

CASE

Partnership-driven municipal solid waste composting at scale (KCDC, India)

Miriam Otoo, Sampath N. Kumar, Pushkar S. Vishwanath and Lesley Hope



Supporting case for Business Model 12

Location:	Bangalore, Karnataka, India
Waste input type:	Municipal solid waste
Value offer:	Provision of waste management services and high quality compost for agricultural purposes; provision of consultancy services for waste management
Organization type:	Public entity (government-owned corporation)
Status of organization:	Operational since 1975
Scale of businesses:	Processes 300 tons of municipal solid waste per day
Major partners:	Bruhat Bengaluru Mahanagara Palike (BBMP), Karnataka Agro Industries Corporation (KAIC), Karnataka State Co-operative Marketing Federation (KSCMF)

Executive summary

Karnataka Compost Development Corporation Limited (KCDC) is one of the oldest public entities involved in the production of compost from municipal solid waste (MSW) for agricultural purposes in India. The business of compost production provides significant value to KCDC by offering viable options for cost recovery and ensuring sustainable sanitation services provision. KCDC has been particularly successful by using an innovative business partnership model. Its strategic partnerships with other local government entities and private enterprises have allowed it to optimize the allocation of resources and activities reduce risk associated with high capital investments and establish an assured market for their product. Another important success driver has been KCDC's ability to mold its business to local context elements. The use of a simple and labor-intensive technology not only gives KCDC a competitive advantage for production, but also generates employment particularly for low-income persons who would otherwise be unemployed. An additional socio-economic benefit from KCDC's businesses the reduction in chemical fertilizer imports from increased usage of organic compost. This in turn has significant ecological benefits, reducing residual chemical pollutants in soils and water bodies.

KEY PERFORMANCE INDICATORS (AS OF 2014)

Land use:	6 ha					
Capital investments ¹ :	USD 910,000					
Labor:	40 (13 skilled, 20 unskilled, 7 administrative)					
O&M cost:	USD 12,400/ day					
Output:	10,000–16,000 tons of compost per year					
Potential social and/or environmental impact:	40 direct jobs created with worker earnings higher than minimum wage; increased crop yield and reduced costs of fertilizer use, reduced waste management costs, reduced human exposure to untreated waste					
Financial viability indicators: ²	Payback period:	7 years	Post-tax IRR:	N.A.	Gross margin:	N.A.

Context and background

Karnataka Compost Development Corporation Limited (KCDC) is a 39-year-old company based in Bangalore engaged in the business of hygienic disposal of solid wastes generated in Bangalore city through composting. The city of Bangalore, the capital of Karnataka, has a population of about 8,000,000 and generates about 3,500 to 5,000 tons of solid waste per day. With an ever-increasing urban population and limited waste management budgets, the local government invested in several integrated resource recovery facilities with the dual purpose of cost recovery and rehabilitating agricultural lands. Bangalore has a number of waste processing facilities at various locations, which are of larger processing capacity ranging from 200–1400 tons per day but KCDC remains one of the few still functioning. KCDC was incorporated in the year 1975 with an equity capital of USD 84,690³ (in 2014 currency value) as equity infusion. The company started by setting up a composting plant using international technology along with 11 other similar plants across the country. The highly mechanized technology proposed was not sustainable for the Indian context and all the plants of similar technology closed down by 1980. KCDC was the only one who continued operations by doing incremental changes to its technology and by early 1990 transitioned completely to the use of an indigenized technology. Given its success, in 2000, KCDC received a subsidy of USD 34,000 from the Government of India to set-up a bio-fertilizer plant. KCDC is a state government entity with equity participation from Karnataka Agro Industries Corporation (KAIC), Bruhat Bengaluru Mahanagara Palike (BBMP) and Karnataka State Cooperative Marketing Federation (KSCMF). The principal shareholder is KAIC, which falls under the agricultural department of the Government of Karnataka. BBMP is the urban local body of Bangalore city and is responsible for municipal waste management in the city. The role of BBMP is to supply municipal solid waste to KCDC. Originally, the role of KSCMF was envisaged to support KCDC with marketing, however overtime KCDC has established its own marketing strategies for its products. KCDC is possibly the only government owned and longest operating municipal waste processing company in India. The waste processing facility of KCDC is located at Haralakunte, near Singsandra, about 13 km from the centre of Bangalore.

Market environment

Sanitization of waste is seen traditionally as a public sector obligation and consumes a large percentage of municipal budgets. A key challenge is managing the daily generation of millions of cubic meters of solid and liquid waste. The potential combinations of domestic, commercial and/or industrial waste streams are primarily viewed as a threat on which the public sector must spend resources to sanitize. Appropriate sanitation services to safeguard public health are however as expensive as they are crucial for exploding cities, consuming most of the municipal budget. Additionally, increasing chemical fertilizer prices, continuous degradation of agricultural soils from over-application of chemical fertilizer and subsequent reductions in crop yields have caused the government of India to shift to a

soil nutrient based fertilizer plan and promoting organic agriculture. KCDC thus took advantage of the government's push for organic agriculture to convert readily available MSW into organic fertilizer for use in the agricultural sector. The size of the organic fertilizer market although fairly large and growing, is comprised of 90% of animal-manure based fertilizer producers. Of the remaining 10% that is non-animal manure-based; the majority of businesses is small-sized and found in the informal sector. These businesses generate demand for their product based on field demonstration, personal relationships and reputation. There have been many products that have been promoted and have not been found useful on the ground. The market acceptability especially for organic compost is based on proof by demonstration and product branding. The compost produced by KCDC competes with the numerous organic fertilizer products produced by private manufacturers as well as imported chemical fertilizers. KCDC, however, has a competitive advantage, as its product is priced lower than the average market price and is able to do this partly due subsidy receipts from the government.

Macro-economic environment

Significant increase in MSW generation in the last decades due to rapid urbanization and high population growth rate has put the identification of sustainable waste management systems at the forefront of local government issues. Around 90% of generated waste in Bangalore is currently landfilled, requiring around 1,200 hectares of land every year. The ever-increasing cost of waste management has limited public investment in other economic sectors. Additionally, chemical and synthetic fertilizers are highly subsidized in India, and this has not only led to inefficient use by farmers and high costs to the government; significant soil degradation has also been observed as a result. To curb public spending on waste management services and chemical fertilizer subsidies, the Indian government has implemented a number of schemes that support the reuse of waste. With a growing need to increase the availability and quality of bio-fertilizers and composts in the country to improve agricultural productivity while maintaining soil health and environmental safety, India has set up a scheme to augment the infrastructure for production of quality organic and biological inputs.

Accordingly, under the National Project on Organic Farming a capital investment subsidy scheme provides credit linked and back-ended capital investment subsidy equivalent to 33% of total financial outlay subject to the maximum of Rs. 60 lakh⁴ per unit and 25% of total financial outlay subject to a maximum of Rs. 40 lakh per unit for commercial production units for organic and biological agricultural inputs has been introduced (see Case A2Z Infrastructure Limited in Chapter 9).

Business model

KCDC is a state government corporation that converts municipal solid waste into organic fertilizer for agricultural purposes. It also provides consultancy services (expertise on technology) to other waste processing companies. It partners with Karnataka Agro Industries Corporation (KAIC), Bruhat Bengaluru Mahanagara Palike (BBMP) and Karnataka State Co-operative Marketing Federation (KSCMF). All the partners contributed to the initial capital investment and are current shareholders in the company. The partnership with BBMP gives it access to municipal solid waste. Although the originally envisaged role of KSCMF was to support KCDC in marketing, overtime KCDC established its own marketing brand and has been successful in increasing its share of the organic fertilizer market. Essential aspects of KCDC's model are its marketing strategy and technology use. The major compost products are marketed through government institutions, dealers' network, KAIC retail outlets and direct selling to consumers. KCDC uses these intermediaries to sell its products to rural and urban farmers, plantation owners, nurseries, floriculturists, landlords and urban households. KCDC captures the large rural market through the well-organized distribution channels of government institutions with which farmers are familiar. The use of dealer networks has widened their market coverage, allowing them to capture most of the Karnataka state and some parts of the Tamil Nadu and Kerala market. KCDC sells

to the marginal farmers through the state's agricultural department with a 50 per cent subsidy, under a scheme to promote organic farming. In addition, KCDC gives a discount on metric ton basis to private buyers. The promotion and marketing strategies adopted by KCDC have doubled its sales in the past one year. Another key sustainability factor of KCDC is its technology, which is simple, indigenous and has low-energy and investment requirements. KCDC has mastered the technology of aerobic windrow composting and vermicomposting and its expertise has been recognized by many municipalities who are now seeking their technical and managerial advice; for which KCDC now generates revenue from their consultancy services. See Figure 149 for diagrammatic representation of the business model for KCDC.

Value chain and position

Figure 150 opposite presents KCDC's compost value chain and position. KCDC was built with equity from three government entities: BBMP, KAIC and KSCMF to promote sustainable waste management and agricultural production practices. The City of Bangalore generates about 3,500 tons of solid waste per day. The capacity of existing facilities is insufficient to process all of the city's quantity of waste and is currently overloaded. KCDC has a contract with BBMP for the supply of 600 tons of MSW each day of which only 50% is being processed. Even with the entry of new organic fertilizer businesses in the market, there is adequate availability of waste for KCDC's operation and even for future scaling-up of operations. KCDC produces two types of compost, namely: (a) regular compost marketed as BIO AGRO; and (b) enriched compost marketed as BIO AGRO RICH (which is enriched with micro nutrients). KCDC's customers are mainly directorates of agriculture, horticulture and sericulture, estate plantations, smallholder farmers and households. As partners, KAIC and KSCMF are responsible for establishing a solid marketing and distribution network for the products. KCDC sells their products through dealer networks, KAIC retail outlets and the existing distribution channels of Karnataka state departments of agriculture. The compost is sold to marginal farmers with a 50 per cent subsidy under a scheme to promote organic farming. Pricing is based on cost of production and a profit mark-up. BIO AGRO is sold at Rs. 1,000/ton in loose form and Rs. 1,550/ton if bagged. BIOAGRO RICH is sold at Rs. 1,500/ton in loose form and Rs. 1,850/ton if bagged. All pricing includes transportation up to 100 kilometres and free loading charges. An additional government subsidy of Rs. 30/ton is provided if the user segment is farmers.

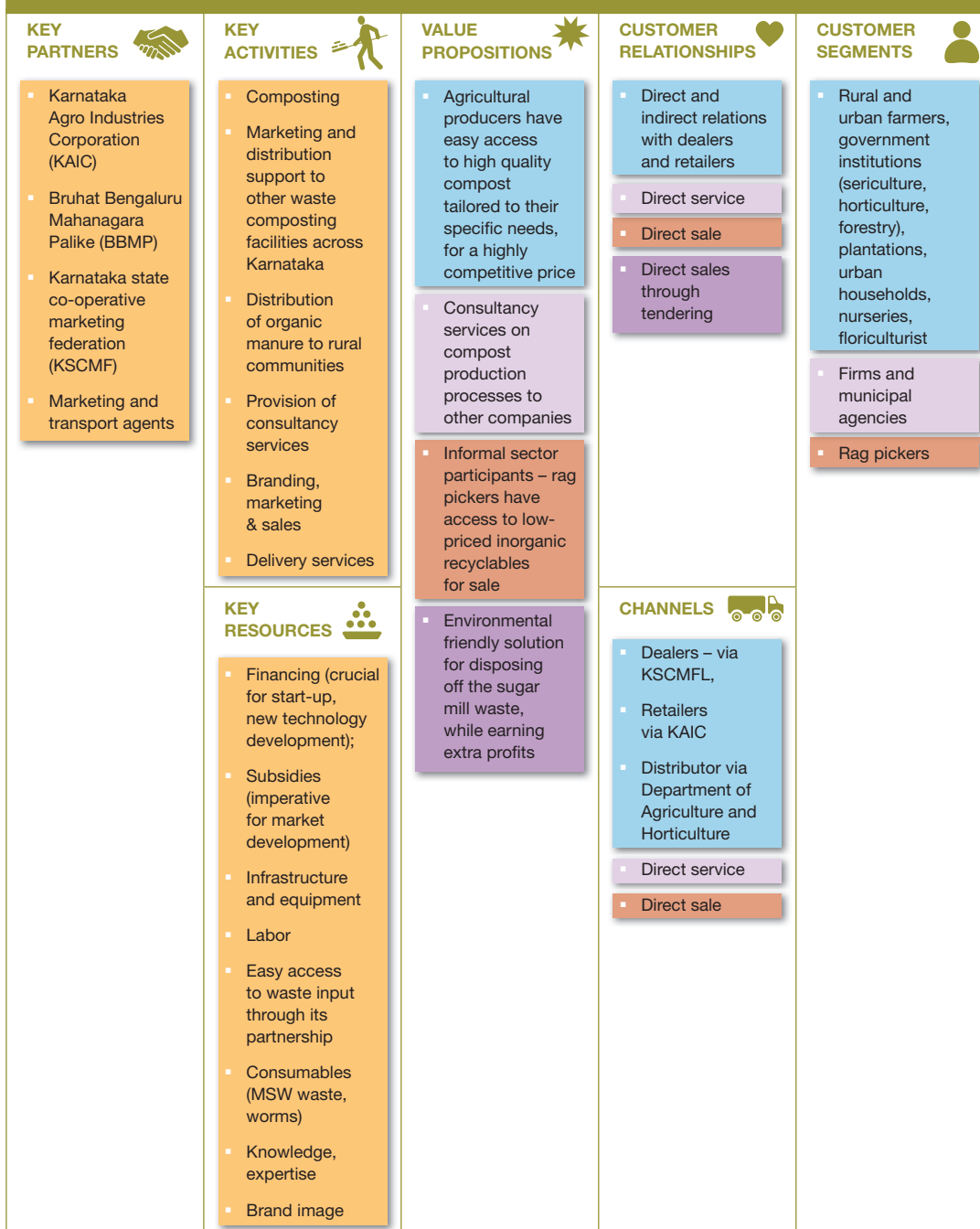
Chemical and other organic fertilizers found on the market are good substitutes for KCDC's BIO AGRO and BIO AGRO RICH. Terra Firma Biotechnologies Limited is a major competitor in the market and produces a variety of equally high quality compost products tailored to different customer segments. Additionally, Terra Firma implements a door-to-door sales strategy (direct sales) for urban households and uses HOPCOMS outlets to reach larger scale agricultural producers which have worked well to increase its market share. Terra Firma's products are however perceived to be an up-market product as they are not cost-effective for marginal farmers. Terra Firma thus has had to focus on the household and large-scale farmer segments. With government subsidies, KCDC's products are the most cost-effective product on the market given its quality (high nutrient levels and compliance with safety standards). KCDC seems to be the market leader compared to the main competitor, Terra Firma, mainly due to its long-standing existence; however, if government support and subsidies are withdrawn, the survival of the product is doubtful.





Institutional environment

There are no legal or regulatory policies that limit the processing of MSW to organic fertilizer products. The key regulation is that waste reuse businesses assure the safety of all actors involved in the business operations and the quality of the product as outlined in the Municipal Solid Waste (Management and Handling) Rules, 2000. In terms of production, there is a statutory guideline – the Fertilizer Control

Order (FCO) instituted by the Ministry of Agriculture and Rural Development for the production and distribution of all fertilizers including organic fertilizer. Product quality recommendations are provided for different organic fertilizer types for which producers have to adhere to. This is particularly beneficial

FIGURE 149. KCDC'S BUSINESS MODEL CANVAS



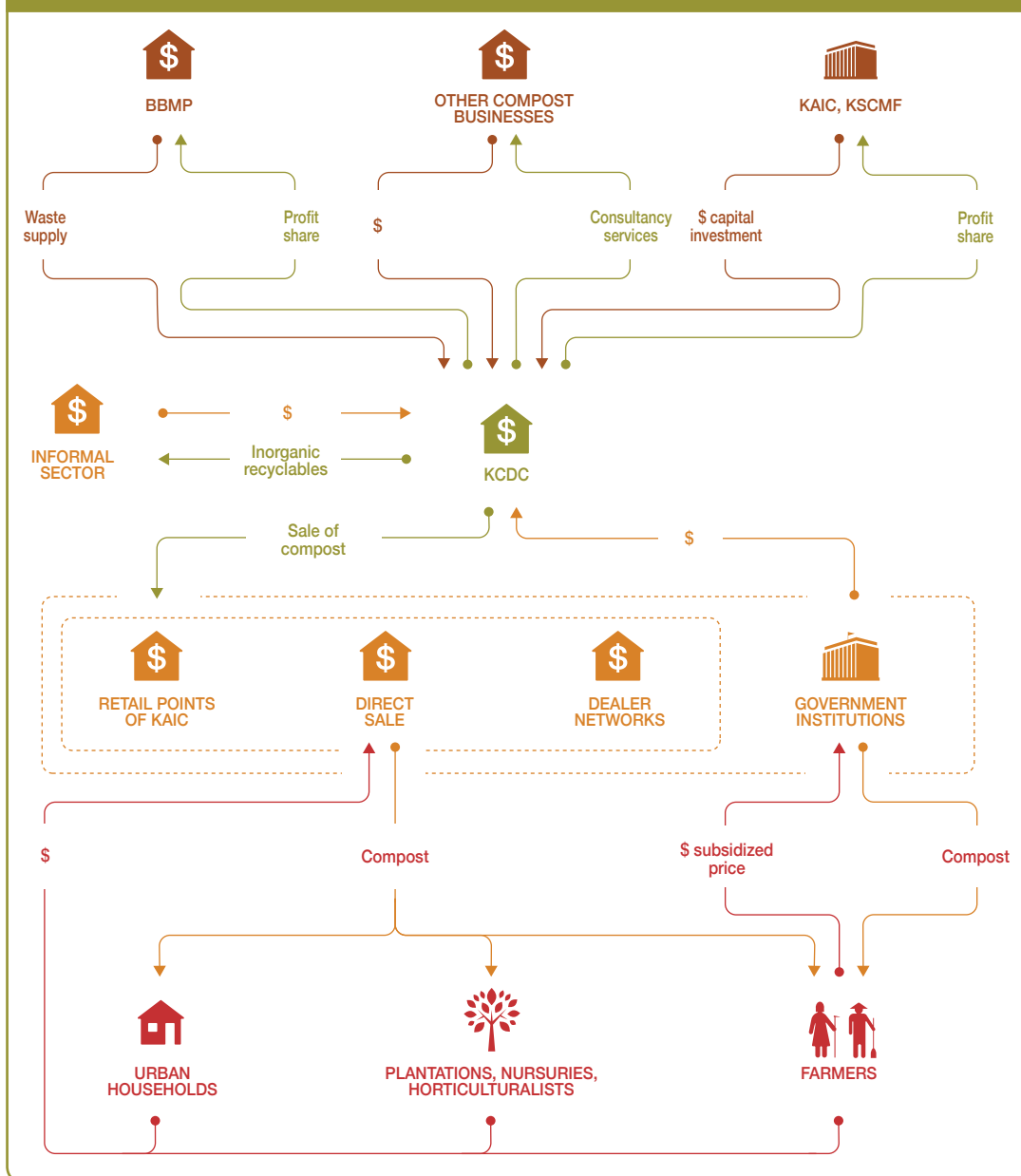
<p>COST STRUCTURE </p> <ul style="list-style-type: none"> ▪ Investment cost ▪ Annual operating cost ▪ Transportation and loading of products sold ▪ Profit share to BBMP, KAIC, KSCMF 	<p>REVENUE STREAMS </p> <ul style="list-style-type: none"> ▪ Revenue from sale of 3 varieties of organic fertilizer ▪ Consulting revenues ▪ Sales from inorganic products (metal scrap), lease rental, tender forms fees
<p>SOCIAL & ENVIRONMENTAL COSTS </p> <ul style="list-style-type: none"> ▪ Decreased land and property value where compost plant is sited ▪ Possible human health risk while handling MSW ▪ No clear disposal mechanism for leachate from composting process 	<p>SOCIAL & ENVIRONMENTAL BENEFITS </p> <ul style="list-style-type: none"> ▪ Reduced waste disposal and contamination of water bodies ▪ Reduced existing waste management costs (Bangalore municipal corp. provides tipping fee to the various waste management contractors. KCDC does not charge a tipping fee there by reducing the waste management cost) ▪ Reduced human exposure to untreated MSW ▪ Reduced human exposure to chemical pollutants in farming and reduced leaching of fertilizer into water bodies ▪ Contribution to agricultural sector via enhancing soil fertility and productivity ▪ Reduced GHG emissions ▪ Employment generation

to farmers as they get what they are paying for, but also for compost businesses as they are able to build their product brand.

Technology and processes

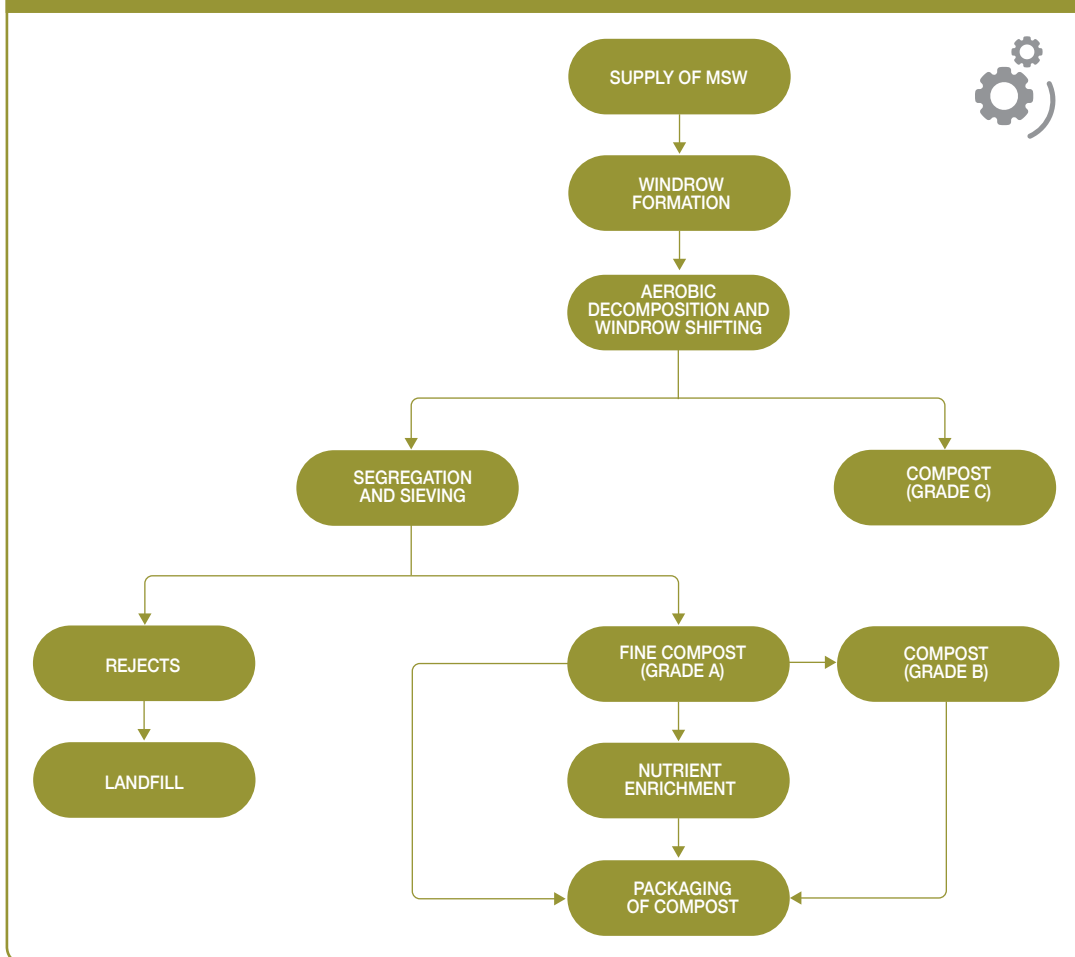
KCDC had initially adopted the mechanical composting process that was developed essentially for western nations but after much experimentation, it adopted a simple, economical and rapid aerobic decomposition method which essentially consists of the rapid decomposition of organic materials in the presence of oxygen (Figure 151). KCDC's technology is found to be cost effective and simple. It implements two types of composting technologies: a) aerobic windrow composting; and b) vermin-composting. The aerobic windrow composting method can handle large quantities of waste as it is mostly mechanized in operation. The vermin-composting operation, on the other hand, has significant manual input requirement and is suitable for the processing of smaller quantities of organic waste. The quality of the compost and the associated price for vermin-compost is higher than that for aerobic windrow composting. The company produces both composts to meet customers demand and specification. KCDC does not conduct a detailed analysis of incoming waste. Visual assessment is done and unsuitable waste is not accepted. For the aerobic decomposition windrow method, the garbage received is arranged in windrows before segregation on the concrete platform. An inoculant is sprayed on the waste to speed up decomposition and reduce odors. The windrow is turned with augers and front end loaders once every seven days to ensure proper aeration and the aeration process continues uninterrupted. Water is sprayed as and when required depending on the moisture content of the mixture. The decomposition process is completed over a period of six to eight weeks. The decomposed mixture which has undergone sanitization and stabilization is taken up for processing by way of screening with different sized sieves. KCDC produces different intermediary and

FIGURE 150. KARNATAKA COMPOSTING DEVELOPMENT CORPORATION COMPOST VALUE CHAIN



compost products: BIOAGRO, BIOAGRO RICH, B Grade and C Grade. B Grade is the decomposed matter after 25mm sieving and C Grade is decomposed matter without sieving (which is rarely sold). BIO-AGRO is the pure form of screened compost (particle size $\leq 4\text{mm}$) without any additives, whereas BIOAGRO RICH is enriched with micro nutrients such as Neem, Gypsum, Cow dung, Rock Phosphate and Poultry Litter. The final product is a safe (free from harmful pathogens) and high nutrient product.

FIGURE 151. COMPOSTING PROCESS DIAGRAM FOR KCDC



Funding and financial outlook

KCDC was set up in 1975 with capital infusion in the amount of Rs. 5 million from KAIC (51%), BBMP (24.5%) and KSCMF (24.5%). These entities are government bodies and have invested in KCDC to promote effective waste handling and supporting usage of organic compost in agriculture. In 2000, KCDC received a grant subsidy of Rs. 2 million from the Government of India to further expand its activities to set up a bio-fertilizer plant. KCDC generates revenue by sale of compost and consultancies. Bangalore City Corporation does not pay any tipping fees to KCDC for processing the city's waste. KCDC manages its operations and maintenance on its own funds. The quantity of waste processed and sales have doubled in the last year. The quantity of sales was around 8,000 tons per year for last few years but has doubled up to about 15,000 tons from 2012 onwards. KCDC had revenues of about Rs. 51 million and an expenditure of Rs. 54 million. KCDC has been incurring losses from 2009–2012 due to the company having to adopt an aggressive pricing strategy to increase the quantity of compost sold. The quantity of compost sold has been significantly growing, doubling between 2010–2011 to 2011–2012 and with a similar trend in 2012–2013 (Table 38). The company reduced its losses in 2013 from Rs. 4.3 million to 0.6 million by increasing the quantity of processing and sales, and thereafter averaging annual profits of Rs. 1–3 million.

TABLE 38. FINANCIAL DATA FOR KCDC FROM 2009–2012

ITEMS	2009–10	2010–11	2011–12
Quantity of compost sold (in metric tons)	8,760	8,060	15,333
Total revenue (in millions of Rs.)	20.4	15.9	51.6
Total expenditure (in millions of Rs.)	19.1	20.4	54.5
Operating Profits (in millions of Rs.)	1.3	(4.4)	(2.9)
Profit after tax/(Losses)	(1.38)	(4.3)	(0.67)

Socio-economic, health and environmental impact

KCDC provides direct employment to about 40 personnel and indirectly about 60 personnel involved in the transportation and distribution of organic compost. In addition, KCDC is helping address the city's waste management problems and creating value out of the waste which was environmentally hazardous. KCDC started running as a profitable firm with average annual profits of Rs. 1–3 million and pays taxes for the consultancy services it renders to other waste reuse businesses. KCDC activities strongly support sustainable agriculture and provide advisory support to new companies and municipalities involved in waste reuse. The products of KCDC have been influential in adding value to farmers by enriching their farmland via increased microbial activity from compost use. The use of compost has also resulted in increase in crop yields. Table 39 below provides details about the economic value of organic compost considering requirement for banana crop. Typically by using organic compost, a farmer gains an economic advantage of about Rs. 6,600 per every hectare of crop. KCDC by serving about 20,000 customers per year by selling about 15,000 tons of organic compost in 2011–2012 added a total economic value of about Rs. 105 million to its consumers. The usage of organic compost in place of chemical fertilizers has also helped the country's economy by reducing imports through chemical fertilizers.

Scalability and replicability considerations

The key drivers for the success of this business are:

- Increasing need for alternative sustainable agricultural production inputs and waste management services.
- Strong business partnerships that reduced capital investment risk and eased entry into a highly competitive fertilizer market.
- Strong commitment of state government in providing an enabling environment for marketing and distribution of the compost products.
- Policy initiatives to phase-out chemical fertilizer subsidies and capital investment subsidies for new and existing compost businesses (government schemes to augment the infrastructure for the production of quality organic and biological inputs).

TABLE 39. ECONOMIC VALUE OF COMPOST USE FOR BANANA PRODUCTION

PARTICULARS	COST IF ORGANIC COMPOST IS NOT USED	COST WHEN ORGANIC COMPOST IS USED
Quantity of fertilizer required per Ha	2 tons of chemical fertilizer	1 ton of chemical fertilizer + 2 tons of organic compost
Cost of fertilizer per hectare	Rs. 40,000	Rs. 20,000+ Rs. 6,800
Total cost of fertilizer	Rs. 40,000	Rs. 26,800
Economic benefit per hectare	–	Rs. 13,200
Economic benefit per ton of compost	–	Rs. 6,600

The KCDC model has high replication potential especially for developing countries in need of sustainable waste management approaches and environmentally-safe agricultural input alternatives. The scale of KCDC's business model is applicable to cities with population size of 1.5 million or above. Strategic partnerships and governmental support are essential at both the start-up and business development phase to mitigate capital investment risk and gain access into new markets. With chemical fertilizer companies typically owning the greatest share of the market, governmental support via price subsidies, for example, will be important to ease the entry of new compost businesses into the fertilizer market. The adopted technology is semi-mechanized and offers opportunity to use unskilled and informal labor an abundant resource in developing countries. The use of a labor-intensive and inexpensive technology also implies that the business will not require large capital investment which mitigates one of the major constraints for business start-ups especially in developing countries.

Summary assessment – SWOT analysis

Figure 152 presents the SWOT analysis for KCDC. KCDC has been particularly successful in leveraging its business partnerships to mitigate capital investment risk and gain entry into a fiercely competitive fertilizer market. Increasing governmental support along with growing demand for organic fertilizers will represent key opportunities for replication and up-scaling of the business. KCDC implements a

FIGURE 152. SWOT ANALYSIS FOR KCDC

	HELPFUL TO ACHIEVING THE OBJECTIVES	HARMFUL TO ACHIEVING THE OBJECTIVES
INTERNAL ORIGIN ATTRIBUTES OF THE ENTERPRISE	STRENGTHS <ul style="list-style-type: none"> ▪ Abundant and easy access to raw materials ▪ Low capital investment requirements ▪ Cost effective technology ▪ Strategic partnerships for accruing capital investments and establishing strong distribution channels, as well as enabling competitive pricing ▪ Aggressive pricing strategy ▪ Business longevity ▪ Strong brand image ▪ Extensive experience in design and operation of composting plants 	WEAKNESSES <ul style="list-style-type: none"> ▪ No tipping fees for MSW ▪ Viability of business dependent on price subsidies ▪ High transportation costs given centralized operations
EXTERNAL ORIGIN ATTRIBUTES OF THE ENVIRONMENT	OPPORTUNITIES <ul style="list-style-type: none"> ▪ Expanding to other markets – a market of about 100,000 tons of compost is achievable. ▪ Availability of financing organizations and support ▪ Government support ▪ Proactive policies and acts of government, especially toward organic agriculture 	THREATS <ul style="list-style-type: none"> ▪ Competition from substitute products ▪ High seasonality of demand for compost may increase investment cost for storage facilities

segmented pricing approach where it charges peri-urban and rural farmers less than its other clients. Its pricing strategy is however dependent on price subsidies provided by the government and its removal may expose KCDC to fierce competition in the fertilizer market, in which case it would have to rebrand its product to maintain its market share. KCDC is exploring the development of a high nutrient granulated compost. This new product retains its nutrient value over a period from production to actual use that can sometimes be between three to six months. Additionally, granulation would provide stability through transportation of the product. The use of a simple technology has also been essential to KCDC's success – taking advantage of cheap and abundant labor. However, with one of the most expensive operational components of the composting business being transportation, KCDC will need to explore a decentralized production unit approach and sourcing operation to reduce its transportation costs. KCDC is an example of an innovative business utilizing a simple partnership approach to address some of the major waste management and environmental challenges in Bangalore, India.

Contributors

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

Alexandra Evans, Independent Consultant, London, United Kingdom

Michael Kropac, CEWAS, Switzerland

References and further readings

Personal communication with plant managers. 2014.

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 2014/15. As business operations are dynamic data can be subject to change.

Notes

- 1 Based on estimates derived by authors from secondary data on the scale of operation and data provided by the business given that KCDC was incorporated (i.e. legally established) in 1975 and accurate details are unavailable.
- 2 Calculations were based on the assumption that if a new project were to be set up today to handle 600 tons per day of compost, the estimated project cost would be about Rs. 350 million. Based on some of the projections done by the company, the payback period would be in the range of about seven years.
- 3 Exchange rate: INR (Rs.)1 = USD 0.02
- 4 1 lakh = 100,000; Rs. 60 lakh were in 2004–2012 about USD 120,000 and about USD 90,000 in May 2017.