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CASE

Municipal solid waste composting with carbon credits for profit (IL&FS, Okhla, India)

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Supporting case for Business Model 12	
Location:	Okhla, India
Waste input type:	Municipal solid waste (MSW)
Value offer:	Provision of an affordable, organic compost and generation of carbon credits
Organization type:	Public-private partnership (PPP)
Status of organization:	Operational since 2008 (registered as Clean Development Mechanism (CDM) project since 2009)
Scale of businesses:	Processes 200 tons of MSW per day (73,000 ton/year)
Major partners:	Municipal Corporation of Delhi (MCD)

Executive summary

The Infrastructure Leasing and Financial Service Okhla composting plant (IL&FS Okhla) started composting operations in 1981 with the aim of avoiding methane (CH_4) emissions generated in the landfill site through the controlled aerobic decomposition of MSW in a windrow composting process. However, the plant was shut down in 2000, as the business was not viable due to insufficient revenues from the sale of the compost. In 2007 IL&FS Ltd. signed a Concession Agreement and a public-private partnership (PPP) with the Municipal Corporation of Delhi (MCD) to rehabilitate the Okhla compost plant on a build, operate and own (BOO) model with carbon finance support. This project demonstrates the significant role of CDM in ensuring sustainable operation of waste reuse businesses while contributing sustainable climate protection. As reported, the plant converts approximately 73,000 tons of MSW into compost every year. The plant has two brands for its compost, the Harit Lehar and the EcoSmart Home Garden, which are both FCO (Fertilizer Control Order) compliant composts sold to farmers and to urban residents. Around 1,600 tons of CH_4 (34,000 ton CO_2eq) emissions are avoided on average per year and it is estimated that 234,231 tons CO_2eq is likely to be achieved within the seven-year renewable crediting period[1]. Moreover, the compost is used as a replacement to chemical fertilizer and thus avoids greenhouse gas (GHG) emissions from the production of chemical fertilizer. Another environmental and economic benefit is that the compost is rich in organic carbon, which increases the soil fertility and farm productivity.

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KEY PERFORMANCE INDICATORS (AS OF 2014)						
Land use:	3.27 ha					
Water use:	50,000 L/day					
Capital investment:	USD 1,454,250					
Labor:	10 skilled, 15 unskilled, 14 other adminstrative full time employees					
O&M:	USD 44.5/ton					
Output:	14,600 tons/year					
Potential social and/ or enviornmental impact:	Reduce pollution of water bodies, reduce waste management costs, reduce human exposure to untreated waste, enhance soil fertility and farm productivity, reduce GHG emissions, generate employment					
Financial viability indicators:	Payback period:	6–7 years	Post-tax IRR:	14.48%	Gross margin:	40%

Context and background

IL&FS Environmental Infrastructure & Services Ltd. (IL&FS Environment) is a 100% subsidiary of India's leading non-banking financial institution Infrastructure Leasing & Financial Services Ltd. (IL&FS). Its remit is to enhance the urban environmental infrastructure of Indian cities especially in terms of MSW management including new projects as well as the upgrading, operation and maintenance of non-functional compost plants all over India. The company has extensive experience in providing MSW consulting and advisory services to municipalities, and designing and implementing similar projects within the public-private partnership (PPP) framework in various parts of the country. It operates nearly 16 urban MSW processing facilities across the country, including the Okhla composting facility. The Okhla compost plant was constructed in 1981 and closed in 2000, as the operation was not cost effective due to insufficient revenues from the sale of compost. In May 2007, IL&FS signed a Concession Agreement with the Municipal Corporation of Delhi (MCD) to rehabilitate the Okhla compost plant with carbon finance support. IL&FS is responsible for financing, rebuilding, operating and maintaining the compost plant. The concession also provides exclusive rights and authority to retain, control, own, possess, collect and appropriate all possible revenue that can be generated from or in relation to the Project. The term of the concession is for 25 years from the date of agreement.

Market environment

The rapidly growing urbanization in Indian cities and the resulting increased need for good waste management practices has made MSW a top priority of most urban local bodies. Like the majority of landfills in India, the Okhla landfill was poorly managed and no precautions were taken to avoid the emission of methane. These have created a serious environmental and public health problem. Appropriate waste management is gaining priority with the government. This is evidenced by the fact that the MCD has signed a Concession Agreement with IL&FS to rehabilitate the Okhla compost plant. The Government of India is also supporting balanced nutrient management for agricultural soil in order to ensure that the productivity of agricultural land does not keep declining due to overuse of chemical fertilizers. The compost produced by IL&FS Ltd. is rich in organic carbon and increases soil fertility. The plant has two brands for its compost, the Harit Lehar and the EcoSmart Home Garden, which are both FCO (Fertilizer Control Order) compliant composts sold to farmers and to urban residents. Since the price of the compost is subsidized using revenue from carbon credit, marketing of compost is easier thus ensuring the sustainability of the project. The demand for the compost exceeds production but is highly seasonal. Demand is high from May to June and November to December. IL&FS sells its products through marketing alliances with fertilizer companies but is planning to be involved in direct sales of organic compost. There is competition from substitute products such as press mud, which is cheaper than the compost produced by the company.

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IL&FS Okhla compost plant is also planning to produce and sell Refuse Derived Fuel (RDF), which is fuel produced from the combustible components of MSW such as plastics and other biodegradable waste. RDF is an alternative fuel to coal and IL&FS plans to sell RDF to cement industries.

Macro-economic environment

MSW management has become essential in India as there has been a significant increase in MSW generation in the last few decades due to rapid urbanization and high population growth rate. Around 90% of waste is landfilled, requiring around 1,200 hectare of land every year. With the growing population and urbanization, municipal bodies are facing financial pressures and challenges in coping with demands. The municipalities are therefore looking at alternative ways of handling waste by identifying activities that generate resources from waste. The government is encouraging reuse businesses. In addition to this, India signed the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and ratified the Kyoto Protocol on 26 August, 2002. The government has a very proactive approach to attract investors to develop CDM projects. India has been ranked first in the world in terms of approved CDM projects and it is considered as one of the countries with high potential for CDM projects. This is partly attributed to the proactive policies of the Indian government towards CDM.

Business model

IL&FS reconstructed the Okhla composting plant and signed a concession agreement with MCD to manage the plant. They obtain revenue from the sale of compost and through the CDM mechanism, by selling carbon credits to UNFCCC Annex I countries[2] (Figure 145). As per the concession agreement with MCD, 25% of the CER earning is shared with MCD for the first five years. The company has not started earning revenues from the by-products (RDF) yet, but it has a contract with cement factories to supply RDF as an alternative fuel to coal in the future. Strong partnership is required with the MCD and good relationships are needed with the customer base, farmers and urban household and organizations maintaining gardens. Sales of compost are either direct or through agreements with fertilizer companies.

Value chain and position

The compost plant receives the MSW from the urban local body, composts the waste, segregates the recyclables and sells the organic compost and recyclables to recover the costs. The MCD is a key partner as it not only supplies the raw materials but also it provided land to set up the facility (Figure 146). The compost is used in the agriculture fields. The company sells its Harit Lehar compost to farmers via fertilizer distributers and its EcoSmart Home Garden compost directly to urban residents and institutions with gardens. The company generates revenue from emission reduction credits and shares 25% of the CER revenue with MCD for the first five years.

Institutional environment

Since IL&FS Okhla composting plant is registered as a CDM project, both the UNFCCC/Kyoto protocol requirements and host country requirements apply. The Municipal Solid Waste Management and Handling Rules, 2000 directed the municipalities to supply only segregated waste to composting facilities but due to financial constraints, municipalities in India have still not implemented the rules. The organic compost is produced as per the Fertilizer Control Order (FCO) rules. MSW Rules 2000 for the overall management of the facility and the FCO rules for the compost quality are adhered to in the operation of the compost facility. The State Pollution Control Board does regular reviews of the facility and provides recommendations, which are to be followed.

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FIGURE 145. IL&FS OKHLA COMPOST PLANT BUSINESS MODEL CANVAS

KEY PARTNERS

- Municipal corporation of Delhi (MCD)

KEY ACTIVITIES

- Receive MSW
- Production of compost and other recyclables (RDF)
- Marketing and sale of compost
- Managing CDM process & obtaining emission reduction credit

KEY RESOURCES

- Equipment (composting platform, segregation machinery, vehicles and other)
- Labor
- Consumables (MSW, energy, bio-culture)
- Intangibles (emission reduction)
- Subsidization resources from carbon trade income

VALUE PROPOSITIONS

- Farmers get high organic carbon content compost ('Harit Lehar' brand) against very low price due to subsidy
- Urban residents and institutions with gardens get high organic content compost (Brand EcoSmart Home Garden) against very low price due to subsidy
- Tradable certified emission reduction (CER) credits to meet carbon emission commitments
- Refuse derived fuel (RDF) at low price

CUSTOMER RELATIONSHIPS

- Farmer contact via fertilizer distributors (contract)
- Personal
- Registered as CDM at UNFCCC
- Personal (contract)

CHANNELS

- Marketing alliances
- Direct
- CDM certificate trading
- Direct

CUSTOMER SEGMENTS

- Farmers
- Urban residents and institutions
- Companies from UNFCCC Annex I countries
- Cement industries

COST STRUCTURE

- Investment cost:
  - Civil works
  - Plant cost
  - Equipment
- Annual operating cost
- Interest on borrowed funds
- MCD share payment
- Compost subsidization

REVENUE STREAMS

- Sales of compost Harit Lehar
- Sales of compost EcoSmart Home Garden
- Expected Sale of CDM benefits
- Sale of RDF (planned)

SOCIAL & ENVIRONMENTAL COSTS

- Possible human health risk while handling MSW

SOCIAL & ENVIRONMENTAL BENEFITS

- Reduced pollution of water bodies (about 1,000 litres of leachate is treated in the facility)
- Reduced existing waste management costs
- Reduced human exposure to untreated waste and chemical pollutants
- Enhanced soil fertility and productivity
- Reduced GHG emissions
- Employment generation

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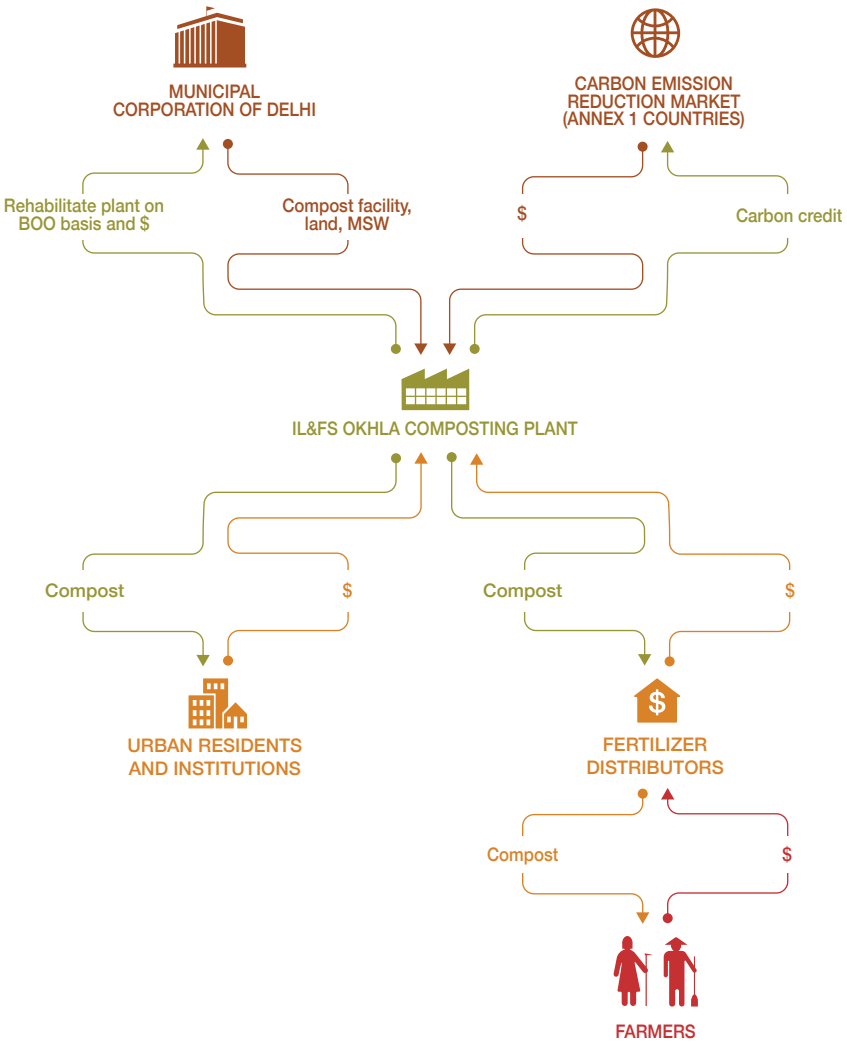
FIGURE 146. IL&FS OKHLA COMPOSTING VALUE CHAIN



Technology and processes

The technology used in the composting process is open windrow aerobic composting. Figure 147 depicts the composting process. The first step in the composting process is that the waste carried by the trucks is weighed and undergoes pre-sorting in which most of the large inorganic particles are separated out. The leachate is pumped to a separate treatment tank and the treated water is reused for the composting process. Inert materials and plastics are removed using sieving machines. The rejects are sent to landfill. The screened organic rich waste undergoes the process of composting. The duration of the composting process is about one month. During this period, the waste is sorted into windrows and undergoes turning and heaping. The compost pad is a concrete platform on which waste is allowed to undergo decomposition. The windrows are turned and shifted once a week using loaders for aeration and temperature control to enable aerobic decomposition of waste. A bio-culture is

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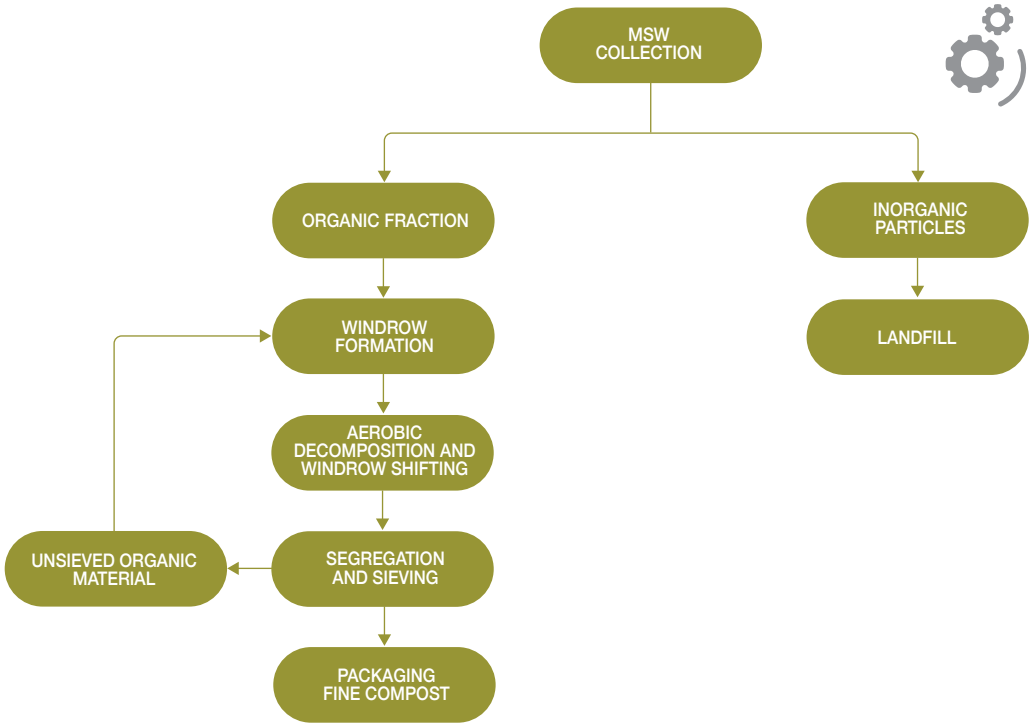
FIGURE 147. IL&FS COMPOSTING PROCESS



sprinkled on the waste heaps to aid growth of microorganisms and speed up the composting process. The temperature and oxygen of the waste heaps are measured and recorded every week. After four to five weeks, the composting heap is shifted to the "monsoon shed" for further stabilization. Next, it is sieved and the remaining inert and inorganic materials are separated out. To achieve maximum screening efficiency, one vibrating screen of 35mm and one trammel of 14mm are used. Cascading action inside the trammel ensures better screening of the waste. Screened material coming out after composting is uniform in texture and contains pure organic compost while the unsieved organic material is recycled back to the windrows for further degradation. The quantity of compost produced is about 15–26% of the quantity of MSW by weight. The NPK content of the compost is respectively 0.4%, 0.4% and 0.8%, organic matter of 50–60% and carbon content of 12%. The equipment used in the composting process is locally produced and spare parts can be easily purchased. However, the equipment needs frequent repairs. In terms of efficiency of the technology, there is a rapid composting technology which is more efficient than the one used by IL&FS but the cost is much higher.

Funding and financial outlook

The total investment cost of the project is USD 1,454,250. The civil works and plant costs account for more than 50% of the total project cost and equipment and other costs account for 42% of the project cost. Land was provided by the MCD. Financing was split between the owner's equity (24% of the total project cost) and debt (74%) at an interest rate of 14%. Table 37 gives the projected annual profits assuming that the first-year capacity utilization is 50% and the second year onwards, it is 100%. The plant has a capacity of producing 14,600 tons of compost and the selling price is 2,000 Rs./ton (USD 40/ton).

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TABLE 37. FINANCIAL SUMMARY AND PROJECTED PROFITABILITY OF IL&FS COMPOST PLANT WITH CDM BENEFIT (USD)

ITEM	2008	2009	2010	2011	2012	2013	2014	2015	...
Investment cost:									
Land	0								
Civil works	425,250								
Plant cost	417,500								
Equipment	330,250								
Other cost	282,250								
Total investment	***1,454,250***								
Revenue:									
Compost sales	365,000	613,200	643,860	676,053	709,856	745,348	782,616	821,747	...
Sales of CER	49,850	121,937	203,111	278,173	347,606	411,850	471,312	0	...
Total revenue	**414,850**	**735,137**	**846,971**	**954,226**	**1,057,461**	**1,157,198**	**1,253,928**	**825,747**	**...**
Total expense	451,134	613,714	630,939	649,105	668,266	688,475	709,792	732,280	...
PBDIT	**(36,284)**	**121,422**	**216,032**	**305,121**	**389,196**	**468,723**	**544,135**	**89,467**	**...**
Interest	154,000	118,580	106,260	47,740	27,207	23,100	18,993	14,887	...
Depreciation	67,235	53,788	53,788	53,788	53,788	53,788	53,788	53,788	...
PBT	**(257,519)**	**(50,946)**	**55,983**	**203,593**	**308,201**	**391,835**	**471,354**	**20,792**	**...**
Income tax	0	0	4,714	17,143	25,951	70,089	158,192	10,119	...
Profit after tax	**(257,519)**	**(50,946)**	**51,270**	**186,450**	**282,250**	**321,746**	**313,162**	**10,673**	**...**

Projected IRR (%)	**14.48**
NPV (USD)	**482,398**
Payback period	**6–7**

PBDIT = Profit before depreciation, interest and tax; PBT = Profit before tax

Assuming a discount rate of 10% and useful life of 25 years, with benefits from CDM, the project is viable and results in a positive net present value (NPV) and an internal rate of return (IRR) of 14.48% and payback period of six to seven years. Under the scenario where there is no revenue from CDM, the plant does not break even and results in a negative NPV and IRR of 7%.

Socio-economic, health and environmental impact

The business was set up to reduce the burden on the environment caused by untreated MSW waste. The compost plant treats biodegradable waste and on average it diverts approximately 73,000 tons of MSW per year (200 tons per day) and thus reduces the amount of waste disposed in landfill sites. The project avoids the emissions of methane that would be produced by landfill and thus contributes to

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GHG emissions reduction. Around 1,600 tons of methane (34,000 ton CO_2eq) emissions are avoided on average per year and it is estimated that 234,231 tons CO_2eq is likely to be achieved within the seven years' crediting period. Moreover, the compost is used as a replacement to chemical fertilizer and thus avoids GHG emissions from the production of chemical fertilizer. About 1,000 litres of leachate is also treated in the facility which would otherwise get into the underground water. The organic compost is rich in organic carbon content and increases the soil fertility and farm productivity. The company had conducted field trials in the district of Agra, Uttar Pradesh state to check the yield gain using the organic compost, which was shown to be 25%–30% higher than the yield obtained using chemical fertilizers. In addition to its environmental benefit and contribution to better management of MSW, the project generates employment opportunities. The plant is semi-mechanized and created jobs for local people directly in the composting facility and indirectly through waste collection and transportation of compost to the end user. It also results in reduced human exposure to untreated waste and chemical pollutants.

Scalability and replicability considerations

The key drivers for the success of this business are:

- Strategic PPP model with the municipal corporation of Delhi (MCD).
- Government support and proactive policies towards CDM.
- Government encouragement of reuse businesses.
- Innovative financing scheme and sharing of benefits between municipality and IL&FS.
- Rapid urbanization combined with high population growth.
- Government support/priority to appropriate MSW management and sustainable soil (fertility) management.

The design and operation of this project, in conjunction with the avoidance of GHG emissions and production of compost as a soil amendment, will serve as an example to many other urban areas in countries that are facing similar waste management challenges. The IL&FS composting uses a holistic approach to processing waste where almost all waste types both degradable and non-degradable are used. The technology is semi-mechanized, simple and relatively inexpensive. In regards to scaling up or scaling out, IL&FS has developed and transferred similar waste management projects to other Indian regions. For example, RWE (German Power Supplier) and IL&FS are working in cooperation on two further composting projects close to Delhi and Varanasi, India. Both were registered as CDM at the UNFCCC in 2009. This project has a good potential to be replicated in other countries. Replicating this business in a locality close to landfill sites will reduce transportation cost and increase performance of the business. Receiving tipping fees for the MSW which does not exist in the case of IL&FS compost plant would also reduce production cost. However, a major limitation for setting up a composting plant of similar scale of operation and which would qualify to be considered as a CDM project, is the high capital requirement, especially in localities yet to be developed in terms of infrastructure. In order for this business to be replicated in other countries, strong partnerships with local authorities (municipalities) along with innovative financing mechanisms and good expertise in waste management practices are important.

Summary assessment – SWOT analysis

Figure 148 presents the SWOT analysis for IL&FS Okhla compost plant. Key strengths of the business are its strong partnership with the Municipal Corporation of Delhi (MCD) and its multiple revenue streams from sales of compost and CER credits. However, the carbon credit market is highly volatile, which puts the sustainability of the business under risk. This can be mitigated through additional revenues from by-products such as RDF, which can replace coal used in cement industries.

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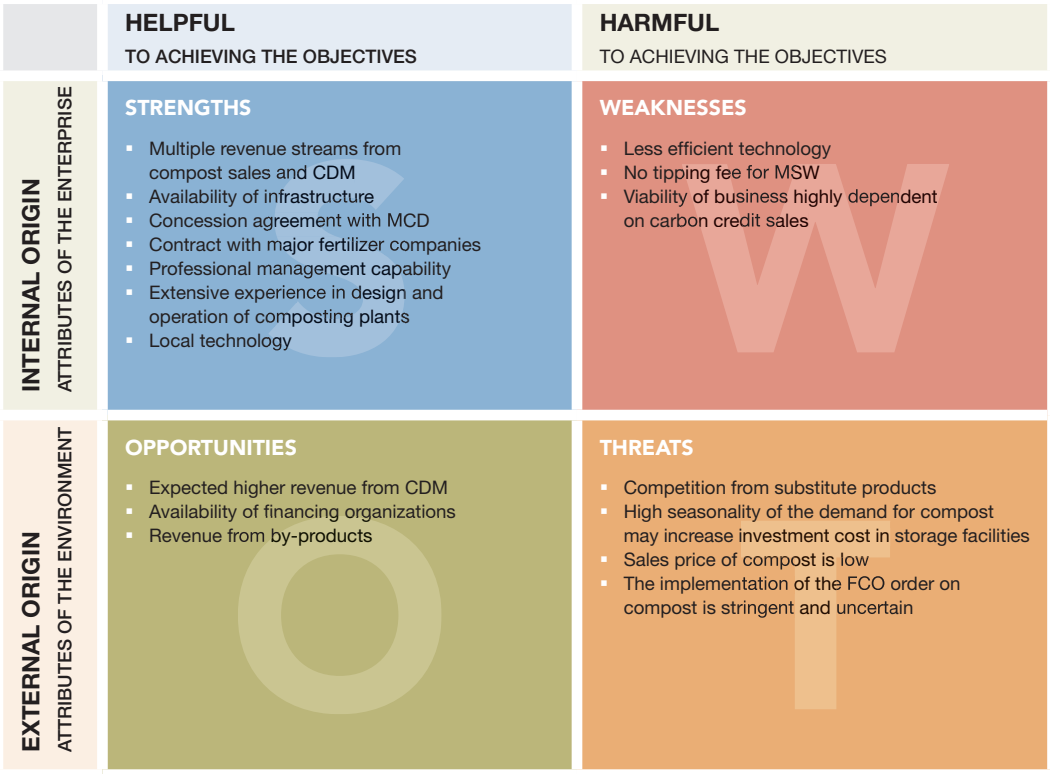
FIGURE 148. SWOT ANALYSIS FOR IL&FS OKHLA COMPOSTING PLANT



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UNFCCC/CCNUCC. 2010. Monitoring report: Upgradation, operation and maintenance of 200 TPD composting facility at Okhla, Delhi.

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 The crediting period for a CDM project is the period for which reductions from the baseline are verified and certified by a designated operational entity for the purpose of issuance of certified emission reduction (CERs). The crediting period for IL&FS is 7 years.

2 Industrialized or transitional economies as listed in Annex I of the United Nations Framework Convention on Climate Change (UNFCCC). http://unfccc.int/parties_and_observers/parties/annex_i/items/2774.php (accessed November 8, 2017).