



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

## CASE

# Municipal solid waste composting for cost recovery (Mbale Compost Plant, Uganda)

Charles B. Niwagaba, Miriam Otoo and Lesley Hope



## Supporting case for Business Model 10

Location:	Mbale, Uganda
Waste input type:	Municipal solid waste (MSW)
Value offer:	Provision of sustainable waste management services, provision of high quality compost, carbon credits
Organization type:	Government-owned public enterprise
Status of organization:	Operational since 2010
Scale of businesses:	Processes 60 tons of MSW per day
Major partners:	Government of Uganda, National Environment Management Authority (NEMA), Makerere University, National Agricultural Advisory Service, World Bank

## Executive summary

Mbale municipal Composting Plant (MCP) is a not-for-profit entity which was started with the primary aim of reducing the quantity of solid waste landfilled and resulting greenhouse gas (GHG) emissions. Additional key drivers have been to: a) reduce open-dumping practices and maintain cleanliness of the city; b) provide an environmentally safe fertilizer alternative for farmers; and c) create jobs for local inhabitants. MCP uses a windrow composting technique and converts approximately 60 tons of waste that it receives daily into a safe organic fertilizer. This initiative is based on a **cost-recovery model** where it seeks to reduce waste management costs faced by the municipality. It mainly generates its revenue from sale of compost and recyclables such as plastics, and plans to engage in carbon trading in the near future as an additional revenue stream. Compost is sold primarily to farmers within Mbale, however MCP's compost product is gradually gaining popularity and is being sold in other regions. Plans are underway to reinvent its marketing strategy by advertising on national television to broaden its market scope. MCP did so far not break even and receives financial support from the government to partially cover its operational and maintenance costs. Additional subsidies are received as operational tax waivers from the National Environment Management Authority (NEMA). MCP has great potential to become financially self-sufficient. It however needs to improve the operational efficiency of its technology to reduce operational costs and invest in product innovation and branding to increase the market demand for its compost product. Additional revenue sources that remain untapped are waste collection fees to be charged to households and businesses. This will however require an instituted mandate by the municipality. Benefits from MCP's activities are substantial and include efficient waste collection systems which have reduced the quantity of openly-dumped waste and consequently

improved environmental and human health, and livelihood improvement for workers at the plant and farmers who now have access to affordable and safe fertilizer alternatives.

#### KEY PERFORMANCE INDICATORS (AS OF 2015)

Land use	2.8 ha					
Capital investment:	USD 350,000					
Labor:	30 people					
O&M cost:	USD 13,400 per year					
Output:	4 tons of compost per day; 95% of incoming solid waste is fully degraded and recycled					
Potential social and/or environmental impact:	Provision of 21 full time jobs, reduced human exposure to untreated waste, improved environmental health from reduced GHG emissions, enhanced soil fertility and productivity					
Financial viability indicators:	Payback period:	10 years	Post-tax IRR:	N.A.	Gross margin:	N.A.

### Context and background

MCP is a public project administered by the Mbale Municipal Council. Its main goal is to reduce GHG emissions and thus transform municipal organic solid waste into organic compost for agricultural use, thereby improving MSW management in urban areas. The project is part of a national program conducted by NEMA, under the Government of Uganda and World Bank-funded Environmental Management and Capacity Building Project II (EMCBP-II). MCP is located in Doko cell, Namataala industrial region, in the Mbale district. The present location of the site was previously (from 1950s) used as an official government landfill site. The revenue streams of the project are sales from compost and sale of recyclables such as plastics, whereas carbon credit is a planned main revenue, which is anticipated to generate an annual income of USD 25,000–USD 30,000.

### Market environment

Most large-scale farming in Mbale is practiced on the slopes of Mt. Elgon, where soil fertility is lost through erosion. Chemical fertilizers and food and agro-waste (not composted) are the primary fertilizers used in restoring the soil nutrients. The nutrients in fresh/un-composted waste are not readily available to the crops. In addition, chemical fertilizers are expensive (approx. USD 1 per kg) and require regular applications throughout the plant growth stages. Mbale composting plant meets the need of the farmers by processing MSW to produce a comparably affordable organic fertilizer and with slow nutrient release into the soil thus requiring fewer fertilization re-applications. The opportunity that MCP exploits lies in the need for affordable and environmentally-friendly fertilizer alternatives by farmers and also sustainable waste management solution to reduce the quantity of landfilled MSW and direct human exposure to untreated waste.

### Macro-economic environment

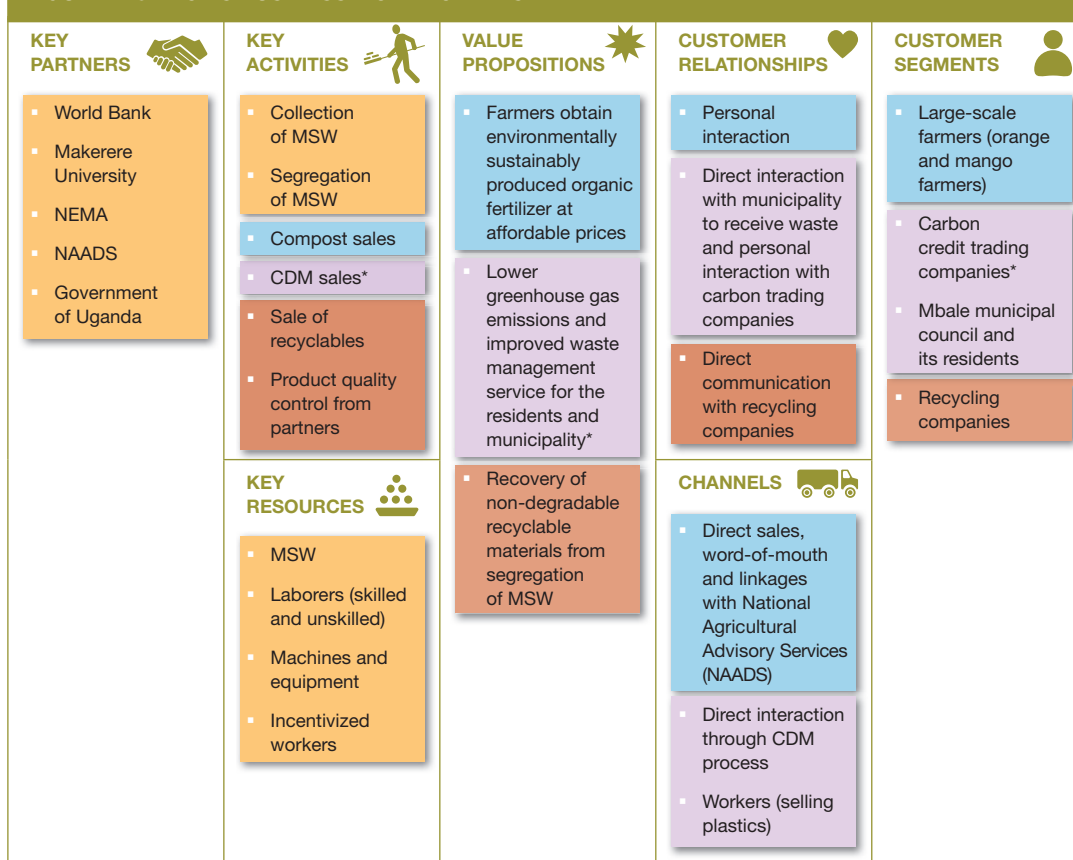
A market condition that could potentially impact MCP's business in Uganda is the price distortions in the fertilizer market from government subsidies for chemical fertilizers. The chemical fertilizer market in Uganda has however never expanded to a significant level due to the ineffective fertilizer policy. The limited use of chemical fertilizers in Uganda is striking and this has also been attributed to the lack of credit to farming households in Uganda. There is neither a large-scale government fertilizer program that provides subsidized fertilizer to farmers nor an active private fertilizer sector that supplies fertilizer at competitive prices (Yamano and Arai, 2010). Additionally, Uganda is landlocked, and with poor transportation system connections to ports, access to the external fertilizer markets is virtually

impossible in the country. This represents a great opportunity for waste-based organic fertilizer businesses like MCP who can take advantage of erratic chemical fertilizer prices and the limited number of actors in the respective market.

### Business model

Figure 118 presents an overview of MCP's business model. MCP is a socially oriented public entity with the goal to reduce GHG emissions via the conversion of MSW to compost with resulting benefits of a cleaner city and improved agricultural productivity. Initial capital for setting up MCP was received from the central government and the World Bank. It partners with Makerere University and the NEMA for technical support. In implementing its objective, MCP receives and sorts MSW into degradable and non-degradable waste, of which the plastic non-degradable is sold to plastic companies by their workers. Allowing the workers to sell the recyclable waste to recycling companies and earn additional income creates an incentive for the workers to properly and efficiently segregate the waste – reducing MCP's production costs. The compost from processing the degradable waste is sold directly to large scale farmers and sometimes through the National Agricultural Advisory Service's (NAADS) established distribution channels. A major source of revenue for the project is anticipated to be from carbon credit claims, for which it receives support from the World Bank. This anticipated revenue from carbon credits has allowed MCP to sell its compost in the initial phase at a very low price to garner market demand. The current unit price of compost is too low for MCP to break even from sales

FIGURE 118. MCP'S BUSINESS MODEL CANVAS



<p><b>COST STRUCTURE</b></p> <ul style="list-style-type: none"> <li>Capital investment including roads and fencing of plant area</li> <li>Operation and maintenance</li> </ul>	<p><b>REVENUE STREAMS</b></p> <ul style="list-style-type: none"> <li>Sale of compost</li> <li>Subsidies (Tax Waiver)</li> <li>Sale of carbon credit (anticipated)</li> <li>Sales of recyclables</li> </ul>
<p><b>SOCIAL &amp; ENVIRONMENTAL COSTS</b></p> <ul style="list-style-type: none"> <li>Potential occupational health risk if protective gear is not used</li> <li>Water pollution from leachate in the rainy season (overflow)</li> </ul>	<p><b>SOCIAL &amp; ENVIRONMENTAL BENEFITS</b></p> <ul style="list-style-type: none"> <li>Job creation</li> <li>Reduction of human exposure to untreated waste</li> <li>Reduction of the emission of greenhouse gases and subsequent global warming</li> <li>Management of MSW which results in a clean environment and reduces land and air pollution</li> </ul>

\* planned activity

of compost only. Thus eventually MCP will have to increase the product price and ensure revenue receipts from carbon credits in order to fully recover costs. MCP's activities have considerable social and environmental benefits including: a) reduced human exposure to untreated waste; b) reduction in GHG emissions from reduced quantities of landfilled MSW; and c) employment generation to name a few.

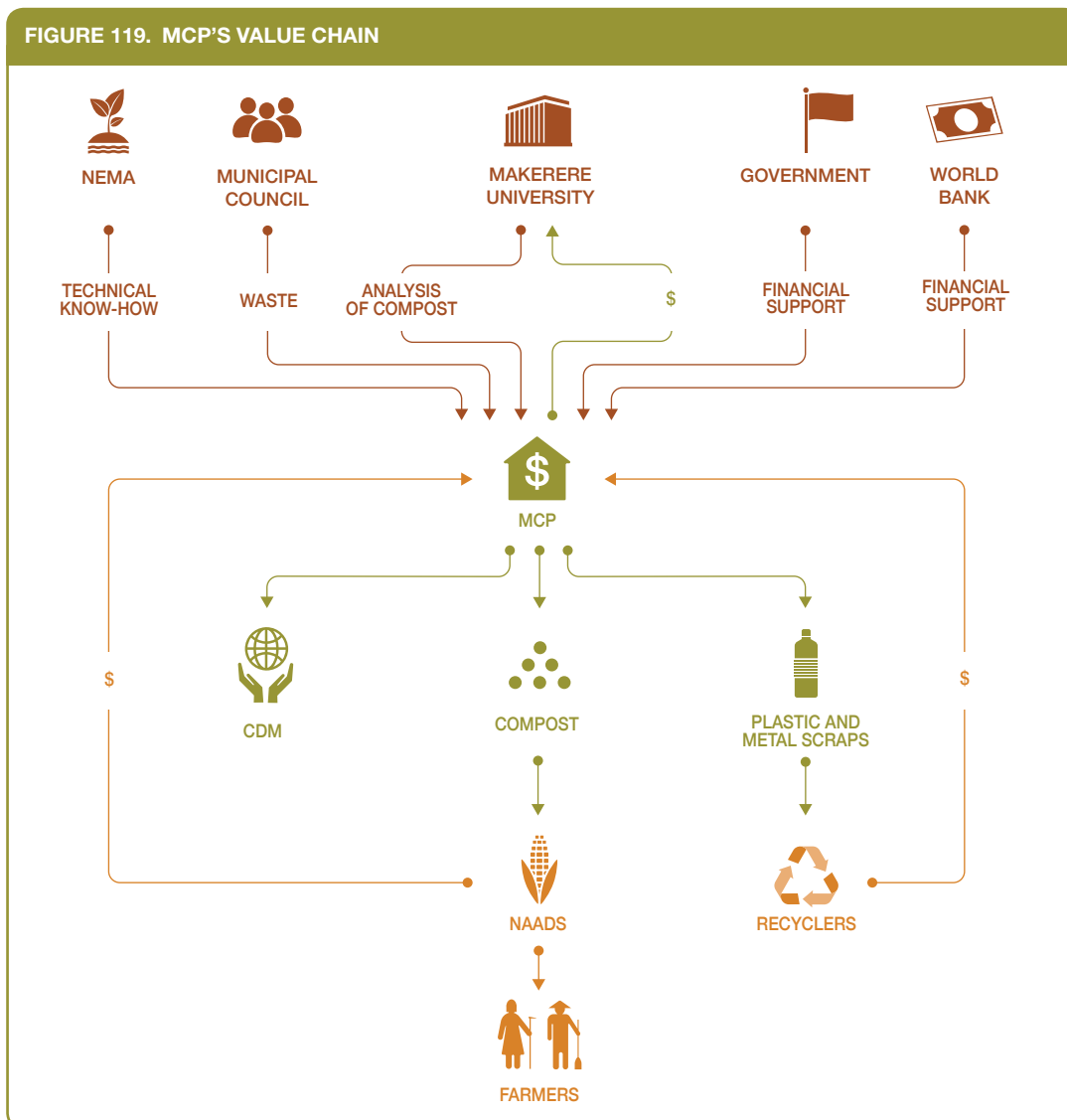
### Value chain and position

The central government and World Bank provided funds for the set-up of the business and injected money for operations. MCP partners with Makerere University and NEMA for laboratory analysis to ensure product quality as well as technical support. MCP in turn pays for the services rendered by Makerere University. The Municipal Council supplies MCP with raw materials at no cost. MCP has unlimited access to raw materials (MSW) and does not compete with any other company for the waste input (Figure 119). The compost is sold directly to farmers through NAADS at USD 0.04/kg. MCP's compost competes with chemical fertilizers and other organic fertilizers in the market. MCP has only been in existence for a few years however, the compost produced is gradually gaining popularity in the Mbale municipality. An average of 60 tons of compost is sold on a monthly basis. Currently, MCP captures a very small share of both the organic and chemical fertilizer market, but planned product innovation and new marketing strategies can significantly increase this proportion. Plastics and metal scraps obtained during sorting are managed solely by workers and sold to recycling companies to earn them additional income. Carbon credit sales, anticipated to be the main source of income, has not yet been realized and is still under documentation for application.

### Institutional environment

According to a 2011 WaterAid report on solid waste management in Uganda, there is no single document of a legally binding nature, either national or regional, that provides comprehensive solid waste management in Uganda. The Public Health Act Cap.281, 2000, Solid Waste Management Strategy (SWMS) December 2002 as revised in 2006, Local Governments Act (1997) revised in 2004, The Constitution of Uganda 1995 (amended 2005) and The National Environment (Waste Management) Regulations, S.I. No 52/1999 provides some coverage for solid waste management in Uganda. Enforcement of regulations have been challenged with weak punitive measures. The ordinance

FIGURE 119. MCP'S VALUE CHAIN



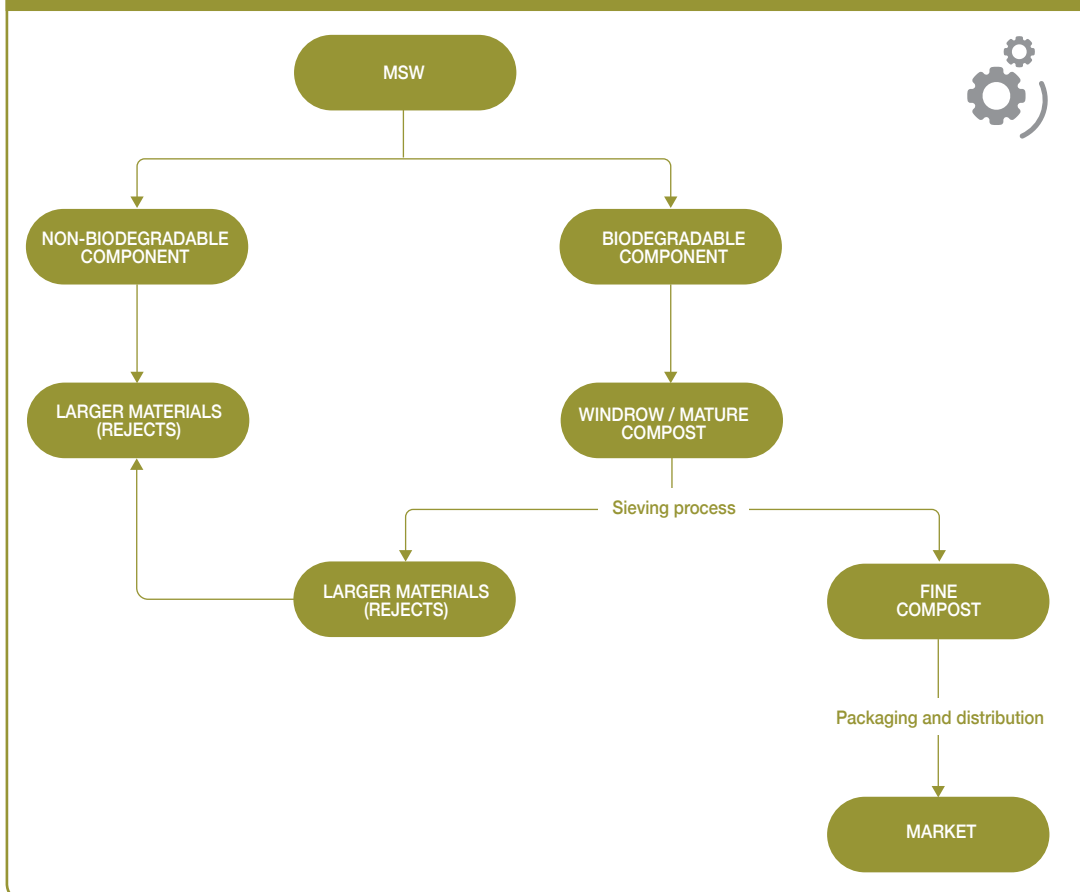
proposes a fee for solid waste generator, however it does not provide a mechanism for collection of these fees, and specifically for Kampala city. Additionally, there were so far no laws or legislations that limit the conversion of human excreta into value-added products or its use. However any organic fertilizer product is to be proven safe and must meet certain minimum nutrient levels – as proven from a product certification from the Uganda National Bureau of Standards. While representative of additional costs to waste-based nutrient recovery enterprises such as MCP, certification of their products represents an avenue for product branding and increased market share.

### Technology and processes

The production site is composed of an aerobic composting yard made of concrete flooring and a series of sloping double pitched roofs. The dimensions of the yard are 3,405 m<sup>2</sup> with surrounding drains and it is fully fenced. Municipal solid waste from the urban areas are collected and taken to

the composting plant for segregation. At the plant, the waste is sorted according to biodegradable and non-degradable waste. A windrow composting technique is used for the conversion of MSW to compost (Figure 120). The biodegradable waste is aligned in the first windrow (active stage) where decomposition initially takes place after it is moisturized with recycled leachate and water in order to increase its moisture content. A locally manufactured sieving drum is used to manually separate larger particle material from the fine compost. This is a laborious and inefficient component of the production process. The low level of machinery coupled with high volumes of incoming waste make it difficult to completely compost all the biodegradables. The rejects from the sieving process is landfilled instead of being re-composted. Windrows are designed to have a gentle slope which allows leachate to flow by gravity to the leachate tank. The windrow piles are arranged in order of decreasing size from active to maturation stages because the size of compost is expected to decrease with time. Due to constraints in resources, the intended design of transferring compost from one windrow pile to another is not followed, but instead, it is left in one windrow pile from active to the matured stage. The total time for maturation before sieving is eight weeks, but due to characteristics of the waste, like the presence of fibres, it can take as much as twelve weeks for it to be ready for sieving. Sieving of the mature waste is done manually using slanted sieving drums to allow the compost to go through as the rejects (size bigger than the mesh size) go over to a separate area when rotated. The rejects are then landfilled and the compost is sold to farmers.

FIGURE 120. PROCESS DIAGRAM FOR MCP'S WINDROW COMPOSTING



### Funding and financial outlook

The government of Uganda through the municipal council contributed land (which was formally used as a landfill) to the project. It also contributed USD 40,000, which was used to improve infrastructure (e.g. open up roads) and fence the plant area. These funds were from internally generated local revenue by Mbale Municipal Council. Infrastructure including machinery and equipment was funded by the World Bank with a grant of USD 300,000. The municipal council spends USD 13,400 annually on fuel and machine costs. In June 2011, the World Bank contributed a one-time grant of USD 4,800 to help boost the operational performance of the project. It is anticipated that MCP will be able to recover the investment cost in eight years when carbon credit claims are made in addition to the sales of compost. MCP then will have two main sources of income – sale of carbon credits and sale of compost. A kilogram of compost is sold at USD 0.04 as set by the government of Uganda, averaging related revenue of USD 2,000. Although at the time of the study not breaking even, with annual expected earnings of USD 25,000 to 30,000 from carbon credits, MCP expects to not only recover its costs but make some profits.

### Socio-economic, health and environmental impact

MCP's activities have accrued significant benefits to society. Its main activity of converting MSW to compost has reduced the quantity of landfilled waste and will result in the reduction of greenhouse gas emissions. Its activities will also reduce waste management costs associated with land acquisition for landfills and their management. Improved sanitation will result in reduced human exposure to untreated waste and associated costs. Improved soil fertility and agricultural productivity from the use of organic fertilizer has noteworthy implications for smallholder farmer livelihoods and food security. Increased crop yields imply increased incomes for farmers and better livelihoods.

### Scalability and replicability considerations

The key drivers for the success of this case are:

- Provision of start-up capital by government;
- Funding support from the World Bank and the government to ensure long term revenue flow from carbon credit;
- Incentives to workers for segregating municipal solid waste by allowing them to sell the recyclable waste to recycling companies and earn additional income;
- Weak national chemical fertilizer market and limited access to external chemical fertilizer markets provide ample opportunity for organic fertilizer production business.

The project currently does not break even and cannot achieve this only from sale of compost without process innovation. The manual nature of the activities, e.g. sorting and sieving, results in a high level of inefficiency and limits scaling up of the enterprise. Whilst there are opportunities for scaling-up and out of the project through mechanization of its production system and exploration of new product markets, continued high dependence on external support may still render the initiative unsustainable. It is also imperative that the suitability of technologies to different contexts and product requirements by different markets be taken into consideration.

### Summary assessment – SWOT analysis

The SWOT analysis for MCP is presented in Figure 121 below. The key strength of the business is the initial financial support from the government at the start-up phase and funding from the World Bank to apply for CDM process to ensure a stable revenue source. The plant also has good access roads to the site, making the transportation of waste and compost easier. The key weaknesses of the enterprise are related to the highly labor-intensive operations required for waste segregation and its high dependence on external funding. So far, the enterprise hardly generates any revenue from



FIGURE 121. SWOT ANALYSIS FOR MCP'S BUSINESS

	<b>HELPFUL</b> TO ACHIEVING THE OBJECTIVES	<b>HARMFUL</b> TO ACHIEVING THE OBJECTIVES
<b>INTERNAL ORIGIN</b> ATTRIBUTES OF THE ENTERPRISE	<b>STRENGTHS</b> <ul style="list-style-type: none"> <li>▪ Continuous availability of raw materials (waste)</li> <li>▪ Financial support from government and World Bank</li> <li>▪ Low sales price of compost</li> <li>▪ Low cost of technology</li> <li>▪ Good access roads to the site</li> <li>▪ Sales of CDM enabled in near future</li> </ul>	<b>WEAKNESSES</b> <ul style="list-style-type: none"> <li>▪ Manual operations resulting in high level of inefficiency and high cost</li> <li>▪ Potentially high occupational health risks from waste segregation process if use of protective gear is not enforced – implications for production costs</li> <li>▪ Poor marketing strategy</li> <li>▪ Highly dependent on external support</li> <li>▪ Inadequate composting facilities</li> </ul>
<b>EXTERNAL ORIGIN</b> ATTRIBUTES OF THE ENVIRONMENT	<b>OPPORTUNITIES</b> <ul style="list-style-type: none"> <li>▪ Mechanization of production process and increasing scale of operations</li> <li>▪ Sorting of waste at source</li> <li>▪ Waste collection fees</li> <li>▪ Increase in the scope of product market</li> <li>▪ Value addition to compost to increase market share and prices</li> <li>▪ Weak national chemical fertilizer market and limited access to external chemical fertilizer markets provide ample opportunity for organic fertilizer production business</li> </ul>	<b>THREATS</b> <ul style="list-style-type: none"> <li>▪ Subsidized chemical fertilizer</li> <li>▪ Increasing labor prices may affect production costs</li> </ul>

the sale of compost. This, however, offers an opportunity for it to rebrand its compost product and also add value via fortification and pelletization to command higher market prices and increase its sales revenue. Subsequently, the enterprise could mechanize its operations and increase its scale of operations. The primary threat for the business is subsidized chemical fertilizers and increase in labor prices.

### Contributors

Krishna Rao, IWMI, Sri Lanka

Jasper Buijs, Sustainnovate, Netherlands; formerly IWMI, Sri Lanka

Josiane Nikiema, IWMI, Ghana

### References and further readings

Mbale Municipal Compost plant monthly and annual operational and manual reports.

Personal Comm. with Dr. John Bosco Tumuhairwe, the National Consultant for NEMA on Compost Quality.

Personal Comm. with the Mbale Municipal Compost Plant manager, Mbale Municipality Environment Officer, Data Clerk at MCN and Project Officer, CDM projects at NEMA.

Wateraid. 2011. Solid Waste Management Study in Bwaise II Parish, Kawempe Division, 2011. <http://www.wateraid.org/~media/Publications/Solid-waste-management-study-in-Kawempe-Uganda.pdf> (accessed November 8, 2017).

Yamano, T. and Arai, A. 2010. Fertilizer Policies, Price, and Application in East Africa. GRIPS Discussion Papers 10–24. National Graduate Institute for Policy Studies, Tokyo.

*Case descriptions are based on primary and secondary data provided by case operators, insiders, or other stakeholders, and reflect our best knowledge at the time of the assessments 2015/16. As business operations are dynamic, data can be subject to change.*