background and history

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 (UGX) 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.

According to The Independent (September 13, 2016)⁶, Kole district was specifically selected to host and benefit from DEFAST project as Sanitation as a Business centre because it had no faecal sludge treatment plant at all, only relying on a few waste water stabilization ponds in Lira.

It started with a capacity of 10 m³ of faecal sludge per day and capital expense (CapEx) of United States Dollar (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 2;

⁴ Faecal sludge is a mixture of human excreta, water and solid wastes including anal cleansing materials, menstrual hygiene management, diapers, plastics, paper and other solid waste that are disposed in the pits, tanks or vaults of on-site toilets and sanitation systems, instead of going into centralised waste water treatment systems. Find at: <https://www.monitor.co.ug/News/National/KCCA-National-Water-move-manage-city-faecal-sludge/688334-4353254-13fevf9/index.html>

⁵ [Water and Environment Sector Development Plan 2015/16-2019/20](#)

⁶ <https://www.independent.co.ug/kole-gets-faecal-sludge-treatment-plant-improves-sanitation-business/>

Figure 2: Major benefits of the plants



Figure 3: Carbonised sludge at Kole



2.2 Financial analysis of DEFASTs in Kole

In this analysis, we present the results from the financial performance based on the monthly kilogrammes (kgs) produced, the prices at which they were sold, quantity (in Kgs) sold and revenues generated from the sales. We look at Inflows from dumping sludge with focus on dumping fees (per trip), number of trips per month: 50 trips. We also analysed inflows from briquettes especially cost per kg, number of kgs per month. Apart from the revenues, we analysed expenses of managing the plant such as water per month, labour to manage plant, general maintenance, solid waste management and production cost per kg.

Table 2: Cost- Revenue overview at Kole (2017/2018)

Inflows	UGX per month
Inflows from Dumping sludge	
Dumping fee: \$3 per trip	10,000
Number of trips per month: 50 trips	50
Dumping fees per month	500,000
Inflows from Briquettes	
Cost per Kg	1,000
No. of Kgs per month	500
Briquette inflows per month	500,000
Anticipated total monthly inflows	1,000,000
Expenses of Managing plant	
Water per month	54,000
Labour to manage plant	180,000
General maintenance	72,000
Solid waste management	36,000
Monthly expenses on managing plant	342,000
Briquette production	
Production cost per Kg	700
No. of kgs per month	500
Expenses on Briquette production	350,000
Total monthly expenses	692,000
Net monthly profit	308,000

Note that Kole is benefiting from a tax exemption

Net Present Value analysis (NPV)

Net present value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time. NPV is used in capital budgeting and investment planning to analyse the profitability of a projected investment or project.

NPV = (Cash flows) / (1+r)ⁱ. Where;

- i. Initial Investment (**UGX 91,876,225**)
- ii. Cash flows= Cash flows in the time period (**UGX 30, 8000** per month *12= UGX 3,696,000 per annum)
- iii. r = Discount rate (**5%**)
- iv. i = time period (**5 Years**)

The growth rate of the enterprise and the cash flows (assuming other factors constant) is subjected to the national economic growth rate of 6.2% as per the Price Water House Coopers Economic Outlook for Uganda (2019).

Table 3: Projected Cash flows at Kole

Discount rate	5%				
Time periods (Years)	1	2	3	4	5
Cash flows	3,696,000	3,925,152	4,168,511	4,426,959	4,701,431
NPV	UGX 18,006,909				

According to the NPV projections, the facility will yield positive returns since the NPV is positive.

Payback period

Payback period in capital budgeting refers to the time required to recover the funds expended in an investment to reach the break-even point. In this analysis, we used the averaging method where we divide the annualized expected cash inflows into the expected initial expenditure for the project. Where;

- i. Initial expenditure = **UGX 91,876,225 (USD. 25,000)**
- ii. Average cash flows for the first five years = **UGX 20,918,053 /5= UGX 4,183,610.63**

Thus, the payback period will be **91,876,225/4,183,610.63 = 21 years and 9 months.**

Return on investment (RoI)

Return on investment is a ratio between net profit and cost of investment. As a performance measure, RoI evaluates the efficiency of an investment. A high RoI means the investment's gains compare favourably to its cost. An average annual return of 5% to 12% is good, and anything higher than 12% is excellent. In this analysis we used a formula of;

ROI = Net Profit / Total Investment * 100 Where;

- i. Net profit is the NPV at year 5 = UGX18,006,909
- ii. Total Investment = UGX 91,876,225
- iii. Thus; $91,876,225/18,006,909 * 100 = 19.6\%$

While the NPV after 5 years is positive, the project seems to take more years to breakeven. However, the analysis of business feasibility ignores the time value for money and other growth opportunities. Therefore, from the strategic point of view, the Resource Recovery and Safe Reuse (RRR) project at Kole is financially feasible by the fact that it has positive financial NPV, a high RoI and continues to expand operations.

Some of the strategies that can be adopted to scale up the business include;

- i. Increasing the dumping trips and or dumpers by increasing the sources of FS.
- ii. Increasing the cost of a kilogram to UGX 1500 since the price has taken long at UGX.1000⁷.
- iii. Scaling up production from 700 Kgs to 3000. This will boost the sales and subsequently benefit the facility with economies of scale.

⁷ See; Briquette Businesses in Uganda The potential for briquette enterprises to address the sustainability of the Ugandan biomass fuel market (GVEP International and Hamish Ferguson, 2012)

3 DEFAST IN KITGUM

3.1 Background and history

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 (MoU) 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.

3.2 Financial Analysis for Kitgum

By the time of this report, Kitgum had not started producing any faecal sludge products. So the only engagement was on collection and treatment of faecal sludge.

Table 4: Costs and revenue detail at Kitgum site

Staffing levels		Number of staff		
Staff Category	Security guard	1		
	Tricycle driver	1		
	Gulpers	5	-	-
Incomes	Source		Monthly income	Income pa
	Hiring barrels ⁸	4 each UGX. 2000	100,000	1,200,000
	Gate collections	UGX. 5,000 Each * 50 trips a month	250,000	3,000,000
Expenses	Salaries	2	300,000	3600,000
	Safety gears ¹ maintenance and replacement	1	25,000	300,000
	Fuel for tricycle and supervision	1	300,000	3,600,000
	Site maintenance and other equipment repairs	1	41,000	492,000
	Removing sludge from the ponds to the drying bed	1	1	50,000
	Water	1	100,000	1,200,000
	Minor Pipeline repairs	1	1	200,000
	Office rent	1	150,000	1,800,000
	Electricity	1	60,000	720,000
	Internet	1	50,000	600,000
Capital expenditure	Detail	Number	Unit cost(UGX)	Total cost
	Ponds	3	6,000,000	18,000,000
	Upgrading the site (Fence and other amenities like tiled and instalments)	1	10,000,000	10,000,000

⁸ These pay fees for hiring the barrels and hire a barrel at UGX 2000 per usage.

Key observations at the Kitgum DEFAST plant

- i. The facility does not produce and or sell any faecal sludge.
- ii. The company (WASH Consult) is using its own money to pay expenses.
- iii. The contract the company had with Water for People expired and has not been renewed.
- iv. No ground rent paid since the land belongs to the Municipal Council.

Challenges being experienced at Kitgum DEFAST site

- i. Competition from cesspool emptiers because they are cheaper than gulpers.
- ii. People do not want to use gulpers because of the negative perception and fear for sanitation safety.
- iii. Water for People has not renewed the contract and this is affecting services because of limited funding and technical support.

Opportunities

There is a growing quantity of FS and this can make money through selling briquettes and other products.

Recommendations for the Kitgum site

- i. There is need to support the municipal with briquettes production. They can be under the mentorship and support of the Kole facility for practical benchmarks.
- ii. GIZ and Water for People can offer further support to the municipal administration in promoting gulpers as opposed to cesspool alternatives to increase uptake.
- iii. A pilot market test should be conducted in Kitgum, neighbouring towns and settlements especially Palabek to establish the attitude of the market towards FS briquettes. This will ease the marketing efforts when production starts.
- iv. The facility needs to be supported with more barrels that can be used for hiring to earn more revenues.
- v. To make the facility more competitive, GIZ and Water for People can work with the Municipal Council to attract private developers through competitive bidding. The terms of reference can include presentation of a business plan and feasibility study.

Conclusion

The facility has a very high potential for sustainable socio-economic benefits such as direct employment, business opportunities, value addition, improved sanitation and environmental protection by substituting charcoal with FS briquettes.

3.3 Opportunities ahead for the DEFASTs

- i. Because of the increasing concern about Water, Sanitation and Hygiene (WASH), there is administrative and political support to extend the services to other districts. For example, the Lira district environment and wetland officer, intends to engage with Kole DEFAST plant management to extend to Amolatar, Otuke, Alebtong, Oyam and Dokolo district because managing waste is becoming a big problem.

- ii. The increase environmental concerns about climate change caused by charcoal burning in the Northern region has strategic opportunities for the FS sector as an alternative source of energy. What needs to be done in the interim is to change the mind-set of the communities about the safety of FS products. This will open up more market space for the sector.
- iii. Access to more supply of FS if the project extends to other districts. Currently there is a challenge of limited FS supply and this has affected economic efficiency. With expanded territories, the sector in Lira will have more access to inputs and this implies high production to generate more revenue. Subsequently, it will attract more entrepreneurs to broaden participation.
- iv. Presence of refugee settlements in the Northern region presents a huge market opportunity of the best quality and quantity can be availed. According to the United Nations High Commissioner for Refugees (UNHCR) Safe Access to Fuels and Energy Strategy 2016-2020, access to energy is a basic need although, to the refugees, access to energy is a real challenge. Therefore, in order for refugees and persons of concern to meet their energy needs in a sustainable and safe manner, UNHCR supports the use of biomass⁹ resources as alternatives to forest resources.

3.4 Challenges experienced at Kole and Kitgum

- i. According to Odyek; the founder of DEFASTs, there is a slow uptake of the FS product, because of the stigma associated with human faeces. However, he reports that there are positive changes but a lot more is still need to change the mind-set.
- ii. Particularly for Kitgum, the production has not started because the district has not yet identified a committed investor. However, in an interview with the focal person, there is an ongoing progress in writing a proposal seeking for funding to develop a production facility.

3.5 Biggest challenge

The District Agriculture Office stopped WCL from selling the compost because it was not tested and approved from the government labs so far only 500 kgs was sold out. Even when Water for People bought a machine for making composts (pelletizer) it still not functional. This has limited opportunities for growth and broadening the revenue streams of the facility.

3.6 Limitations encountered during the study

The DEFAST management was not disclosing financial information and this limited access to updated data. Nonetheless, this was managed by using the previous periods to analyse the financial viability of the enterprises.

⁹ The UNHCR strategic objectives seek to promote clean and sustainable energy efficiency for cooking and lighting through a complementary two-pronged approach targeting both energy demand and supply: (a) improving biomass fuel efficiency because although use of biomass is expected to decline, it is unlikely that absolute consumption of biomass will decrease over the coming decades due to population growth and urbanisation; and (b) fuel substitution from biomass to renewable energy such as biogas, solar and hydropower (UNHCR Uganda Energy and Environment Programme Strategy, 2016-2020; page 5)