Overall Project:
rosa
Resource-Oriented Sanitation concepts for peri-urban areas in Africa

Community-based, resources-oriented management of separated human waste in peri-urban areas in Nakuru, Kenya

This paper aims to derive a strategy for sustainable implementation of a waterless sanitation system with urine diversion under East African conditions that is based on an analysis of the situation in Austria.

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Abstract

This article presents the main points of a business plan developed for a community-based resources-oriented human waste management system in Nakuru, Kenya. In this system a community-based organisation (CBO) is working as a small business engaged in the collection, transportation and treatment of separated excreta from Urine Diverting Dry Toilets (UDDTs). To verify the potential profitability of the system a projected income statement, included in a detailed business plan, was developed. In order to identify the related costs a case study was conducted in Nakuru in November 2009. The detailed financial projections indicate that profitability can be reached by year four of operation.

Introduction

The project „Resource Oriented Sanitation concepts for periurban areas in Africa“ (ROSA, Langergraber et al., 2010) identified Urine Diverting Dry Toilets (UDDTs) as an appropriate alternative to pit latrines in low-income areas in Nakuru, which are characterized by inadequate water supply and unfavourable soil structure for pit latrines (Moseti, 2010).

Menengai Waste Recyclers Management (MEWAREMA) is a community-based organisation (CBO) based in Nakuru. Since 2002 MEWAREMA became the largest compost manufacturer and a licensed operator of solid waste collection in the two of Nakuru's peri-urban estates, Hilton and London. The experiences in these two fields of operation present an advantage in the management of separated human waste from UDDTs. Additionally MEWAREMA's work is already highly appreciated by the community. Within the ROSA project MEWAREMA widened its activities and is now also offering a collection, transport and treatment service for excreta from UDDTs. It is widely acknowledged that sustainability of a human waste management system depends to a large extent on effective and efficient operation and maintenance (Sohail et al.; 2005, Brikké, 2000). The potential cost effectiveness of an operation and maintenance concept is one factor that determines its sustainability. The potential profitability of the presented community-based human waste management system has been calculated within a business plan. A business plan is a strategic planning document to develop ideas on how to conduct business by examining the company from all perspectives, such as marketing, finance and operations (Ford et al., 2007).

The paper is based on the main points of the business plan for MEWAREMA that was developed in the master thesis „Profitability of a community-based resources-oriented human waste management system in Nakuru, Kenya“ (Grambauer, 2010). All financial data are given in Kenyan Shillings (KES) whereby 1 EUR equals ca. 100 KES.

Key facts of the human waste management system in Nakuru:

- In two peri-urban areas in Nakuru UDDTs have been introduced by the ROSA project.
- Most inhabitants are interested to use UDDTs if they are not responsible for O&M.
- A CBO currently involved in solid waste collection and market waste composting is willing to operate the human waste management system.
- The service charge for a UDDT owner is 100 KES per emptying of one 50 litre faecal matter container
- Cost effectiveness of the system depends on the price obtained for the sale of compost
- Under current conditions the break-even point can be reached after 4 years of operation. Temporary subsidy might be required to cover the loss in the first three years of operation.

Main points of MEWAREMA's Business Plan

The company

MEWAREMA wants to diversify its operation by offering a faecal matter collection and transport service to UDDT owners. Furthermore MEWAREMA operates a treatment plant to co-compost organic waste with the faecal matter collected into hygienically safe, high quality compost. MEWAREMA is therefore functioning as a service and manufacturing business. The organisation aims to improve the quality of life of disadvantaged inhabitants and to contribute to resource recovery through efficient organic and human waste management. Based on the detailed financial projections, it is estimated that 10'000 KES are required to start these two operations successfully. The funds received will be used to build a urine storage tank and to finance the operating loss during the first three years of operation.

Product and Service

The product MEWAREMA offers is high quality compost made out of faecal matter and organic waste. Co-composed excreta are rich in nutrients (nitrogen, phosphorous, and potassium) and organic material and thus enhance sustainably the fertility of topsoil. This compost will be further processed by an organic fertiliser manufacturer and than offered at half the price of chemical fertilizer. Treatment facilities are already available and the operators are being trained to guarantee the required high level of management.

The service of collecting and transporting faecal matter from households to the treatment plant will be done professionally, reliably and customer oriented. Depending on the number of households of each compound (using one or more UDDTs) the collection and transportation service will be carried out in regular intervals. The transportation will be done with a purpose-made donkey cart and two trained workers. The purpose-made cart is under construction and the operators are being trained in the safe handling of faecal matter. If required the operators perform repair work (blocked pipes, etc.) thus ensuring the durability of UDDTs.

Market Potential

Market research conducted in the course of the ROSA project shows that there is a demand of resources-oriented sanitation technologies like UDDTs in Nakuru. Especially in low-income areas, characterized by inadequate water supply and unfavourable soil structure for pit latrines, UDDTs represent an appropriate alternative (Moseti, 2010). Thus, a remarkable up scaling of UDDTs can be observed since the first implementation of UDDTs by the ROSA project in 2008. During the year 2009 a total of 20 UDDTs have been build in the target area privately financed by Landlords/ladies. This development will increase the demand for MEWAREMA's collection and transport service of faecal matter since over 70 percent of UDDT owners require and are willing to pay for the faecal matter collection service. The second target market is compost buyers. Since there is a demand of organic fertilizer in the region NAWACOM (the leading organic fertilizer seller in Nakuru) is disposed to pay 5 KES for 1 kg compost. The compost will be further processed by NAWACOM and sold as organic fertilizer. Researches indicate that virtually all farmers in the region use fertilizer and that the globally rising price of chemical fertilizer leads to an increased demand for the less expensive organic fertilizer. Furthermore it could be observed that small-scale farmers tend to prefer organic fertilizer due to its slower release of nutrient, which is advantageous in the rainy season (Bräustetter, 2007). Additionally, the ongoing research by Jomo Kenyatta University on production of eco fertilizer from urine, could lead to a profitable market for urine as well.

Marketing Strategy

MEWAREMA plans to limit it service to the area of two estates which are not supplied by a sewerage system, have favourable features for UDDT implementations, and are in short distance to the co-composting plant. The plant workers will sell the produced compost to the bulk buyer NAWACOM or if there is a demand directly to other compost buyers.

Pricing strategy

The price for the service of collecting and transporting 50 litre of faecal matter is 100 KES. The price was derived from discussions with potential customers and is set as low as possible to convince UDDT owners to use the service. An increase in price for economic reasons is not planned to avoid a loss of costumers. Depending on the number of household and UDDTs per plot an average payment of 50 KES per month and UDDT is assumed. Compared to the price paid for water in the area (10 KES per 20 litre, i.e. 400 KES to 3000 KES per month per household) the costs for the faecal matter collection service can be considered as affordable. The selling price of the compost sold to NAWACOM is sill under negotiation. At present NAWACOM buys 1 kg of compost for 5 KES.

Advertising , Public relation and Promotion

To convince UDDT owners to use MEWAREMA's collection and transport service they will receive 10 kg of compost per UDDT per year (amount increases with an increase in profit). (Costs: 50 KES per year per UDDT.) This incentive is furthermore a kind of sales promotion since the UDDT owner test the free compost samples in their own garden; transmit or sell it to relatives or neighbours.

To potential customers of the collection and transport-service branch (Landlords/landladies interested in investing in a UDDT) an advisory service is offered by the ROSA and Practical Action office that provides information on how to build and maintain an UDDT.
To promote the organic fertiliser, in and around Nakuru several demonstration sites, showing plant growth enhancement, were established by NAWACOM. Promotional price of 1750 KES for 150 kg organic fertiliser (which is the same price of 50 kg chemical fertilizer) tries to attract more customers. To further promote the use of compost to potential customers (horticulture, gardening, landscaping, plant nurseries, farming) an organic demonstration farm, could as well be installed and operated by MEWAREMA. The produced crop could then be used by members of the organisation or sold. To rise the demand for the high quality compost the awareness rising campaign (started by NAWACOM and the ROSA project) have to be expanded.

Operational concept

The operational concept developed can be described as: Community-based, resources-oriented management of separated human waste. A depiction of the concept is provided in Figure 1. The operation of UDDTs in this case is a system consisting of excreta separation, containment, collection, transportation, treatment and re-use of urine and faeces as compost. The CBO MEWARMA is working as a small business engaged in the collection, transportation and treatment of faecal matter via co-composting additionally it sells the compost to re-user. The transportation is carried out by means of a donkey cart and the treatment is accomplished by co-composting at a community-based facility. The underlying assumptions of the concept are:

Community-based organisation:

- Is licensed by the municipality to offer solid waste management in two estates;
- Operates without financial government intervention;
- Operates in two estates where the ownership structure of the built-up plots is legally recognized.
- Receives a fee for the service of collection of faecal matter from UDDT owners.

UDDT-owner (Landlord/ladies):

- Receives a loan from the Family Bank to cover the capital investment cost of one or more UDDTs (equipped with three faecal matter collection containers).
- Will be charged with an emptying fee of 100 KES per 50 litre container of faecal matter or urine
- Receives 10 kg of compost per UDDT per year as an incentive to use the collection service and the UDDT appropriately. (Amount can be increased with an increase in profit.)

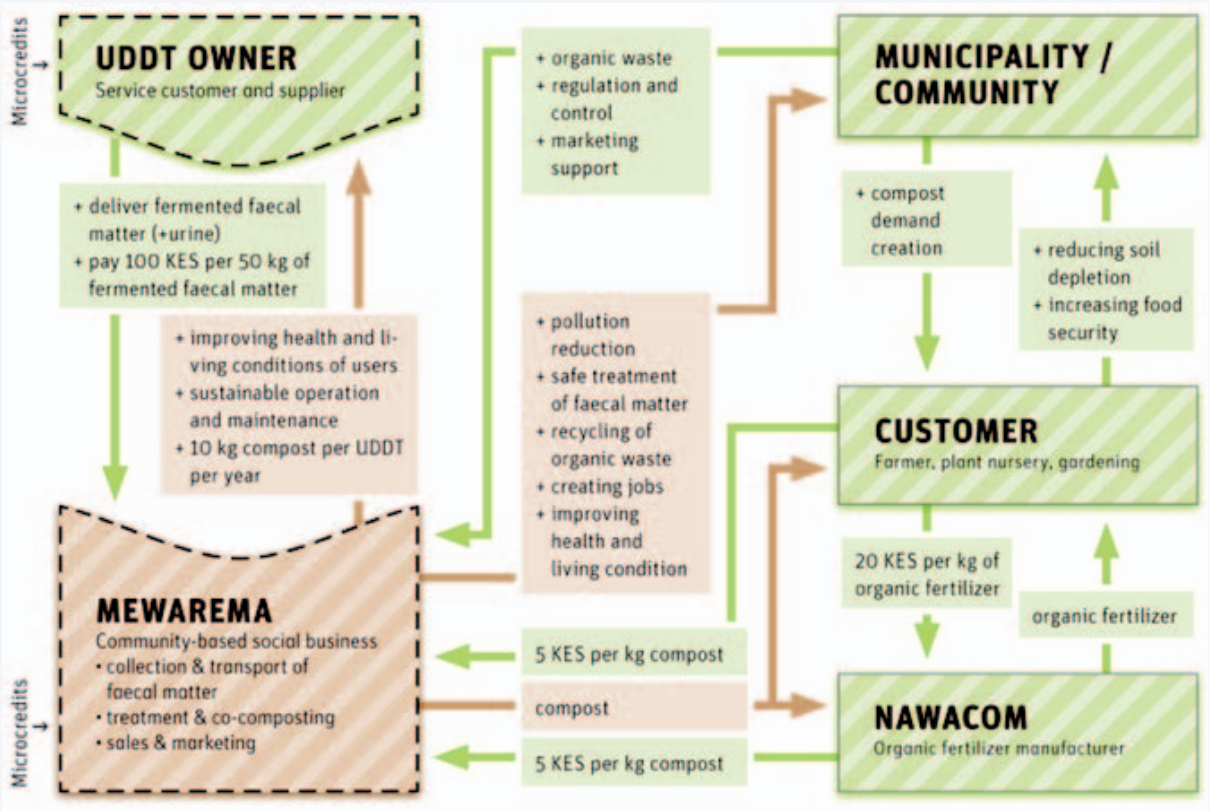

Figure 1: Scheme of the community-based resources-oriented management of separated human waste (100 KES= 1 EUR)

Collection, transportation and treatment:

- Faecal matter containers from UDDTs are emptied manually by two trained collection and transport operators after a minimum storage time of three month.
- Faecal matter will be transported with a purpose made donkey cart to the treatment plant.
- A community-based faecal matter secondary-treatment plant for co-composting. i.e. a drying shed and required equipment, is available to allow a hygienically safe production of compost. Responsible for this work are as well two trained labourers.
- The moisture content of the compost will be adjusted using urine, which saves water and enriches the compost with nutrients.
- The co-composting process will take about three month.
- 100 kg faecal matter can be converted into about 210 kg compost; the mixing ration of faecal matter and organic waste is 1:2; volume reduction of 30 % occurs during co-composting.
- NAWACOM, the only organic fertilizer manufacturer in Nakuru, will buy the compost at 5 KES/kg. The market price for organic fertilizer is 1000 KES per 50 kg bag

Financial Summary

The projected income statement reveals that MEWAREMA could operate profitable by year four, due to the revenues of the manufacturing branch (compost sold) even though the operation of the collection and transportation is not cost-effective. Based on the main assumptions that the number of UDDTs served rises from 24 UDDTs in the first year to 30 UDDTs in the fourth year and that the manufactured compost will be sold at 5 KES/kg, MEWAREMA expects to generate an overall operating profit of 7780 KES in the year four. Table 1 presents the projected income statement for year one to five of MEWAREMA's faecal matter collection, transport and treatment service.

Breakeven point:

The breakeven analysis provides information about the potential profitability. The breakeven analysis demonstrates the level of sales that must be attained in order to meet cash obligations. The contribution margin method was used for determining the breakeven point. The procedure to calculate the breakeven point is to separate all cash obligations into fixed or variable costs and to insert these figures in the following formula:

Breakeven number of units =
Fixed costs / Unit contribution margin

Whereby the number of units is the output of compost in kg and the contribution margin is equal to the unit selling price minus the unit variable costs.

Table 1: Projected income statement for year one to five of MEWAREMA (in KES)

MEWAREMA Projected Income Statement					
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Service-branch					
Revenues	**18800**	**19200**	**21600**	**22800**	**22800**
Costs					
wages	28800	29400	32400	33600	33600
depreciation (cart, equipment)	0	0	0	0	0
other costs (donkey food, water, maintenance)	4290	4300	4350	4370	4370
Operating Profit	**-14290**	**-14500**	**-15150**	**-15170**	**-15170**
Manufacturing-branch					
Revenues	**48300**	**72450**	**80850**	**89250**	**91350**
Cost of goods sold	0	0	0	0	0
Opening finished goods	0	0	0	0	0
Cost of goods manufactured	62400	62400	62400	62400	62400
Cost of goods available for sale	0	0	0	0	0
closing finished goods	0	0	0	0	0
Gross margin	-14100	10050	18450	26850	28950
Operating costs:					
marketing (advertising per UDDT 10kg compost = 50 KES per UDDT)	1200	1200	1400	1500	1500
general and administrative	2400	2400	2400	2400	2400
Operating profit	**-17700**	**6450**	**14650**	**22950**	**25050**
Overall Profit (loss)	**(-31990)**	**(-8050)**	**(-500)**	**7780**	**13780**

In this case the wages of the treatment plant operator are regarded as fixed cost since their number of working days does not depend on the number of UDDTs served but on the co-composting process only. Furthermore in order to be able to calculate the breakeven point against the units (kg) of compost sold, the operating loss of the service branch (collection and transportation) was regarded as direct material cost used in the manufacturing branch (co-composting). The calculation allows the conclusion that under the given conditions a sale of 16300 kg per year would be necessary to breakeven.

Further breakeven points have been calculated to analyse the affect of different scenarios. An optimistic scenario would be an increase in the selling price for the produced compost. A selling price of 6 KES (instead of 5 KES) per kg compost would lead to a breakeven point of 13200 kg compost. Thus an operating profit of 7500 KES could already be reached in year 2 with 24 UDDTs served. A selling price of 7 KES per kg compost would result in a breakeven point of 11000 kg compost. Thus the operating loss of the first year could be reduced by 64 % to -11500 KES and in the second year an operating profit of 22000 KES could already be generated.

Risks

General risks that are specific to Kenya and might have negative influence on the performance of MEWAREMA are natural disasters and political risks. Whereby floods caused by heavy rainfall can affect the composting process since moisture content and temperature are the main influencing factors in the process. Droughts might lead to an increase in water price, which would have an influence on the indirect costs of MEWAREMA. According to the latest Kenya Business Leaders Confidence Index by Synovate, perceived political risks have been on an upward trend. The study, conducted in March 2010, reveals that most business leaders in Kenya (76 per cent) consider political instability to be the main risk to their businesses currently (Olouch and Kapchanga, 2010).

Risks that are specific to the business of MEWAREMA are the following:

Product risk:

The compost produced can fail to be hygienically safe due to failures within the composting process. Those malfunctions can be caused by neglect of the treatment work, vandalism or unexpected shortage of raw materials (organic waste). To avoid this a high level of management and maintenance is necessary which the supervisor controls.

Compliance with safety regulations:

The risk that workers not wearing proper safety tools (gloves, protection masks and boots) have to be considered. Therefore the supervisor must be held accountable for violating such regulations.

Customer risk:

UDDT owners might empty the faecal matter containers by themselves into abandoned pit latrines to save the collection fee. To counteract this risk public awareness campaigns should be launched by the municipality (or NGOs) to clarify the relations between excreta disposal and diseases.

Market risk:

The organic fertilizer market can develop differently than expected (i.e. reduction of demand). This might occur if the government subsidise chemical fertilizer even more than presently. To counter this development described marketing strategies will not be disregarded.

Economic risk:

Payment policies have to be handled strictly enough to avoid getting behind the cash flow curve. Possible deficits could be financed through MEWAREMA's profit from its solid waste collection branch. Since the produced compost is exclusively sold to NAWACOM the operating profit highly depends on NAWACOM's performance. Thus further compost buyers have to be identified to counter the dependence on NAWACOM.

Political support of recourses-oriented sanitation:

There is the risk that capacity development at local, regional and national level concerning ecological sanitation has not yet taken place to an extent that would guaranty full support of the sanitation system and the work of MEWAREMA. Hereby the law actually prohibiting the use of excreta as fertilizer needs to be mentioned.

Competition

MEWAREMA has a monopoly position since no other company is offering this kind of collection and transport service. The risk of imitators in future is neglectable and the license obtained by the Nakuru Municipal Council guaranties the monopole in the two estates. It is assumed that the Municipality will never provide a sewerage system and that the integration of MEWAREMA as a CBO in the two estates will lead to wide acceptance, use and appreciation of the service.

Since NAWACOM is the only fertilizer manufacture in the region MEWAREMA highly depends on the sales of NAWACOM and the overall demand for organic fertilizer

in the region. Chemical fertilizer are subsidised by the government and therefore distort the competition. However the rising price of chemical fertilizer (driven by the increase in oil prices) is presumably contributing to a rethinking towards sustainable farming. This could already be observed at the end of 2007 when rising global fertilizer prices gave NAWACOM sales a significant boost, since farmers in the region opted for their cheaper organic fertilizer (Sprung and Stevens, 2009).

Conclusion

The major findings of MEWAREMA's business plan can be concluded as follows:

- The income statement projects that the operation of the community-based human waste management system is economically sustainable in year four. Thus MEWAREMA would need temporary subsidy to cover the operating loss in the first three years of operation. Furthermore it emerged that a urine storage tank is required in addition to the already implemented drying shed.
- A breakeven analysis revealed that an increase of 1 KES in the selling price of the produced compost (thus 6 KES instead of 5 KES per kg compost) would lead to profitability in year two already. Therefore MEWAREMA needs support in creating demand for the produced compost since current operating profit is insufficient to cover extensive promotion.

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