# CASE Enriched compost production from sugar industry waste (PASIC, India)

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Supporting case for Business Model 13				
Location:	Pondicherry (Puducherry), India			
Waste input type:	Sugar mill organic waste			
Value offer:	Provision of enriched pressmud compost for agricultural production			
Organization type:	Public			
Status of organization:	Operational since 1996			
Scale of businesses:	Processes 6,000–9,000 tons of waste/year			
Major partners:	Puducherry Cooperative Sugar Mills (PCSM), Agricultural Department of the Government of Pondicherry; Government of India			

## **Executive summary**

The Pondicherry Agro Service and Industries Corporation Limited (PASIC) is a government-owned agricultural inputs producer and supplier. Seeing an opportunity with producing enriched pressmud compost from sugar mill waste and effluent water, PASIC set up a compost production arm to its business in partnership with the Pondicherry Cooperative Sugar Mill (PCSM) - the largest industrial unit in the cooperative sector under the Pondicherry government to process their waste. PCSM's inefficient disposal practices were adversely affecting groundwater quality and polluting surrounding areas. Thus, this partnership represented a win-win for both parties - PCSM was able to continue their operations according to legislative guidelines and PASIC produced and sold a nutrient-rich organic fertilizer to farming communities. The business arrangement is such that profits are split equally between both parties. PCSM provides the waste input to PASIC free of charge and provides the land for the processing of the waste. PASIC on the other hand covers all other capital and recurrent costs and has a budget of USD 45,600 per year. The corporation has so far created 25 jobs to benefit local workers and their families. The corporation deliberately keeps its annual net profit low at 5-7% given its social orientation. The compost, which is heavily subsidized by the agricultural department, is sold in agricultural depots and outlets. A 75% subsidy scheme is provided for farmers and 100% for Schedule Caste (SC) farmers. The project has significantly contributed to the peri-urban economy and safeguarded the health of local water bodies and environment in general. Beyond this, the increased adoption of organic fertilizer will contribute to the reduction of imported chemical fertilizer and related government subsidy expenditures.

KEY PERFORMANCE INDICATORS (AS OF 2015)						
Land use:	2.43 ha					
Capital investment:	USD 75,000 including cost of 2.43 ha of land					
Labor:	25 people (9 skilled and 16 unskilled)					
O&M cost:	USD 49 per metric ton					
Output:	3,000 tonnes of enriched pressmud compost / year					
Potential social and/or enviornmental impact:	Creation of 25 jobs, reduction in groundwater and land pollution, waste management cost savings and improved environmental health					
Financial viability indicators:	Payback period:	8 years	Post-tax IRR:	N.A.	Gross margin:	5–7%

### Context and background

Pondicherry Agro Service and Industries Corporation Limited (PASIC) is located in the southern part of peninsular India, which is a Union Territory. It was incorporated in 1986 and is owned by the Government of Pondicherry. The main activity of the Corporation is to distribute agricultural inputs such as fertilizers, seeds, organic fertilizer (enriched pressmud and municipal solid waste-based compost), plant protection equipment, horticultural plants, implements, tools, bio-fertilizers etc., to the farming communities at a reasonable price. In 1996, PASIC and the Pondicherry Co-operative Sugar Mills Limited (PCSM), entered into a joint venture for the processing of sugar mill waste to an enriched pressmud compost. This became necessary due to the difficulty experienced by PCSM with the disposal of its sugar mill waste. Each processed ton of crushed sugarcane produces between 0.16 to 0.76 m<sup>3</sup> of wastewater. PASIC processes about 6,000 to 9,000 tons per annum of pressmud and effluent from PCSM units. The sugar mill's wastewater has excessive amounts of suspended solids, dissolved solids, BOD, COD, chloride, sulphate, nitrates, calcium and magnesium, creating significant deleterious effects to both water bodies and soil when disposed of untreated. PASIC also took advantage of the increasing chemical fertilizer prices and need for sustainable agricultural inputs alternatives and established a sound and viable reuse business.

# Market environment

Government expenditures on chemical fertilizer imports for agricultural production are at an all-time high and on an increasing trend in India, in an effort to increase agricultural production. Government subsidies on chemical fertilizer have however resulted in inefficient use by agricultural producers. Over-application and extensive use of chemical fertilizers has had a dilapidating effect on agricultural soils and resulted in less productive yields. The demand for more sustainable agricultural input alternatives coupled with the increasing awareness of organic farming are some of the factors that PASIC capitalized on in setting up the business enterprise. In addition, there was the need to properly manage the waste generated by the sugar mill industry which had become a source of land and water pollution. India has a gross cropped area of 190 million hectares and would require about 627,000,000 tons/year of enriched pressmud compost to cover this agricultural production area. There are 600 sugar factories crushing 145 million tons of sugarcane annually in the country. The annual by-products generated through these industries are about 5 million tons of pressmud/year. This is indicative of a potential demand that will be greater than supply, assuming there are mechanisms in place to incentivize adoption by farmers. Organic fertilizer businesses face fierce competition in the fertilizer market from chemical fertilizer and other organic fertilizer businesses. The enriched pressmud compost produced by PASIC is heavily subsidized by the government - 100% subsidy for schedule caste farmers and 75% for general farmers. Additionally, although PASIC is socially-oriented, its profit margin remains positive and regulated between 5-7%. These measures have given PASIC a

competitive advantage over other new market entrants (organic fertilizer producers) and chemical fertilizer. PASIC produces and sells about 3,000 tons of enriched pressmud compost, accounting for 90% and 15% of the compost and chemical fertilizer markets respectively in Pondicherry. Although PASIC's compost is fairly substitutable with other organic fertilizers, the relatively low price of USD 0.01/Kg and its high nutrient content (N: 1.24%, P: 2.77, K: 1.68%, OC: 21.6%, Mg: 0.95% and Zn 0.012%) give it an edge over other products.

## Macro-economic environment

The Indian government highly subsidizes chemical and synthetic fertilizers, particularly Nitrogen, Phosphorus and Potassium (NPK). The amount of subsidies on chemical fertilizer has grown exponentially in the last few decades and has been mainly attributed to inflation and price fluctuations in the international market (Mishra and Gopikrishna, 2010). Significant subsidy allocation has not only led to inefficient use by farmers and high costs to the government; substantial soil degradation has also been observed as a result. With a growing need to increase the availability and quality of biofertilizers and composts in the country to improve agricultural productivity while maintaining soil health and environmental safety, the Indian government has set up over the last few years new schemes to augment the infrastructure for production of quality organic and biological inputs, and also from organic municipal waste.

A capital investment subsidy scheme for compost production has been introduced under the National Mission for Sustainable Agriculture (NMSA). The scheme provides 100% financial assistance to state governments and government agencies up to a maximum limit of about USD 300,000 per construction unit, and for individuals or private companies up to about USD 100,000 per unit (max 33% of project costs) through the National Bank for Agriculture and Rural Development (NABARD). Moreover, the Government of India is providing a Market Development Assistance of about USD 23.4 per metric ton to Fertilizer Companies for sale of City Waste Compost (Ministry of Agriculture, 2017). Policies to reduce the budget allocation for chemical fertilizers and provide capital investments for new and existing compost businesses are important instruments that catalyze the business development in the RRR sector and the scaling-up of initiatives similar to that of PASIC.

# **Business model**

PASIC undertook a long term (99-year) agreement with PCSM to process the sugar mills' waste into an enriched pressmud compost (Figure 171). PASIC is funded by the government of India; and produces and sells enriched pressmud compost to farmers directly through agricultural depots. It implements both a value-driven and a price-driven sales strategy, and a segmented market approach, selling enriched pressmud compost at a higher price to urban horticulturist than general farmers who represent 99% of its customer base. This is because, although PASIC's compost is fairly substitutable with other organic fertilizers, the relatively low price of USD 0.01/Kg and its high nutritive value (N: 1.24%, P: 2.77, K: 1.68%, OC: 21.6%, Mg: 0.95% and Zn 0.012%) gives it an edge over other products. Essential in its business model is PASIC's partnership with PCSM and the Indian Government via the agricultural department. It partners with PCSM for the continuous supply of waste at no cost. In addition, all production activities are executed on PSCM's production site to reduce investment costs (land purchase) and transportation costs thereby reducing overall production costs. PASIC manages and covers all costs associated with the production unit, technology, manpower, and production and marketing activities of the processed pressmud. PASIC does not compensate PCSM for the raw materials as it carries out the task of value addition of waste and disposal. Profits are shared on a 50:50 basis between PASIC and PCSM. The partnership with the government mainly is for easy marketing of products through price subsides provided to farmers. The government of Pondicherry through agricultural department annually allocates budget for the distribution of the pressmud compost

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to farmers and also offers a 75% and 100% price subsidy to general and schedule caste farmers respectively. With the adoption of a social-oriented approach, profit margins are deliberately kept low and have been fixed at 5–7% by the government of Pondicherry. This in addition to the subsidies provided has made the product affordable to majority of farmers. These partnerships enable PASIC to maximize its profits in spite of a profit ceiling, obtain a regular supply of raw materials and also create an assured market for the enriched pressmud compost product.

# Value chain and position

PASIC's key business activities are the production, marketing and sale of the pressmud compost (Figure 172). The value chain is very simplistic and has PASIC as the key player. PASIC sources its raw materials from PCSM and is the sole user of the 6,000–9,000 tons of sugar mill waste generated per year. Given the long-term agreement between these two parties, PASIC faces no competition with any other company for raw materials and has an assured supply of inputs. PCSM, in addition, provides the space and facilities for the processing operations of pressmud compost. PASIC in turn covers all remaining operational costs and the profits are split equally between the two parties. PASIC



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was funded by the Indian government at a cost of USD 75,000 excluding land costs, and provides significant subsidies to farmers. These subsidies have eased PASIC's entry into the fertilizer market in the face huge competitors such as chemical fertilizers who own a large share on the market. The agricultural department provides technical expertise for the laboratory analysis of compost to ensure that the pressmud compost is a safe and nutrient-rich product. PASIC is sold directly to farmers and also through agro-outlets and agricultural depots. PASIC has been able to capture a significant share of the organic fertilizer market in Pondicherry mainly due to using the agricultural depots via its partnerships with the agricultural department and government subsidies.

## Institutional environment

At the local government level, the Pondicherry Government has been very supportive of the business activities of PASIC. In addition to putting up the start-up capital for the business, it annually makes a budgetary allocation for the distribution of the pressmud compost under a 75% subsidy scheme for general farmers and 100% subsidy for schedule caste farmers via the Department of Agriculture. The subsidy scheme has been essential for PASIC in gaining an easy enty into the fertilizer market. At the country level, 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 fertilizer types for which producers have to adhere to. This is particularly beneficial 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

Composting of pressmud is carried out using an aerobic decomposition of pressmud in windrows (Figure 173). Most of the processing equipments are simple and locally manufactured, making them more cost-efficient. The technology has a waste input–output conversion ratio of about 30%. Decomposition is accelerated by inoculation of microbial cultures and the provision of required fermentation optima (maintenance of optimum moisture, aeration and temperature). The composting process takes between 45 to 70 days, after which the decomposed material is mixed with other products listed in Table 42 to produce the enriched compost. The majority of these organic materials are produced by PASIC. For the aerobic composting process, raw pressmud is formed in windrows and dried for three to four days to reduce the moisture content. With an aero-tiller, the product is aero-tilled once in three days. The sugar mill effluent is sprayed on the product when the moisture level reaches 50%, and the process of aero-tilling is carried out again. This process is repeated for 60 days. The product is then enriched with bio-fertilizers and micronutrients through spraying over the windrows. This mixture undergoes the aero-tilling process to ensure a uniform mixture. The final enriched pressmud compost is then packed into 50kg high density polyethylene bags. The cost for

<b>TABLE 42.</b>	TYPE AND QUANTITY	OF PRODUCTS ADDI	ED TO ENRICH TH	E PRESSMUD
COMPOST	PRODUCT			

NAME OF THE NUTRIENTS	QUANTITY PER 10 TONS OF PROCESSED COMPOST
Rock phosphate	200 kg
Azospirillum broth	10 litres
Phosphobacterium broth	10 litres
Pseudomonas broth	10 litres
Magnesium sulphate	75 kg
Zinc sulphate	75 kg



quality control is noted to be the lowest O&M cost, with input costs for micronutrients and enriched materials been the highest. Micronutrients and enriched materials cost is about USD 8.81 per ton of enriched pressmud compost, accounting for almost a fifth of per unit operational cost.

# Funding and financial outlook

PASIC is a public company established by the government of Pondicherry at a cost of USD 75,000 excluding land costs, with a payback period of eight years. There are no land costs to PASIC as all plant operations take place on the PCSM production site as part the established long-term agreement. PASIC has an average production capacity of 3,000 tons per annum. The average production cost of the enriched pressmud compost is USD 49 per ton, with labor costs comprised of wages, salaries and management cost accounting for 45% of the total operation cost. PASIC covers all costs related to technology, manpower, production and marketing of the enriched pressmud compost. Profit margins are estimated at 5–7% and with 50:50 sharing system between PASIC and PCSM – annual profit per entity of USD 7,900. Sales from enriched pressmud compost and waste management fees paid by PCSM are the revenue streams for PASIC. Twenty-five percent of the compost sale price is paid by farmers and the rest is paid for by the state government (i.e. Pondicherry government) through the agricultural department. Plans are underway to have enriched pressmud compost sold in other states.

# Socio-economic, health and environmental impact

The business activities of PASIC have reduced the purchase of chemical fertilizer and subsequently led to enhanced sustainable crop production. In the last sixteen years, PASIC has processed about 1.46 million tons of sugar mill waste into about 444,350 tons enriched press mud compost. Applying a nominal value of USD 56 per ton to the waste, the project has generated approximately USD 2.56 million in "new waste to value" to the community. The project will continue to produce approximately 3,000 tons of packaged enriched pressmud compost annually, resulting in an increase in rice yields of 1,067 tons equivalent to about USD 0.25 million. This project has reduced environmental pollution due to unregulated disposal of untreated sugar mill waste which hitherto was a major problem. It has and continues to safeguard the health of local water bodies and soil health. It has also improved the livelihoods of the local community through the provision of jobs. The project supports 25 jobs and has a budget of USD 45,600 per year to benefit to local workers and their families. Additionally, PASIC

ensures to safeguard the health of its workers through the provision of safety gear – hand gloves and rubber boots and annual medical check-ups.

# Scalability and replicability considerations

The key drivers for the success of this business are:

- Strong commitment of the state government in providing an enabling environment for the implementation of the business via the provision of start-up capital and price subsidies.
- Strong partnerships with the agricultural department provided key technical expertise to produce a high quality product and easy access to customers via its agricultural depots.
- Long-term contractual agreement with PCSM (agro-processing unit) ensures continuous supply of waste input and premises for plant operations.
- Policy initiatives to phase-out chemical fertilizer subsidies and capital investment subsidies to new and existing compost businesses.
- Environmental legislation making waste treatment a requirement.
- Government scheme set up to augment the infrastructure for production of quality organic and biological inputs.
- Local government supportive of the business initiative.

PASIC's model has a high replication potential in agrarian developing countries with large agroprocessing units. Initial governmental support will be required to mitigate capital investment risk and gain entry into an oligopolistic fertilizer market. The contractual agreement between PASIC and PCSM on use of all the sugar mill's waste and premises for processing activities, eliminates transportation costs and land rent (implying higher profits) which have been known to be substantial costs incurred by organic fertilizer producers. PASIC, however, faces a profit margin ceiling which prevents overpricing but also the maximization of profits. This business has a social focus and its pricing model may not be applicable to a profit-oriented business. Out-scaling of PASIC's model will increase the costs of production proportionately more than the generated revenue, thus governmental support at least at the start-up stage will be required in replicating this model. It would be ideal for the sugar processing companies to contribute to the investment cost in addition to the land cost in the instance where government support is lacking.

# Summary assessment – SWOT analysis

Figure 174 presents the SWOT analysis for PASIC. Composting is a promising business in India especially given the abundance of waste inputs and the growing need for environmentally sustainable agricultural input. PASIC has been particularly successful in leveraging its business partnerships to mitigate capital investment risk and gain entry into a fiercely competitive fertilizer market. Additionally, PASIC implements a segmented pricing approach where it charges urban horticulturists more than it does peri-urban and rural farmers. The sustainability of this business is however largely dependent on price subsidies provided by the government. The removal of these subsidies may expose PASIC to fierce competition in the fertilizer market, in which case it would have to rebrand its product to maintain its market share. Increasing governmental support along with growing demand for organic fertilizers will represent key opportunities for replication and up-scaling of the business. The use of a simple technology has been important to the business' success – taking advantage of cheap labor, however with increasing wages and energy prices, PASIC will have to consider other alternatives with future expansion plans. PASIC is an example of an innovative waste reuse business utilizing a simple partnership approach to address some of the major waste management and environmental challenges in Pondicherry, India.



# **Contributors**

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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.