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Markets for Compost – a key factor for success of urban composting schemes in developing countries.

By Chris Zurbrugg,

In low- and middle-income countries the continuous and rapid urban growth and the lacking urban environmental management is seriously threatening the health of citizens and the overall environmental quality. Solid waste is considered to be one of the most immediate and serious challenges of urban environmental management confronting urban authorities. Applying the traditional approach of "collect and dispose" however, can hardly be considered an environmentally sustainable solution to the waste problem.

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Background

In low- and middle-income countries the continuos and rapid urban growth and the lacking urban environmental management is seriously threatening the health of citizens and the overall environmental quality. Solid waste is considered to be one of the most immediate and serious challenges of urban environmental management confronting urban authorities. Applying the traditional approach of "collect and dispose" however, can hardly be considered an environmentally sustainable solution to the waste problem. An expert group - brought together in a meeting at Bellagio in February 2000 by the Environmental Sanitation Working Group of the Water Supply and Sanitation Collaborative Council - agreed that current waste management policies and practices are abusive to human well-being, economically unaffordable and environmentally unsustainable. They had therefore called for a radical overhaul of conventional policies and practices world-wide, including the assumptions on which these conventional approaches are based on (Schertenleib, 2001). A new approach shall enhance progress towards the objective of "universal access to safe environmental sanitation, within a framework of water and environmental security and respect for the economic value of wastes". The principles governing this new approach were identified as:

1. Human dignity, quality of life and environmental security at household level should be at the centre of the new approach, which should be responsive and accountable to needs and demands in the local and national setting.
2. In line with good governance principles, decision-making should involve participation of all stakeholders, especially the consumers and providers of services.
3. Waste should be considered a resource, and its management should be holistic and form part of integrated water resources, nutrient flows and waste management processes
4. The domain in which environmental sanitation problems are resolved should be kept to the minimum practicable size (household, community, town, district, catchment, city) and wastes diluted as little as possible.

One step in this direction is improving the current solid waste situation by specifically enhancing resource recovering activities. Although recycling of inorganic materials, from municipal solid waste, such as paper, scrap metal, and others, is already often well developed by the activities of the informal sector, the recovery, treatment, and reuse of the organic fraction is still fairly limited. From a waste management point of view, the appropriate management of these wastes must be given emphasis as the organic biodegradable material accounts for often more than 50% of the total waste. Enhancing recycling and reuse of organic wastes and thus returning this non-renewable resource to the soil, is one important step toward urban sustainability (figure 1). For a municipal authority responsible for solid waste management, recycling organic matter reduces costs of the disposal facilities, prolongs the sites life span, and also reduces the environmental impact of disposal sites as the organics are largely to blame for the polluting leachate and methane problems.

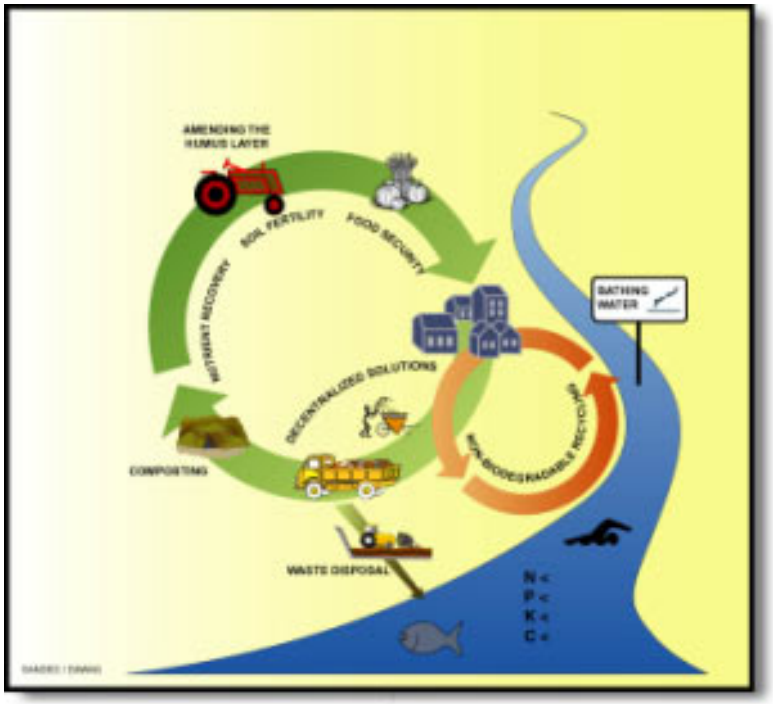

Figure 1: Environmentally sustainable solid waste management involves recovery and reuse of organic as well as inorganic waste materials.

Unfortunately, the past has shown many composting efforts, which have failed and were abandoned. Hoornweg et al.(1999) have summarised the main reasons for failure as a combination of:

- lack of support and cooperation from the public and municipal governments
- poor marketing plans for the end product
- poor quality feedstock waste
- inappropriate technology resulting in high operating costs and frequent mechanical breakdowns through poor maintenance
- lack of understanding of the composting process and training in operational procedures,often resulting in offensive odor emissions.

An important prerequisite, often given too little attention before initiating a composting scheme, is a detailed feasibility study. Such a study should not only analyse technological and financial issues of the composting unit, but also look a few steps further into available and potential markets for the product. These markets must be analysed and the financial implications assessed. In many cases of failed composting schemes, a preliminary market study could have recognised the main challenges - of lacking market demand - thus giving the project a chance to focus it efforts on marketing at an early stage.

Assessing market demand

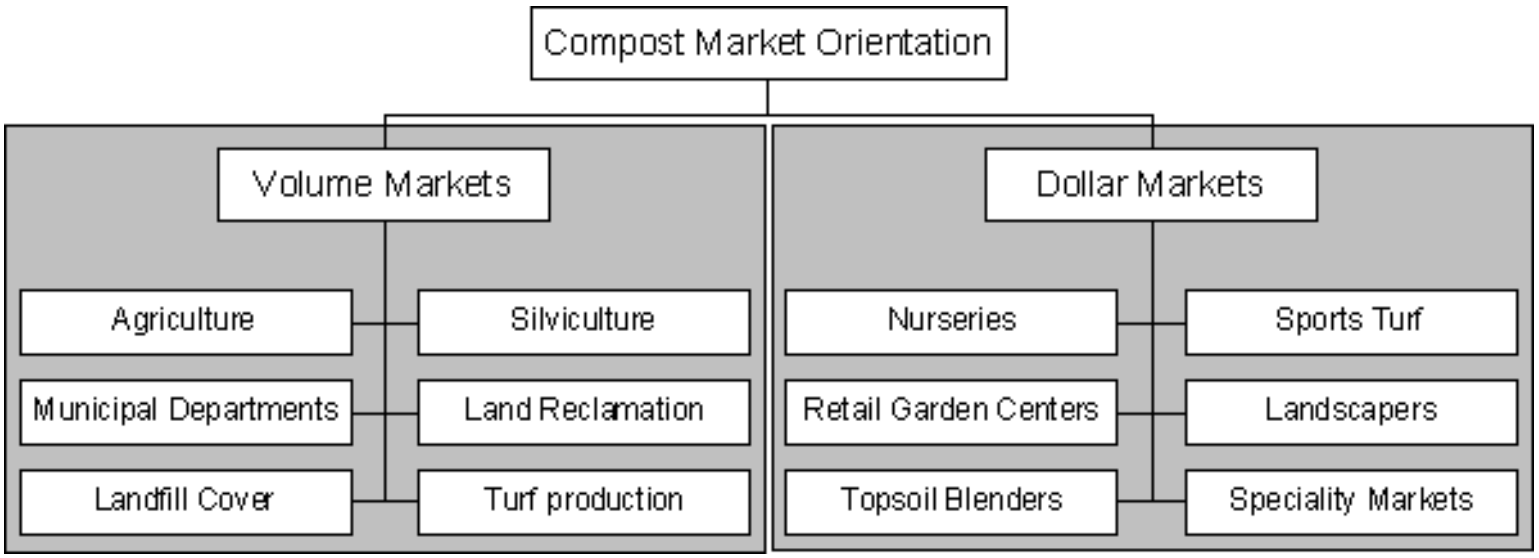

Figure 2: Compost market categories (adapted after Tyler 1996)

Two main market categories for compost can be distinguished (Figure 2). Volume markets are large markets however the barrier to widespread sales is determined by price and location of the users. Generally the possible sales price per unit compost is low. Location of these volume markets are often in the peri-urban and rural areas thus involving more complicated distribution and transport arrangements. Urban volume markets comprise municipal departments using compost for public spaces, parks and road side management as well as urban agricultural farmers. For the dollar markets, on the other hand, prices are significantly higher. This market is available in the urban and peri-urban area. In India for instance prices for compost vary between Rs 2 per kg (0.04 Euro) for volume markets and Rs. 20 per kg (0.40 Euro) for dollar markets (Zurbrugg 2002).

Systematic analysis on the potential urban compost demand for urban areas in the developing world is lacking. To understand the methodological difficulties of assessing compost market demand in cities of developing countries, two collaborative studies on market demand were conducted in Dar es Salaam, Tanzania and in Karachi, Pakistan[1] . Some results are described in this paper. The studies focussed on assessing the existing solid organic waste management practices in both cities (existing and potential supply) and determining current use of compost or potential interest in compost derived from municipal solid waste (existing and potential demand). A preliminary checklist of questions was developed as planning tool (Table 1). Methods used for obtaining data were: literature study, key interviews with selected individuals or organisations, and random surveys with predefined questionnaires. Unfortunately, during the individual studies not all questions could be answered satisfactorily as budget constraints limited the surveys certain quantitative data.

Table 1: checklist of questions for estimating compost supply and demand

Municipal Organic Solid Waste	**Current Use of Compost and Competing Products**
- What type of organic wastes are generated? - How much waste is generated and by whom? - Are there significant seasonal variations in waste generation? - What are the quality/contamination aspects of these organic wastes? - How are the different types of waste currently managed? - What types of organic waste are used, by whom, for what? - How much of each is being used? - What prices are being paid? - What are user perceptions and requirements versus this use? - How is the waste marketed?	- By whom, how much, when, for what is compost being used? - What prices are being paid? - What are users perceptions and requirements with regard to this use? - How is compost currently marketed? - What type of competing products are used, by whom, when, for what? - How much of each is being used? - What prices are being paid? - What are user perceptions and requirements versus these products? - How are these products marketed?

Constraints for Compost Use and Production	Potential customers
- Is knowledge available or accessible regarding the benefits and proper use of compost - Are there cultural barriers constraining the use of compost? - Are the financial constraints limiting the purchase of compost? - Are there legislative issues hindering the use of compost? - Is knowledge available or accessible on composting science and techniques (operation)? - Is start-up capital available? - Is land available? - Is there a reliable availability of waste? - Are any institutional support mechanisms feasible? - Do any rules, legislation or regulations constrain the production of compost?	- Who are the customers, how much are they willing to pay? - How much compost could potentially be sold, when? - What are the customers requirements and perceptions? - What is their knowledge of use? - What strategies can be recommended to develop a market for compost

The Case of Dar es Salaam, Tanzania

The metropolitan city of Dar es Salaam has a population of approximately 3 million residents with diverse incomes and lifestyles. Recently, as part of decentralisation efforts, the city was divided into 3 municipalities. The project activities focused on the urban and peri-urban areas of the municipality of Kinondoni, which reflects different levels of income, development, population density, and commercial activity. The whole of Kinondoni municipality effectively encompasses an area of 531 km2, and a population of 611'000 in 1988 (estimates for 2001 are around 1.3 million). It is administratively divided into 4 divisions, then 27 wards and finally "rural" villages and urban sub-wards

Availability of waste - potential production of compost derived from waste

Extensive research on Dar es Salaam's solid waste management system was conducted by Kokusai Kogyo Co. Ltd. for the Japan International Cooperation Agency (JICA) in 1996 (JICA, 1997). Field surveys established waste generation rates[2] for Kinondoni of around 730 t/day. Waste composition studies derived an average biodegradable fraction of 35-45 %. Thus the organic solid waste amount that can potentially be treated, is around 255 - 329 t/day. Using basic assumptions of compost production rates of around 25% (Rytz 2000), a rough and high estimate of potential compost production was calculated. For Kinondoni this amounts to approximately 63 - 82 tons/day or 22'500 - 30'000 tons/year. The estimate is certainly too high, as management and operational realities are not taken into account. For instance, the amount of waste currently collected is estimated at only 25-30 % of the total amount generated. Waste collection is provided by the Municipal Street Authority as well as franchise contracts with 3 private enterprises, 14 Community-based Organisations (CBO) and 9 Medium and Small Enterprises (MSE). Uncollected waste is dumped indiscriminately along river banks, road sides, and on open spaces. In Kinondoni only 8 composters were identified. Six of these are also involved in waste collection service provision and three indicated that they were also farmers. Feedstocks for these composting activities are residential wastes, garden wastes, and/or market wastes. Although the past has seen other small scale composting pilot schemes in Dar es Salaam, these have focussed rather on experimenting with the composting process and have not looked into marketing the product.

Agricultural Production and Potential Use of Compost

Out of the 52'000 hectares of arable land in Kinondoni, about 13'600 ha are currently used for cash crop production such as coconut, cashew, vegetables, and palm oil. Approximately 9'000 ha are further used for food crops such as cassava, sweet potatoes, rice, maize, and green leafy vegetables (Kinondoni Municipal Council, 2001). Productivity per hectare is considered low as most farmers still use traditional agricultural techniques. Using conservative assumptions, with compost application rates of 2 tons/ha and cultivation, and an average of 2 cultivations per year, a potential compost demand of 36'000 tons/year can be estimated for food crop farmers. Other potential user segments such as street side nurseries, landscapers and municipal and parks proved difficult to quantify, as no information was available on the products used and amount of areas managed.

Current use of Compost and Competing Products

Compost production and use is currently very limited, in spite of wide spread urban farming activities. The compost producers which were identified, use compost on their own plots or sell between 6-20 kg per day, at 20 Tsh/kg (0.02 Euro). Their customers are pot flower growers and embassies. To some extent old garbage heaps are mined and the degraded organic matter used for individual purposes or sold to nurseries (Kiango & Amend 2001). Of the limited amounts of compost utilized in the urban area of Kinondoni, nurseries are currently the main users. Vegetable farmers have little to no experience with compost. Generally the use of chicken manure is preferred as it is easily available and experience has shown that it increases crop yield. Kiango and Amend (2001) estimate an annual production of chicken manure in Dar es Salaam amounting to 91'250 tons with an average nutrient content of 2:2:1 (NPK in %). Next to chicken manure, cow dung is considered the next most frequently used product.

Responses on the willingness to purchase or use compost were difficult to interpret as the knowledge on compost and its benefits were largely lacking. As the majority of farmers responded that they would be willing to use compost in amounts equivalent to their current use of fertiliser one can deduce that there are no general negative attitudes or cultural barriers towards compost. Earlier surveys (JICA, 1997) showed that a minority (5%) of farmers, when asked about compost, rejected compost derived from waste as they were afraid of diseases affecting their crops.

The Case of Karachi, Pakistan

Availability of waste - potential production of compost derived from waste

Karachi, the largest city of Pakistan, is home to over 10 million people. Solid waste management is faced with a major crisis as there is a serious lack of long term plans, resulting in a number of often counter productive policies, plans and administrative frameworks. Responsibilities for the collection, transport and disposal of household, commercial, and institutional waste as well as street sweepings, lie with the municipal authorities. Waste generation amounts to 6600 tons per day (Hasan, 2002). Approximately 2200 tons/day (33%) are not managed and end up in drains, water ways or are indiscriminately dumped in open spaces. Average biodegradable organic content of a typical middle-income area is approximately 40-50 % consisting mainly of food and garden wastes (KMC, 1992). Using these figures a potential compostable amount of 2600-3300 tons/day can be estimated.

Two major markets of Karachi provide significant amounts of practically pure organic waste, which would constitute an excellent raw material for composting. According to estimates provided by Karachi Metropolitan Cooperation (KMC), approximately 100 tons/day originates from the Vegetable Market and some 70 tons/day from the Empress Market. Alone these two waste sources could potentially provide production of 14'500 tons of compost per year[3] .

In Karachi, private and informal groups are frequently collecting and separating different types of solid waste, which are then sold for recycling and reuse. The organic fraction is hardly recycled and reused. One large composting plant, the Farooq Compost Fertiliser Corporation Plant, was established in North Karachi in the early 1980s, but has never operated successfully and is not in operation anymore. The reasons for its failure can be attributed to inadequate, highly mechanised technology; an oversized scheme; insufficient compost quality (mixed waste); and the unrealistic marketing assumption to focus on export of compost to the Middle East. Currently there are some local NGOs treating small amounts of organic waste and selling the product to residents for use in their gardens. However the processes used for handling the organic waste are questionable and can hardly be considered composting as such.

One factor which ve significantly influences the feasibility of compost production in Karachi, is the scare availability of water. As the composting process needs addition of moisture, alternative scenarios, such as using wastewater, would have to be analysed in more detail.

Agricultural Production and Potential Use of Compost

In the urban and peri-urban area, nutrient supply to crops such as vegetables, is currently often practised by application of raw sewage - with its higher workers and consumers health risks - as well as animal manure. The Western District Municipal Council (DMC-West) is currently in charge of maintaining 73 ha of developed and partially developed parks with plans to develop another 62 ha of allocated but not developed parks and public gardens. They are currently not aware of other nutrients and soil conditioners, which could help with improved growth and survival of their plants. Their priority preoccupation is water availability for irrigation.

Current use of Compost and Competing Products

At present very little awareness exists among the stakeholders in Karachi about composting, the product compost, and its characteristics. Even the mainstream users such as nursery/plant shop owners - a fast growing business in Karachi - do not have any information about composting or compost. Absence of current and past exposure to compost and allied products is seen as a major hindrance in its utilisation. The District Municipal Council (DMC) West, as well as large-scale nursery owners and operators reported that the lack of a demonstration project further diminishes the possibilities of use of any other form of plant food or manure. Similarly urban professional farmers that grow crops in the outskirts of the city are largely unaware about the existence, nature and characteristics of compost.

Most of the actors possess a basic awareness about urban organic waste and its possibility of conversion into compost as a useful plant supplement. The missing link is the non-availability of any existing example or product for demonstration purposes. The only existing examples are of questionable quality and damage the compost image rather than support the awareness on its benefits. The municipal agencies responsible for the plantation, management and maintenance of public parks, playgrounds, green belts and open spaces, use mainly animal manure or chemical fertilisers. In general buffalo dung is most frequently used as fertiliser and its supply is larger than the demand. In fact such animal waste is often dumped into waterways or on roadsides near to the cattle pens.

Conclusions

Rough estimations on potential compost production and potential compost use can be easily made using statistical data of urban agricultural areas and crops cultivated, if this data is available. Unfortunately, not many studies have been yet undertaken to assess data of urban and peri-urban agricultural activities. In the near future an increasing interest and research on the significance of urban agriculture may compensate for this deficiency.

The availability of organic waste for composting is very seldom a limiting factor, however, mixed municipal waste needs preliminary sorting before being composted to avoid risks of compost contamination. Source segregated residential waste or pure organic waste streams such as vegetable market waste constitute an excellent raw material for composting.

Virtually any soil will benefit from the application of compost. Theoretically, therefore there is a potentially large market for compost for use in the urban and peri-urban area. However, the lack of knowledge on compost benefits and hands-on experience, the cost of the product, as well as transportation and application constraints can significantly hinder compost demand. In just about virgin market situations such as in Dar es Salaam or Karachi, good marketing programs go hand in hand with good quality compost production, and a strategy of demonstration of compost benefits and training of optimal compost use. Such a strategy will necessarily involve an initial phase of market development with little expected income, and thus need of sufficient funds to bridge this period of financial losses. Avoided collection and disposal costs, which would be paid if the organic matter was not composted, should be included in the financial calculations and compensated (even if only partly) by the solid waste management authorities.

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[1]partners in the project were: AGENDA in Dar es Salaam, Tanzania; Association Protection of Environment (APE) in Karachi, Pakistan; and the Dept. of Water and Sanitation in Developing Countries (SANDEC) at the Swiss Federal Institute of Environmental Science and Technology (EAWAG) in Duebendorf, Switzerland

[2]equals the ratio of compost production to input of organic waste.

[3]assuming 95% organic waste, and 25% compost production rate.

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