Contribution Margin Analysis for Selected Micro- and Small-sized Briquettes Businesses in Uganda

ABOUT THIS REPORT

Content of this report is the sole responsibility of cewas, the international centre for water management services.

The contents reflect broad-brush contribution margin analysis of selected micro- and small-sized briquettes businesses supported in Uganda.

The contents do not necessarily represent the position of Kampala Capital City Authority (KCCA), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and the Swiss Agency for Development and Cooperation (SDC).

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TABLE OF CONTENTS

LIST OF ABBREVIATIONS

DWD ..... Directorate of Water Development

FS ..... Faecal Sludge

FSM ..... Faecal Sludge Management

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

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

INRM ..... Integrated Natural Resources Management

KCCA..... Kampala Capital City Authority

kg..... Kilogram

l..... Litres

LPG ..... Liquefied Petroleum Gas

Ltd. ..... Limited

LUCHACOS..... Lubaga Charcoal Briquettes Cooperative Society Ltd. (briquette business)

MWE..... Ministry of Water and Environment

NWSC..... National Water and Sewerage Corporation

RRR..... Resource Recovery & Safe Reuse

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

SEACO ..... Sustainable Energy Answers Cooperative Ltd. (briquette business)

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

USA ..... United States of America

LIST OF TABLES

LIST OF FORMULAS

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.

The general objectives of the extension of the 2nd phase of the RRR Project 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.

2 RESOURCE RECOVERY AND SAFE REUSE

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 in the sanitation sector 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 [WAFLER 2018].

3 CONTRIBUTION MARGIN ANALYSIS

The contribution margin analysis is an accounting tool that investigates 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 can be stated either on a gross or per-unit basis and 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.

Formula 1: Contribution margin

$$Contribution\ Margin = Sales\ Revenues - Variable\ Costs$$

The contribution margin ratio is the contribution margin divided by the sales revenues.

Formula 2: Contribution margin ratio

$$Contribution\ Margin\ Ratio = \frac{Sales\ Revenues - Variable\ Costs}{Sales\ Revenues}$$

An advantage of the contribution margin analysis is its ease of use. It is conducted using information that is readily available as most businesses calculate sales figures and record cost information. The only additional work that may need to be done is to classify costs as fixed or variable. However, performing contribution margin analysis requires some assumptions such as that 1) the selling price is constant, 2) costs are linear and can be cleanly divided into fixed and variable components and 3) lastly, that the same number of units are produced and sold. The extent that these assumptions affect the usefulness of the technique varies from company to company and should be consider when interpreting results [FREEDMAN n.y.].

The 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 to pursue strategies to reduce variable costs or explore possibilities of increasing unit prices to increase the contribution margin. If production and sales volumes can be increased, the contribution margin will continue to grow in conjunction with sales, while fixed costs remain (approximately) the same. This will lead to higher net profits (after all fixed expenses have been subtracted).

4 LUBAGA CHARCOAL BRIQUETTES COOPERATIVE SOCIETY LTD.

4.1 About

LUCHACOS - Lubaga Charcoal Briquettes Cooperative Society Limited - is a Cooperative Society by business form. The executive committee comprises of nine officials, who form the management team. LUCHACOS produces honeycomb and stick briquettes as affordable and effective source of energy for cooking to institutions (poultry farms, schools, etc.) and low-income households.

4.2 Process, production and sales information

Using manually operated briquette presses, LUCHACOS manufactures both, honeycomb and stick briquettes from mixtures consisting of ingredients listed in Table 1:

Table 1: LUCHACOS' faecal sludge briquette ingredients

Ingredients	Amount
Charcoal	25 kg
Charcoal dust	15 kg
Carbonised faecal sludge	10 kg
Water	10 l
Clay	1 kg
Cassava flour or Molasses (using either of the two)	1 kg 2 kg

These mixtures allow to produce ca. 50 or 100 honeycomb briquettes (@ 1kg or ½kg each) or 500 stick briquettes (@ 100 grams each), which are sold at prices listed in Table 2.

Table 2: LUCHACOS' briquette sales prices

Briquettes	Sales prices
Honeycomb briquettes (@ ½ kg)	UGX 1.000 per piece
Honeycomb briquettes (@ 1 kg)	UGX 2.000 per piece
Stick briquettes	UGX 500 per kg

An employee producing ca. 100 honeycomb briquettes per day is paid UGX 200 per piece, which translates to UGX 20,000 per day on an average. The manually operated stick briquette press has a total number of 9 cylindrical shaped moulds therefore allowing to produce 9 numbers of stick briquettes per press. With an average 32 presses a day, a person can produce 40 kg of wet stick briquettes which translates into 32 kg dry stick briquettes. Monthly production capacities of honeycomb and stick briquettes are summarised in Table 3.

Table 3: LUCHACOS' monthly briquettes production capacities

Briquettes	Production capacity
Honeycomb briquettes	1.600 pieces (ca. 1.600 kg)
Stick briquettes	500 kg

The average fixed wage for an employee producing stick briquettes is UGX 5.000 per day (if only doing briquetting, which does not involve mixing the ingredients), but if the same person does also mixing, then its UGX 7.000 per day. At present, overall payment of permanent staff is UGX 600.000 per month (4 x UGX 150.000). Actual briquettes pressing happens at an average of 4 days per week, on the other days - amongst others - carbonisation of organic solid waste and preparation of the mixture takes place.

Carbonised faecal sludge is purchased from Chamuka Briquettes. The cost of charcoal dust fluctuates as there is competition with UMEME Ltd., Uganda's main electricity distribution company, which uses the material for earthing systems during installation of power in buildings. The price for clay changes depending on weather condition and the distance from where it is procured. Raw material costs (as per November 2019 and including delivery to LUCHACOS' production site) are summarised in Table 4.

Table 4: LUCHACOS' raw material costs

Ingredients	Raw material costs (including delivery to site)
Charcoal	UGX 30.000 per 100 kg
Charcoal dust	UGX 5.000 - 10.000 per 60 kg
Carbonised faecal sludge	UGX 40.000 - 50.000 per 100 kg
Water	UGX 200 per 20litres jerry can
Clay	UGX 180.000 - 200.000 per truckload (4 tons)
Cassava flour	UGX 1.600 - 2.000 per kg
Molasses	UGX 40.000 - 60.000 per 20 litres

The hand operated honeycomb and stick briquette presses costed UGX 800.000 and UGX 1.000.000, respectively. Their useful life is assumed to be 10 years. Maintenance costs is very little and mainly associated to the purchase of lubricants. Most repairs can be made in-house.

4.3 Contribution margin analysis

Table 5: Monthly contribution margin statement for LUCHACOS

	Honeycomb briquettes	Stick briquettes
Possible production capacity	**[kg/month]**	**[kg/month]**
Tonnage	1.600	500
Revenues	**[UGX/month]**	**[UGX/month]**
Briquettes sales	3.200.000	500.000
Total:	**3.200.000**	**500.000**
Raw material costs	**[UGX/month]**	**[UGX/month]**
Charcoal	240.000	75.000
Charcoal dust	72.000	23.000
Carbonised FS	144.000	45.000
Clay	2.000	1.000
Water	4.000	1.000
Molasses	175.000	50.000
Total	**637.000**	**195.000**
Other variable costs	**[UGX/month]**	**[UGX/month]**
Wages	320.000	110.000
Total	**320.000**	**110.000**
Gross contribution margin	**[UGX/month]**	**[UGX/month]**
Monthly total revenues	3.200.000	500.000
Monthly total variable costs	957.000	305.000
Gross contribution margin	**2.243.000**	**195.000**
Gross contribution margin ratio	70%	39%
Contribution margin (per kg briquettes)	**1.400**	**390**

A financial analysis (see **Error! Reference source not found.**) performed for LUCHACOS' briquette production suggests that, at the present possible monthly production rate of up to 1.600 honeycomb briquettes (corresponding to ca. 1.600 kg briquettes) and about 500 kg

stick briquettes, the gross contribution margin of honeycomb briquettes (ca. UGX 2.250.000 per month) is about 12 times that of stick briquettes (UGX 195.000 per month). From an economic point of view, LUCHACOS' honeycomb briquettes production is more profitable. This is not only because of the much higher possible production capacity, but also because both, the per-kilogram contribution margin (UGX 1.400 per kg) and the gross contribution margin ratio of 70% are in favour of honeycomb briquettes.

5 SUSTAINABLE ENERGY ANSWERS CO-OPERATIVE LTD.

5.1 About

Sustainable Energy Answers Cooperative (SEACO) Limited was registered as company limited by shares in December 2016. 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 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.

5.2 Process, production and sales information

SEACO uses mixtures (Table 6) of charcoal, carbonised FS, water, clay and Molasses for production of honeycomb and stick briquettes.

Table 6: SEACOS' faecal sludge briquette ingredients

Ingredients	Amount
Charcoal	60 kg
Carbonised faecal sludge	40 kg
Water	20 l
Clay	2 kg
Molasses	½ kg

These mixtures allow to produce about 34 honeycomb briquettes (@ 3 kg each) or 1.630 stick briquettes (@ 60 grams each), which are sold at UGX 2.000 per honeycomb briquette and UGX 1.200 per kilogram stick briquettes (Table 7).

Table 7: SEACOS' briquette sales prices

Briquettes	Sales prices
Honeycomb briquettes (@ 3 kg)	UGX 2.000 per piece
Stick briquettes	UGX 1.200 per kg

Using a simple, manually operated briquette press, a person can produce an average number of 50 honeycomb briquettes (weighting 3 kg each after drying) per day. Employees are paid UGX 200 for each honeycomb briquette produced. Manual stick briquette production capacity is 15 kg per person per day. On an average, 16 stick briquettes make 1 kg and UGX 200 is paid per kg of stick briquettes produced. The briquette production process is not a continuous, but involves preparation of the mixture of charcoal, carbonised FS, water, clay and molasses on one day and the actual pressing of briquettes on the other.

Table 8: SEACOS' monthly briquettes production capacities

Briquettes	Production capacity
Honeycomb briquettes	800 pieces (ca. 2.400 kg)
Stick briquettes	240 kg

Charcoal costs about UGX 6.000 per 70kg bag. Carbonised FS costs about UGX 40.000 - 50.000 per 100 kg. Water costs UGX 100 per 20litres jerry can (including transport). Clay is sourced at UGX 180.000 per small truck load (that is 4 tons). Total costs for molasses is UGX 70.000 per 20litres jerry can (including UGX 10.000 for transport by Boda Boda).

Table 9: SEACOS' raw material costs

Ingredients	Raw material costs (including delivery to site)
Charcoal	UGX 6.000 per 70 kg
Carbonised faecal sludge	UGX 40.000 - 50.000 per 100 kg
Water	UGX 100 per 20litres jerry can
Clay	UGX 180.000 per truckload (4 tons)
Molasses	UGX 70.000 per 20 litres (including UGX 10.000 for transport by Boda Boda)

5.3 Contribution margin analysis

When performing a financial analysis of SEACO's briquette production, it becomes obvious, that at the present possible monthly production rate of up to 800 honeycomb briquettes (corresponding to ca. 2.400 kg briquettes) and about 240 kg stick briquettes, the gross contribution margin from honeycomb briquettes production (i.e. UGX 815.000 per month) contributes about 5 times more to covering monthly fixed costs and to potentially generating profit. Although the gross contribution margin ratio of honeycomb and stick briquettes production is in the same range in percentage figures (i.e. ca. 50%), the per-kilogram contribution margin of stick briquettes (UGX 600 per kg) is almost twice as high as that of honeycomb briquettes (UGX 340 per kg). Therefore, each kilogram of stick briquettes sold contributes almost double the amount to covering fixed costs and generating profit compared to honeycomb briquettes.

Table 10: Monthly contribution margin statement for SEACO

	Honeycomb briquettes	**Stick briquettes**
Possible production capacity	**[kg/month]**	**[kg/month]**
Tonnage	2.400	240
Revenues	**[UGX/month]**	**[UGX/month]**
Briquettes sales	1.600.000	288.000
Total:	**1.600.000**	**288.000**
Raw material costs	**[UGX/month]**	**[UGX/month]**
Charcoal dust	121.000	13.000
Carbonised FS	428.000	45.000
Clay	3.000	1.000
Water	3.000	1.000
Molasses	70.000	35.000
Total	**625.000**	**95.000**
Other variable costs	**[UGX/month]**	**[UGX/month]**
Wages	160.000	48.000
Total	**160.000**	**48.000**
Gross contribution margin	**[UGX/month]**	**[UGX/month]**
Monthly total revenues	1.600.000	288.000
Monthly total variable costs	785.000	143.000
Gross contribution margin	**815.000**	**145.000**
Gross contribution margin ratio	51%	50%
Contribution margin (per kg briquettes)	**340**	**600**

6 CHAMUKA BRIQUETTES

6.1 About

Chamuka Briquettes is a briquette business, manufacturing and selling FS-based products (briquettes and biochar) in partnership with NWSC. It is supported by Water for People 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 promotion of Sanitation As A Business (SAAB). It works 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, reuse the treated waste into marketable products, and create business opportunities wherever possible.

6.2 Process, production and sales information

Chamuka Briquettes blends charcoal dust and carbonized FS at a ratio of 60:40 for 35-kg mixtures, adding 1 kg clay mixed in 20 litres of water and half a litre of molasses (Table 11).

Table 11: Chamuka Briquettes' faecal sludge briquette ingredients

Ingredients	Amount
Charcoal dust	21 kg
Carbonised faecal sludge	14 kg
Water	20 l
Clay	1 kg
Molasses	½ kg

These mixtures make 14 honeycomb briquettes of 2,5 kg each or 35 kg of stick briquettes. Honeycomb briquettes are sold at UGX 2.000 per piece. Stick briquettes are packed in 10kg, 25kg and 50kg sacks and sold at UGX 1.200 per kilogram (Table 12).

Table 12: Chamuka Briquettes' briquette sales prices

Briquettes	Sales prices
Honeycomb briquettes (@ 3 kg)	UGX 2.000 per piece
Stick briquettes	UGX 1.200 per kg

A manual press is used for production of honeycomb briquettes and a diesel-engine driven automated press for production of stick briquettes. On average, a person can make 50 honeycombs per day. The average pay per honeycomb briquette produced is UGX 100. Operation of the automated stick briquette press is a team effort: a minimum of 2 people is needed to run the machine. Average production for stick briquettes is 1,5 tons per week. Each person gets an average of UGX 50 for every kg of stick briquette produced.

Table 13: Chamuka Briquettes' monthly briquettes production capacities

Briquettes	Production capacity
Honeycomb briquettes	800 pieces (ca. 2.000 kg)
Stick briquettes	6.000 kg

Chamuka Briquettes carbonises dried FS, which is purchased from NWSC at UGX 20.000 per ton. At present, total production costs of their carbonised FS is UGX 100 per kg. Raw material costs for Chamuka Briquettes is as follows (Table 13):

Table 14: Chamuka Briquettes' raw material and other variable costs

Ingredients	Raw material costs (including delivery to site)
Charcoal dust	UGX 10.000 per 50 kg
Carbonised faecal sludge	UGX 10.000 per 100 kg
Water	UGX 10 per kg of briquette produced
Clay	UGX 75.000 per 4 ton
Molasses	UGX 50.000 per 20 litres

Weighted average costs of diesel and service oil is UGX 14 per kg of stick briquettes, each. Average monthly maintenance costs for the automated briquette press is ca. UGX 50.000.

6.3 Contribution margin analysis

At possible monthly production rates of up to 6.000 kg of stick briquettes (using the automated briquettes press) and 800 pieces (ca. 2.000 kg) of honeycomb briquettes, the gross contribution margin of stick briquettes (ca. UGX 4.360.000 per month) is about 4 times that of honeycomb briquettes (UGX 1.040.000 per month). From an economic point of view, Chamuka Briquettes' stick briquettes production is more profitable. This is because of the much higher possible production capacity and the per-kilogram contribution margin (ca. UGX 730 per kg) is in favour of honeycomb briquettes.

Table 15: Monthly contribution margin statement for Chamuka Briquettes

	Honeycomb briquettes	Stick briquettes
Possible production capacity	**[kg/month]**	**[kg/month]**
Tonnage	2.000	6.000
Revenues	**[UGX/month]**	**[UGX/month]**
Briquettes sales	1.600.000	7.200.000
Total:	**1.600.000**	**7.200.000**
Raw material costs	**[UGX/month]**	**[UGX/month]**
Charcoal dust	240.000	720.000
Carbonised FS	80.000	240.000
Clay	45.000	135.000
Water	8.000	60.000
Molasses	105.000	315.000
Diesel		84.000
Service oil		84.000
Total	**478.000**	**1.638.000**
Other variable costs	**[UGX/month]**	**[UGX/month]**
Wages	80.000	1.200.000
Total	**80.000**	**1.200.000**
Gross contribution margin	**[UGX/month]**	**[UGX/month]**
Monthly total revenues	1.600.000	7.200.000
Monthly total variable costs	558.000	2.838.000
Gross contribution margin	**1.042.000**	**4.362.000**
Gross contribution margin ratio	65%	61%
Contribution margin (per kg briquettes)	**520**	**730**

7 REFERENCES

FREEDMAN, J. (n.y.): Advantages or Disadvantages of Contribution Margin Analysis. URL: http://smallbusiness.chron.com/advantages-disadvantages-contribution-margin-analysis-65329.html [Accessed: 3. December 2019]

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