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DECENTRALISED COMPOSTING IN DHAKA, BANGLADESH
PRODUCTION OF COMPOST AND ITS MARKETING

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ABSTRACT

This study is based on the experiences of *Waste Concern* a research based Non-Governmental Organisation with a community-based decentralised composting project in Mirpur, Dhaka, Bangladesh. The composting scheme started its activities in 1995 with the aim of developing a low-cost technique for composting of municipal solid waste, which is well-suited to Dhaka's waste stream, climate and socio-economic conditions along with the development of public-private-community partnerships in solid waste management and creation of job opportunities for the urban poor.

Organic waste is converted into compost using the "Indonesian Windrow Technique", a labour intensive aerobic and thermophile composting procedure. In an assessment study conducted in 2001, key information on the Mirpur Composting Scheme was collected. This includes a description of the technical and operational aspects of the composting scheme (site-layout, process steps, mass flows, monitoring of physical and chemical parameters) the evaluation of financial parameters and the description of the marketing strategy.

The case study shows a rare successful decentralised collection and composting scheme in a large city of the developing world. Essential for acceptance by consumers was that the composting scheme was able to get an approval from the Bangladesh Agriculture Research council for acceptance of their product for agricultural purposes and policy support from Minitry of Agriculture. Financial success of the scheme is based on the fact that large bulk buyers of compost were found. Thus the marketing strategy is, to let others do the individual marketing of the compost. In the Mirpur case the product is mainly sold to fertiliser producing companies which blend the compost with additives/ nutrients to suit different customers. Sales of the products are then done through existing extension services and retail networks of these companies.

The case of Mirpur shows that composting can be a good alternative to conventional solid waste management options, reducing the amount of waste to be transported and dumped by producing a valuable raw material for fertilisers.

KEYWORDS

Composting, Marketing, Organic Waste, Biological Treatment

INTRODUCTION

Urban solid waste management is considered to be one of the most serious environmental problems confronting urban areas in developing countries. Dhaka City Corporation (DCC) is responsible for management of solid waste in Dhaka City. DCC area is composed of 360 km^2 with a population 6.5 million, which are approximately 27 percent of the total megacity area. DCC area generates about 3000-3500 metric tons of municipal solid waste daily. Total land required for disposal of solid waste in Dhaka City is estimated at 110 ha per year. With increase in population and horizontal expansion of the city, it has become very difficult to find waste disposal sites in future within easy access for solid waste disposal consequently necessitating long haulage and increase in transportation cost. Inadequate collection and uncontrolled disposal of solid waste results in a serious threat to inhabitants and environment. Waste recovery such as recycling and composting is an option of reducing the waste amount to be disposed of. Furthermore, valuable nutrients and organic matter are returned to the soil.

Recycling of inorganic waste is common in many countries and practised by the informal sector. Composting however is still not wide spread, though often more than 50 % of the total waste amount is organic and biodegradable. Many institutions doubt the feasibility of composting as a sustainable means of organic waste recycling. Indeed the image of composting is dominated by the failed examples of oversized, over-mechanised, and centralised plants. Small scale and decentralised approaches are more successful but often also struggle with the marketing of the compost product. Most previous projects regarding composting with initiated with a focus on technological or social issues. The importance of financial aspects and the availability of markets for compost were often neglected. According to the process cycle of composting, marketing is the last link in the chain. On the other hand, a detailed market analysis and a marketing strategy for the compost product are essential for the success and durability of a plant set-up and should be elaborated beforehand.

APPROACH

The study of the Dhaka Plant followed an approach that comprises - besides the evaluation of the composting scheme itself - an assessment of the compost marketing strategy - and a cost-benefit analysis regarding the municipal institutions and budget. Figure 1 describes the issues considered for the assessment, which state the overall approach for the evaluation of the feasibility of a decentralised composting scheme.

On-Site Investigation – From Source to customer

The overall assessment was conducted by on site investigations of 3 ½ months. This approach ensured a full understanding of the areas organic solid waste stream starting from the source of waste generation to the customers of the final compost product. Following a short description of the composting process, the emphasis of this paper is set on the financial aspects as well as the marketing strategy of the Mirpur composting scheme.

Figure 1: Assessment of Feasibility of Composting Plants

RESULTS

Introduction of *Waste Concern*

The plant was founded by *Waste Concern*, a non-governmental research based organisation, with the aim to improve the solid waste condition in Bangladesh. *Waste Concern* works in partnership with government, private sector and local communities and international agencies. Amongst other things, the line of activities comprises solid waste management and resource recovery where composting plays an essential role. The organisational set-up of the composting scheme follows a business approach, which means that the community is seen as client who is paying for the service of waste collection. *Waste Concern* established a house-to-house daily collection service by means of Rickshaw vans with a capacity of 1.18 m^3. The mixed waste is pre-sorted at the composting site, before composting.

Process Description

During the assessment study in the first half of 2001, the plant treated 1.7 tons of municipal waste per day, which was collected from 790 households in Mirpur. The full capacity of 3 tons / day was reached by the end of 2001, serving 1430 households. Currently 10 people are employed at the plant. Organic waste is converted into compost using the "Indonesian Windrow Technique", a labour intensive aerobic and thermophile composting procedure. The pre-sorted organic waste is mixed with additives and piled around a triangular aerator/ rack made of bamboo, which allows a better air circulation inside the pile. The total composting process lasts 53 days, which can be described by a thermophilic phase (27 days, 40-70 °C) and a mesophilic phase (26 days, 20-40 °C). During the first phase the compost piles are turned frequently to regulate their temperature and ensure an equal decomposition level throughout the pile. The turning process, together with the observed temperature curve indicates that the pile is well hygienised and pathogenic organisms and weed seeds do not survive. As the pile temperature drops to ambient temperature the material is left to mature without turning or watering. The material changes its colour into dark-brown, which is a sign for mature compost (Solvita maturity index 6). The mature compost is then screened and packed in 50 kg bags. *Waste Concern* adjusts the compost quality to the requirements of their main client, a fertiliser trading company. In addition to compost sales, *Waste Concern* runs its own nursery and a farming demonstration plot, where the compost is used. Figure 2 shows a schematic diagram of the whole process. Table 1 gives an overview of all actors involved at the Mirpur collection and composting scheme.

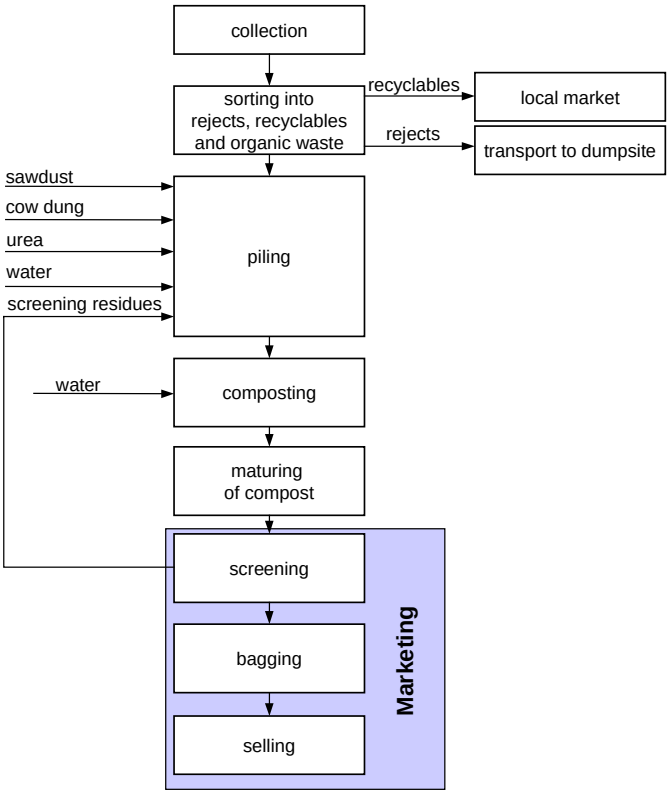

Figure 2: Flow Chart of Composting Process

Table 1: Actors of the decentralised composting scheme in Mirpur (WC is Waste Concern).

Actors/ Stakeholders	**Actions**
Waste Generators	
▪ Households	give their solid waste to WC and pay for the collection service
▪ (Vegetable Markets)	give their solid waste to WC
Waste Operators	
▪ Waste Concern	collects the solid waste from households and markets, sorts it into different fractions and converts the organic waste fraction into compost
▪ Dhaka City Corporation (DCC)	collects the inorganic rejects (after sorting) from the composting site of WC
Compost Buyers/ Users	
▪ M/S. MAP Agro Industries	buy and enrich compost on behalf of Alpha Agro Ltd.
▪ Retailers	buy (enriched) compost from Alpha Agro Ltd. and sell it to the farmers
▪ Nurseries	buy compost from WC and use it for plant cultivation
▪ Farmers	buy compost from retailers and apply it on their fields
▪ Waste Concern	use their compost (raw and enriched) for their nursery and farming demonstration

Financial Assessment

Transparent bookkeeping by the plant manager and further investigations allowed a detailed analysis of the financial situation of the plant. The plant in Mirpur was started as a demonstration project and was not run at full capacity till mid 2001. Therefore, two cases were compared in the financial evaluation:

1. Financial situation with the lower production level (1.7 tons of collected waste per day)
2. Financial situation in the case of full capacity (3 tons of collected waste per day)

Investment costs as well as operation costs were investigated on site by means of interviews, observations of man-hours, and analysis of accounts. Both cost categories comprise the waste collection step as well as the composting step. Regarding the investment costs it must be pointed out, that costs for land were calculated separately as the land was given to *Waste Concern* by Lions Club, Dhaka Northern for free. The figures of the scenario of full capacity operation were estimated together with *Waste Concern* based on experience from the observed operational capacity.

Furthermore, the revenues were assessed. Three types of revenues from the Mirpur scheme can be categorised:
1. Income from collection fees (approximately Tk. 17 per household and month according to their financial situation)
2. Proceeds from the compost sales (Tk. 2,5/ kg)
3. Proceeds from the sale of recyclables like hard plastic, cardboard, glass and metal)

The following table 2 shows a summary and comparison of the costs and revenues of both cases on a yearly basis:

Table 2: Yearly Costs and Revenues of Mirpur Composting Plant (including waste collection)

Costs	**Capacity**	
Item	**1.7 t/day** US$/ year	**3 t/day** US$/ year
Investment costs for collection	268	448
Investment costs for composting	1647	1647
Operation costs for collection	1725	3119
Operation costs for composting	5475	7511
Total	**9115**	**12725**

Revenues	**Capacity**	
Item	**1.7 t/day** US$/ year	**3t/ day** US$/ year
Collection fees	3366	6087
Compost sales	5393	9728
Recyclables	362	655
Total	**9121**	**16470**

Note: 1 US$ = TK. 58 (present rate, Feb. 2002)

The table shows, that the plant was barely financially viable when operating at 1.7 tons/ day. Comparing the cost and revenues categories it becomes evident that the revenues from the collection fees are partly cross-subsidising the composting activities. Hence, it seems advisable to combine composting activities with neighbourhood waste collection ensuring a viable operation of the scheme. An additional advantage of a combination of waste collection and

composting is the direct influence on the waste composition in the collection area by means of disseminating information to the customers (e.g. separate collection). Since operating at full capacity the composting plant is clearly financially viable. The revenues from compost sales cover 91 % of the operation costs and 76 % of the total annual costs of the scheme. The annual profit amounts to 3745 US$. As mentioned before, investments for land acquisition is not included in this calculation, because it was freely given to *Waste Concern*. Land prices in Dhaka are extremely high due to a high population density and lack of large vacant land. However, a study conducted by Waste Concern shows that there are enough vacant small pockets of land owned by different public agencies spread over the city which may be utilised for decentralised composting (Enayetullah & Sinha, 1999). Calculations based on current land prices in Dhaka and a minimum necessary land requirement for composting at low scale (380 m^2) show, that additional yearly costs of US$ 17 100 per year would arise. However, in case of smaller cities of Bangladesh like Khulna the project is viable, considering the local land price (Sinha & Enayetullah, 2000)

This analysis confirms the results of other investigations of decentralised urban composting plants, showing that small-scale plants struggle with their economical viability if all costs have to be covered by the plant revenues. However, in this case the analysis shows that a plant with a capacity of 3 tons of waste/ day can be viable with an initial support by municipalities or other donators, as land acquisition in urban areas is always one financial key obstacle for initiating a composting plant. An initial support by municipalities can be justified, if one keeps in mind, that a decentralised waste collection and composting activity relieves a certain burden from municipal budgets of municipalities. For the Mirpur composting plant, estimates show that the cost savings for transportation and landfill services can save the municipality US $ 18 518 per year (full capacity of the plant). With or without municipal support, any composting plant should however focus on long-term financial feasibility where operational costs are covered by revenues. Therefore, marketing strategies and the development of a market for compost are crucial for the long term success of a composting plant.

The Role of Marketing

Experience shows that many previous composting projects have either focused on technological aspects of composting or social aspects composting schemes in marginalised population groups. Much less attention was given to a detailed assessment of the market for compost in the respective regions. The importance of the interaction of product quality, price and customer demand is often underestimated. Hence, many projects failed due to the lack of a market for the product thus leading to financial problems, which could not be solved. The potential market for compost does not only determine the size of the plant but also the composting technique and the post treatment of the compost (see figure 2), as potential customers have specific needs for their application of compost. Hence, to ensure sustainability of the composting scheme, market analysis and the market development should begin before the product is produced. The demand for the compost product can be influenced by various factors, some of which are listed below. These factors can be assessed beforehand by a market study for compost.

- the current use of organic municipal waste (e.g. life stock farming or fertiliser)
- the customer segments (e.g. agriculture, horticulture, land reclamation, bulk suppliers or public agencies)
- the type and place of application
- perceptions versus compost and knowledge of its use
- the potential demand

- the required quality and state of maturity of compost and
- the availability of competitive products (e.g. cow and poultry manure, residues from agro-industries, municipal waste or artificial fertilisers)

An appropriate marketing and distribution strategy takes all these factors into consideration. Two main distribution strategies for compost can be described as:

- direct marketing to end users or
- marketing through a retailer or bulk supplier.

Which distribution strategy to use, depends on the existing resources for transport, which in the most cases is the limiting factor. Many decentralised and community-based projects do not have a distribution network in place or do not have appropriate means of transport. Costs for transportation of the product adds to the price thus automatically restricting the distance of distribution.

In the case of the Mirpur composting plant in Dhaka, *Waste Concern* decided to market the main bulk of their compost through MAP Agro Industries - a fertiliser company in Dhaka. MAP Agro Industries grinds the compost and enriches it with additional nutrients. Alpha Agro Ltd., a fertiliser trading company, distributes the final products in 40 kg bags through their distribution network all over the country. The products are sold as organic fertilisers for vegetables and many other crops like tea, paddy, wheat, potato, onion, lemon etc. to farmers. In addition to the sales to MAP Agro Industries, some nurseries buy compost directly at the composting site, and *Waste Concern* also uses some compost for their own nursery. Realising the lack of awareness on the benefits of compost, Waste Concern also launched an information campaign using a farming demonstration site. The characteristics of the compost itself and the fertiliser products as well as their market price are compared in Table 3.

Table 3: Nutrition contents of the "raw material" compost and organic fertiliser brand

Brand	**Content**				
	N [%]	**P [%]**	**K [%]**	**OM [%]**	**Price [Tk/kg]**
Compost	~2.4	~1.2	~1.7	--	2.5
Vegetable Fertiliser	1.5	15	10	30	6
Potato Fertiliser	7	7	14	30	6

The marketing strategy used by *Waste Concern* significantly reduces their costs for marketing and transportation. *Waste Concern* solely concentrates on the production of compost while benefiting of the distribution network of the fertiliser company. On one hand the plant's revenues from selling a basic unrefined compost to MAP Agro Industries is lower than if they were to retail the product themselves. On the other hand however, *Waste Concern* gains by selling more compost as Alpha Agro Industries covers the whole country. According to other examples in Asia, the market radius for compost from decentralised plants is limited to 25 km (Lardinois, 1993). This example shows that it is possible to market compost within a very large radius. Obviously *Waste Concern* is in some respect dependent from their one main customer. To keep this risk low *Waste Concern* has negotiated a long-term sales contract and is also assessing further applications and customers for compost (e.g. tea plantations). Recently, *Waste Concern* has signed an agreement with another company called Nature Farming to market the compost produced from newly established 4 more composting plants in Dhaka.

CONCLUSIONS

The case of *Waste Concern* in Dhaka is one example of a viable small scale and decentralised composting plant. Using an appropriate composting technology in combination with a sound financial management, as well as an appropriate marketing strategy ensures high quality compost and constant sales throughout the year. The awareness building programmes for users has started to show effects and the demand for normal and enriched compost is rapidly increasing. Waste Concern is negotiating with further large bulk compost users to limit dependency from their main customer.

One main constraint for a replication of the composting scheme is the lack and high cost of land. However, in Dhaka, different and the municipality have recently shown interest in composting activities and are supporting the idea by providing land for such purpose due to the demonstration effect of the Mirpur project. The Public Works Department has given permission to use land at six different sites, two of which are now developed and operating as composting plants. Dhaka City Corporation (DCC) has also provided land to *Waste Concern*, where a 5 tons/day capacity composting plant has been constructed recently. Construction cost for the 4 new composting plants in Dhaka is being met by the Ministry of Environment and Forest of the Government of Bangladesh under its "Community Based Urban Solid Waste Management Project in Dhaka". These are being implemented by *Waste Concern* with support from the UNDP, since September 1998. This project is one of the components of Sustainable Environment Management Program (SEMP) of the Government of Bangladesh. *Waste Concern* has also designed another composting plant at Khulna, the third largest city in Bangladesh. The cost of the construction was borne by SDC. The composting plant is now being run by a local NGO in Khulna. Recently, Chittagong City Corporation (CCC) the second largest in Bangladesh has also agreed to provide land in the city and requested Waste Concern to initiate a composting project over there.

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