

CASE

Agricultural waste to high quality compost (DuduTech, Kenya)

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Supporting case for Business Model 13

Location:	Naivasha, Kenya
Waste input type:	Vegetative waste, livestock waste
Value offer:	Vermicompost
Organization type:	Private
Status of organization:	Operational since 2005
Scale of businesses:	Processes 125 tons of waste per month
Major partners:	Finlays Kenya Limited, Local livestock farmers

Executive summary

DuduTech is an autonomous division within the parent company Finlays Kenya Limited, producing and selling biological control organisms for Integrated Pest Management (IPM), together with the production and sales of vermicompost. Finlays – a wholly owned subsidiary of the Swire Group – is engaged in the production and processing of tea and horticultural products. With increasing scales of production, Finlays needed to identify sustainable treatment and disposal alternatives for their vegetative waste and dependence on synthetic pesticides – thus their motivation for the establishment of DuduTech. DuduTech's business model – onsite nutrient recovery – is hinged on the concept of the processing of a business' 'own' waste to organic fertilizer to reduce waste disposal costs, generate revenue via portfolio diversification and mitigate risk associated with fluctuations in compost while ensuring the sustainability of the larger business entity on a whole. Key success drivers for DuduTech's model are: a) portfolio diversification through the sale of biological control organisms and vermicompost; and b) market segmentation – sale of compost at USD 0.4/ton to Finlays (mother company) and USD 0.74/ton to other clients. Strategic partnerships have also contributed to DuduTech's sustainability. Animal manure is purchased on a contractual basis from local livestock producers for a fee as a corporate social responsibility gesture. Windrow and vermicomposting technology is used to process the livestock waste and vegetative waste from Finlay into a vermicompost – Vermitech. The use of a simple and labor-intensive technology not only gives DuduTech a competitive advantage for production, but also generates employment particularly for low-income persons who would otherwise be unemployed. The purchase of feedstock from local livestock farmers represents an added income-generation stream and implicit improvement of their livelihoods. DuduTech's activities have contributed to a reduction in water and soil pollution from reduced nitrate release attributed to chemical fertilizer use. DuduTech's long-term goals remain: a) to achieve good practices in sustainable and safe agriculture; b) to improve and sustain soil health; c) to up-scale its activities via production mechanization to satisfactorily serve

other customer segments; and d) to develop versatile products for soil health improvement to carve its niche in the fertilizer market.

KEY PERFORMANCE INDICATORS (AS OF 2015)

Land use:	0.5 ha					
Capital investment:	USD 46,460					
Labor:	11 people (2 skilled, 9 unskilled)					
O&M costs:	USD 103 per ton of vermicompost					
Output:	40 tons of vermicompost per month					
Potential social and/or environmental impact:	Creation of 11 jobs, reduction of water and land pollution, reduction of CO ₂ emissions					
Financial viability indicators:	Payback period:	5 years	Post-tax IRR:	N.A.	Gross margin:	N.A.

Context and background

DuduTech is located in the outskirts of Naivasha, a market town in rift valley province of Kenya, lying North West of Nairobi. Naivasha is on the shore of Lake Naivasha and along the Nairobi-Nakuru highway and Uganda Railway. It is part of the Nakuru district and has an urban population of 14,563 (1999 census). The main industry is agriculture, especially floriculture. DuduTech was established in 2001 as an autonomous division within the parent company Finlays Limited which was founded in 1750. Finlays as a wholly owned subsidiary of the Swire Group, has extensive tea and horticultural interests in Kenya, South Africa, Sri Lanka and China. The motivation for the establishment of DuduTech was Finlays' vision for sustainable and safe agriculture. Apart from environmental conservation through reduction in the amount of nitrates released into the soil from the use of chemical fertilizers, the availability of safe vermicompost has enabled Finlays to produce certified organic products and obtain Fair Trade Certification. This certification brands products as those meeting internationally-set environmental and labor standards and thus receives higher market prices – from which Finlays has substantially benefited.

Market environment

Finlays – a major tea and horticultural production and processing business entity – generates approximately 125 tons of vegetative waste weekly. With plans for increasing their scale of production, Finlay faces a significant challenge with the management of their waste, which was disposed of in open spaces within their farms. The conversion of vegetative waste to compost represents a sustainable option for Finlays to reduce its current and future land requirements for waste disposal. Furthermore, the continuous use of chemical fertilizers has had a negative effect on soils and water bodies from the release high quantities of nitrates. This in addition to the increasing international demand for organic agricultural products has catalysed the promotion of organic farming and the demand for related agricultural inputs. Finlays' desire to tap into the international market segment requires their use of agricultural inputs that meet organic farming standards. It is in this regard that the development of DuduTech remains crucial for the sustainability of Finlays but also the growing agricultural sector in Kenya.

Macro-economic environment

In the early 1990s, fertilizer markets were liberalized, government price controls and import licensing quotas were eliminated, and fertilizer donations by external donor agencies were phased out. Fertilizer use then almost doubled over the 15-year period from 1992 to 2007, with much of the increase attributable to smallholder farmers. The liberalization of the foreign exchange regime in 1992, resulted

in the convergence of what were then the official and the parallel market exchange rates, and effectively removed implicit taxation on fertilizers amongst other imports. While availability of fertilizers has been enhanced, these measures did not have the desired impact of lowering retail prices. This suggests that although businesses such as DuduTech may face fierce competition, organic fertilizer prices remain comparatively more cost-effective than those of chemical fertilizer. Additionally, increasing consumer preferences for organic foods and related local and global prices are representative of factors supportive for the development and sustenance of businesses such as DuduTech – given the related demand by farmers for organic agricultural inputs.

Business model

DuduTech's business is to process the waste of its parent company – Finlays Kenya Limited – into a valuable resource, vermicompost, and also produce and sell biological control organisms for agricultural purposes. Key success factors of DuduTech's business model have been: a) partnership with parent company to mitigate capital start-up risk and ensure continuous supply of vegetative waste; b) diversified portfolio through the sale of biological control organisms and vermicompost; c) segmented markets for its compost product. Vermitech, the brand name for the compost product is sold directly to Finlays and other local agricultural producers. Finlays' purchases represent 80% of all sales, with the remaining 20% by local farmers. The large purchase of the parent company represents an assured product demand and mitigates any risk associated with fluctuations in demand. Essential to DuduTech's business model is the market segmentation of its customer base. It sells compost at USD 0.4/ton to Finlays and USD 0.74/ton to other clients. It is thus able to recover the majority of its cost from the price differential. Additionally, DuduTech has invested a lot in developing high quality products, which has given it a competitive advantage in the fertilizer market, and has also enabled Finlays to produce certified organic products and obtain Fair Trade Certification. This certification brands products as those meeting internationally-set environmental and labor standards and thus receives higher market prices – from which Finlays has substantially benefited. For the production of the vermicompost, DuduTech sources its waste inputs – vegetative waste and animal manure – from Finlays and local livestock producers, respectively. These strategic partnerships have contributed to DuduTech's sustainability as they assure a consistent supply of inputs. Windrow and a vermicomposting technology is used to process the livestock and vegetative waste into a vermicompost. The use of a labor-intensive technology not only gives DuduTech a competitive advantage for production, but also generates employment particularly for low-income persons who would otherwise be unemployed. Although making use of an abundant input, labor, increasing wages have motivated DuduTech to explore the use of a more mechanized technology for labor-intensive activities such as heaping, turning and bagging, especially in light of foreseen production expansion. See Figure 167 for diagrammatic representation of the business model for Dudutech.

Value chain and position

Figure 168 provides an overview of DuduTech's value chain. The business sources its key inputs: vegetative waste and animal manure from Finlays and local livestock farmers (as part of its corporate social responsibility project), respectively. Access to and supply of vegetative waste is assured as Finlays currently produces more waste than DuduTech can actually process. On the other hand, however, DuduTech faces potential competition for animal manure given its demand for agricultural purposes. To mitigate this production risk, DuduTech plans to source this waste from larger scale livestock producers on a long-term contractual basis. DuduTech sells its products – compost and biological control organisms – to Finlays and other local farmers. The production capacity of DuduTech is approximately 10 tons per week of which about 80% is sold to Finlays. Vermicomposting gives Vermitech an edge over other compost products and chemical fertilizers in terms of its water retention capacity. Field trials have established a 30% reduction in irrigation when Vermitech was used in

FIGURE 167. DUDUTECH'S BUSINESS MODEL CANVAS

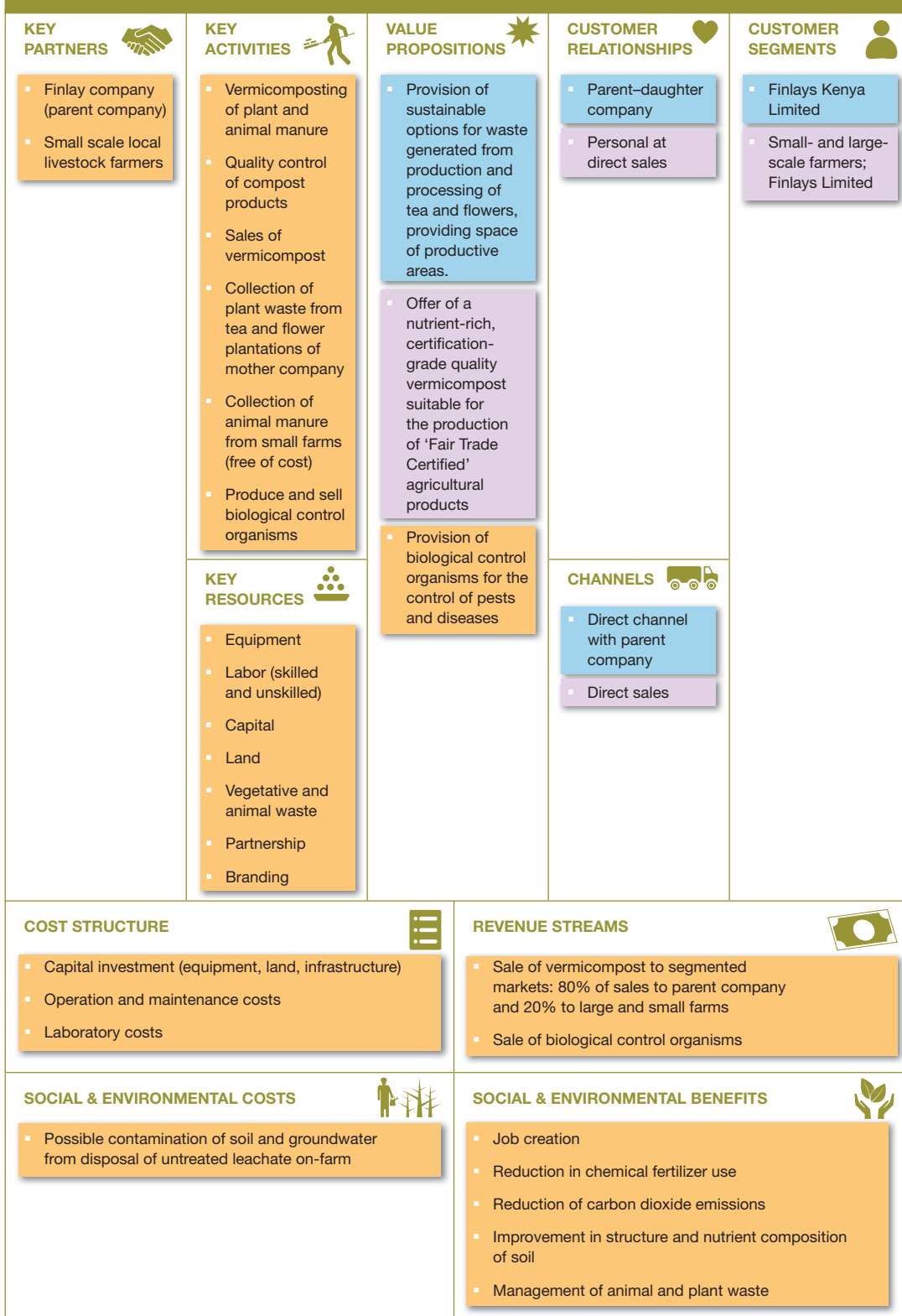


FIGURE 168. DUDUTECH'S VALUE CHAIN

The diagram illustrates the value chain for Dudutech, showing the flow of materials and services between various stakeholders. The central node is **DUDUTECH**, represented by a house icon with a dollar sign. Inputs to Dudutech include **Animal manure** (from **LOCAL LIVESTOCK FARMERS**), **Vegetative waste** (from **FINLAY KENYA LTD (PARENT COMPANY)**), and **Vermi-compost and biological control organisms** (from **FINLAY KENYA LTD (PARENT COMPANY)**). The output of Dudutech is **Vermi-compost and biological control organisms**, which are then distributed to **SMALL AND LARGE SCALE FARMERS**. Additionally, **LOCAL LIVESTOCK FARMERS** provide **Animal manure** to **SMALL AND LARGE SCALE FARMERS**. **PRIVATE AND PUBLIC LABORATORIES** provide **Product quality check services** to **FINLAY KENYA LTD (PARENT COMPANY)**. The diagram uses color-coded lines: red for the main value chain, green for inputs from Finlay Kenya Ltd, and blue for inputs from local livestock farmers.

replacement of some quantity of chemical fertilizer. However, Vermitech can be comparatively more expensive than chemical fertilizer given the relatively high application rates. Gaining additional share of the fertilizer market will require a more competitive product price. On the other hand, DuduTech's products are garnering great demand given the increase in global and local demand for organic products.

Institutional environment

Management of solid waste in Kenya in general is dealt with under several laws, by-laws, regulations and acts of parliament. As with DuduTech, in order to legally engage in composting activities on a business scale in Kenya, a waste management permit from the county council and waste recycler's permit from NEMA are a requirement and these are renewable on an annual basis. Additional regulations have been

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set in place including the Occupational Safety and Health risk Act and the Factories Act (cap 514 of the laws of Kenya) to protect plant workers and for which Dudutech has to comply to. The main policy and regulatory bodies that are responsible for overseeing the operations of composting activities in Kenya are: the City Council, Local Authorities in the Ministry of Local Government; Kenya Bureau of Standards (KEBS) in the Ministry of Industrialisation; and the National Environmental Management Authority in the Ministry of Environment and Mineral Resources (Onduru et al., 2009). The City Council provides guidance on waste management practices (collection, transportation and safe disposal), zoning and licensing. KEBS is mandated to develop standards (product quality certification) and ensure compliance with such standards. In collaboration with Kenya Organic Agriculture Network, KEBS has developed standards for the use and marketing of compost and other organic inputs (Onduru et al., 2009). The standards being developed recognize three categories of compost: liquid compost (e.g. leachates from vermicomposting), pelletized/granulated compost and natural/solid compost. KEBS' activities in particular will enable businesses like DuduTech to brand their product and increase their share of the fertilizer market.

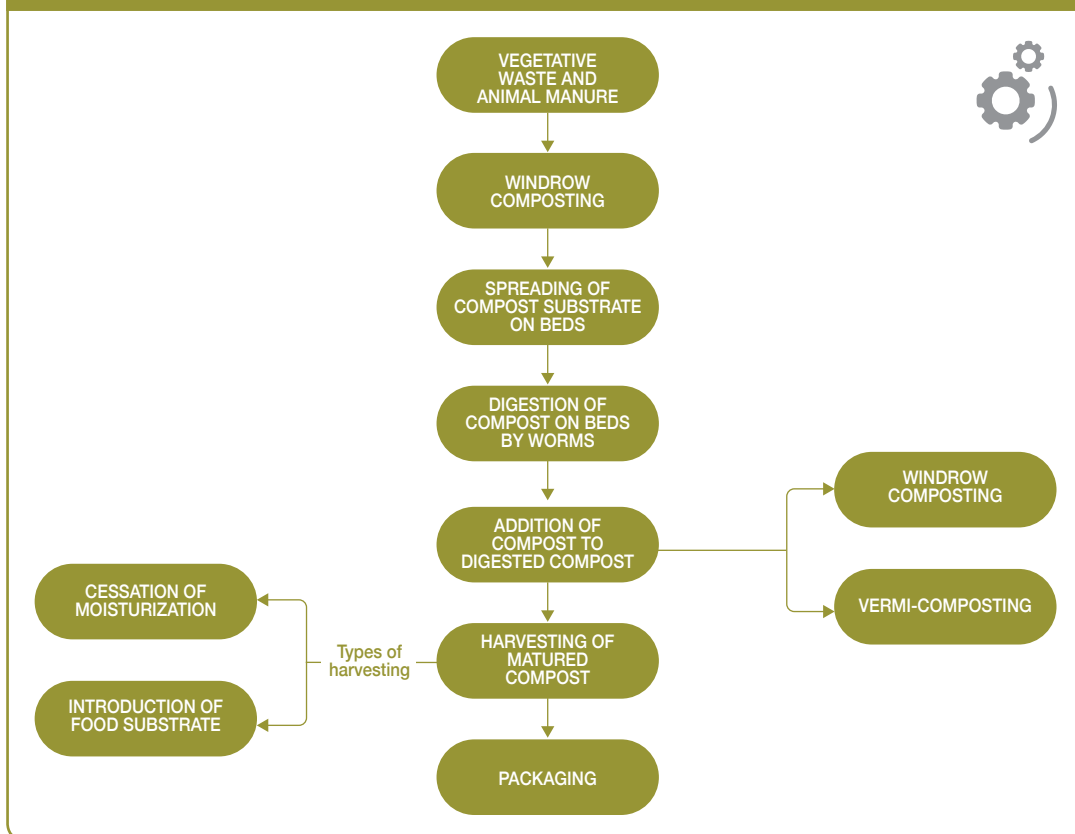
Technology and processes

DuduTech employs a combination of windrow and vermicomposting for the production of compost (Figure 169). A tractor fitted with trailers transports the vegetative waste from Finlays and a 10–20 ton lorry transports the animal manure from livestock producers to the production site. DuduTech uses both manual and mechanical methods for the vermicomposting process; however, plans are underway to mechanize other activities for its future expansion plans. Activities that are done manually include heaping, turning, watering and bagging. The equipment used is locally manufactured and spare parts are obtained locally. Danish International Development Agency (DANIDA) trained staff on vermicomposting and quality monitoring at the onset of the business. For the processing activity, vegetative waste is mixed with animal manure in the ratio of 1:2 and the mixture is composted for eight to ten weeks after which it is spread on beds to form a layer of ten centimetres. The beds are 45 meters long. As the substrate is digested by the worms, the volume shrinks and so additional waste is added in intervals to maintain the 10 centimetres depth until the vermicompost is mature for harvest. Once mature, there are two ways of harvesting. One way is discontinuing moisturization/ watering so that the worms move to the lower parts of the compost in search of water. Upper parts are scooped until all matured vermicompost is harvested. This is a dry harvesting technique and bagging can be done without having to re-dry the compost. The second harvesting technique involves creating a layer of food substrate on top of the matured vermicompost, separated by a net. This allows for easy separation between the matured compost and added food substrate but also permits the worm to access the food. Moistening continues until almost all the worms have penetrated the net into the substrate. The worms are harvested along with the food substrate, leaving only the vermicompost which is then harvested and dried to attain 40% moisture content then bagged for sale.

Funding and financial outlook

Initial capital cost comprising of land, equipment and other infrastructure was financed by DuduTech at a cost of USD 46,457 (4 million Kenyan Shillings). Total operational costs amount to USD 4,126 per month of which wage and salaries is the largest component, constituting 64%. Cost of waste input (largely acquisition costs of animal manure) accounts for 18%; and water, fuel and repairs each representing 3% of all costs. DuduTech earns revenues from the production and sale of biological control organisms and vermicompost. An annual profit of USD 7,000–8,500 is made from sales of vermicompost. Revenue and profit data were not disclosed for the sale of biological organisms.

FIGURE 169. PROCESS DIAGRAM OF DUDUTECH'S COMPOST PRODUCTION



Socio-economic, health and environmental impact

DuduTech's activities have resulted in several socio-economic and environmental benefits. DuduTech's business activities, particularly compost production, provide employment to 11 people on a regular basis. Furthermore, the use of vermicompost has contributed to the reduction of nitrates released into the soil and water bodies within and around the Finlay's farms from reduced chemical fertilizer usage. Although actual nitrates reduction figures were not provided, evidence of good agricultural practices can be attested to through Finlay's attainment of a Fair Trade Certification and receipt of premium prices for its agricultural products. Additionally, monetary gains are represented by cost savings from the use of Vermitech instead of chemical fertilizers by Finlays. Available data indicates that Finlays saves up to 20% in fertilizer costs and up to 30% in reduction of water used for irrigation. The conversion of vegetative waste to compost has also made available productive space which was originally used from disposal purposes. Improved livelihoods beyond benefits from reduced CO₂ emissions and groundwater contamination include increased revenues to livestock farmers from the sale of animal manure to DuduTech. DuduTech's operations, however, release raw leachate into the soil and water bodies. Plans are underway to add value to the leachate also for agricultural purposes. Health risks to workers are very low as any likelihood of exposure to pathogens from waste handling, for example, is mitigated from workers use of protective gear.

Scalability and replicability considerations

The key drivers for the success of this business are:

- Provision of start-up capital by parent company, Finlays Limited – which mitigated capital investment risk.
- Assured supply of key production input (vegetative waste) at no cost.
- Diversified portfolio – which mitigates risk associated with fluctuations in market demand.
- Increasing international demand for (certified) organic produce.

DuduTech's model has a high replication potential especially in developing countries with increasing agro-processing businesses and related limited waste management options. An opportunity for the up-scaling of DuduTech's composting relates to the abundant vegetative waste produced by Finlays that is still being dumped untreated and used on farmlands. Increased production represents potential economies of scale that DuduTech can capture; which will help reduce its production costs and invariably lower product prices. This strategy will help capture a larger share of the fertilizer market. It is important to note however that adaptations to the production process may be necessary given increasing costs of labor and animal manure, in order to make the increase in scale of production monetarily worthwhile. The organic foods market is growing globally, suggesting a potential increase in demand for organic agricultural products for which DuduTech can additionally take advantage of.

Summary assessment – SWOT analysis

Figure 170 presents an overview of the SWOT analysis for DuduTech. Composting is a promising business in Kenya especially given the abundance of waste inputs and the growing need for environmentally sustainable agricultural input. DuduTech has been particularly successful in leveraging its business partnerships to mitigate capital investment risk and ensure consistent supply of waste inputs. Additionally, DuduTech implements a segmented pricing approach where it charges local farmers almost double the price its parent company, Finlays, pays. DuduTech produces a quality compost with high nutrient contents that is in high demand in spite of its comparatively higher market price. Its additional investment in quality assurance and monitoring by a third party has also enabled Finlays to produce certified organic products and obtain Fair Trade Certification. This certification brands products as those meeting internationally-set environmental and labor standards and thus receives higher market prices – from which Finlays has substantially benefited. The sustainability of DuduTech is however largely dependent on the parent company – Finlays Kenya Limited. Finlays provides raw materials at no cost and also buys 80% of the compost. Although unlikely, decreased demand from Finlays will significantly affect its profitability. Additionally, the technology currently in use is highly labor-intensive and any up-scaling initiatives without some changes to the technology process, exposes DuduTech to unpredictable labor costs. Despite these limitations, several opportunities exist for DuduTech to ensure sustainability: a) increase its scale of production to capture economies of scale; b) increase its market scope via the production and sale of leachate-based products; and c) sale of carbon credits through the establishment of a CDM project. DuduTech represents an example of an innovative business making use of its parent company's (Finlays) agricultural waste to ensure its sustainability whilst generating significant profits and benefits to society.

FIGURE 170. SWOT ANALYSIS FOR DUDUTECH

	HELPFUL TO ACHIEVING THE OBJECTIVES	HARMFUL TO ACHIEVING THE OBJECTIVES
INTERNAL ORIGIN ATTRIBUTES OF THE ENTERPRISE	STRENGTHS <ul style="list-style-type: none"> Continuous and assured supply of vegetative waste Produces nutrient-rich compost Diversified portfolio Segmented markets Cost-effective technology Good local buy-in for products due to establishment of brand name 	WEAKNESSES <ul style="list-style-type: none"> High capital investment required High level of technical expertise required Production process adaptations required for up-scaling
EXTERNAL ORIGIN ATTRIBUTES OF THE ENVIRONMENT	OPPORTUNITIES <ul style="list-style-type: none"> Mechanization of labor-intensive production processes to increase scale of compost production Increase in market scope – production of leachate-based products Up-scaling potential of CDM project to earn carbon credits Increasing organic food/agriculture markets globally 	THREATS <ul style="list-style-type: none"> High dependency on parent company for sales of compost Unpredictable labor cost Competition for animal manure

Contributors

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 Johannes Heeb and Leonellha Barreto-Dillon, CEWAS, Switzerland

References and further readings

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Personal interviews with management personnel of DuduTech. 2015.

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.