Urban Waste Management Strategy
Abstract

Our current lifestyle and activities are producing vast quantities of waste. Growing environmental awareness, restricted finances and a declining abundance of natural resources is demanding a change in waste disposal practices.

This paper looks current waste management techniques via the inverted waste pyramid. The dimensions and levels of solid waste management (SWM) are discussed within an urban framework and the SWM matrix is introduced. SWM encompasses the social, political, technical, economical and administrative dimensions of waste management across all levels, i.e., from household to the entire nation. Finally, examples of small scale waste reduction initiatives are provided.
Introduction

A rising quality of life, and high rates of resource consumption patterns have had an unintended and negative impact on the urban environment - generation of wastes far beyond the handling capacities of urban governments and agencies. Cities are now grappling with the problems of high volumes of waste, the costs involved, the disposal technologies and methodologies, and the impact of wastes on the local and global environment.

But these problems have also provided a window of opportunity for cities to find solutions - involving the community and the private sector; involving innovative technologies and disposal methods; and involving behaviour changes and awareness raising. These issues have been amply demonstrated by good practices from many cities around the world.

There is a need for a complete rethinking of "waste" - to analyse if waste is indeed waste. A rethinking that calls for

WASTE to become WEALTH
REFUSE to become RESOURCE
TRASH to become CASH

There is a clear need for the current approach of waste disposal that is focused on municipalities and uses high energy/high technology, to move more towards waste processing and waste recycling (that involves public-private partnerships, aiming for eventual waste minimisation - driven at the community level, and using low energy/low technology resources. Some of the defining criteria for future waste minimisation programmes will include deeper community participation, understanding economic benefits/recovery of waste, focusing on life cycles (rather than end-of-pipe solutions), decentralised administration of waste, minimising environmental impacts, reconciling investment costs with long-term goals.

Most local governments and urban agencies have, time and again, identified solid waste as a major problem that has reached proportions requiring drastic measures. We can observe three key trends with respect to solid waste - increase in shear volume of waste generated by urban residents; change in the quality or make-up of waste generated; and the disposal method of waste collected, by land-fill, incineration etc.

It is critical to adopt a broad approach in developing a working framework for solid waste management (SWM). This covers the social, economic, technology, political and administrative dimensions. For example the social dimension of SWM involves waste minimisation; the economic dimension of SWM involves waste recycling; the technology dimension of SWM involves waste disposal; and the political and administrative dimensions cuts across all the three issues of minimisation, recycling and disposal.

Figure 1 - Solid Waste Management Dimensions

<table>
<thead>
<tr>
<th>Waste Minimisation</th>
<th>Waste Recycling</th>
<th>Waste Disposal</th>
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<tbody>
<tr>
<td>« … SOCIAL … »</td>
<td>« … ECONOMIC … »</td>
<td>« … TECHNOLOGY … »</td>
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<td>« … … POLITICAL … … »</td>
<td>« … ADMINISTRATIVE … … »</td>
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But SWM is not an isolated phenomena that can be easily compartmentalised and solved with innovative technology or engineering. It is particularly an urban issue that is closely related, directly or indirectly, to a number of issues such as urban lifestyles, resource consumption patterns, jobs and income levels, and other socio-economic and cultural issues. All these issues have to be brought together on a common platform in order to ensure a long-term solution to urban waste.

Traditionally, urban solid wastes are managed in a hierarchy that looks like an inverted pyramid shown below (Figure 2). At the broad top is landfill, which is a macro solution applied at the level of the city. Very little of the waste is processed or treated in any way, and has a maximum impact on the environment.

At the narrow bottom of the inverted pyramid is waste minimisation at source. This is a micro solution to waste management, applied at the level of an individual and household, or a business/industry - at the place where the waste is actually generated. Here a conscious effort is made to reduce the amount of waste generated - indeed to avoid situations where waste is generated. The impacts and effects on the environment at this level are minimal.

Ranged in-between the two extremes are other means of waste management - from incineration (with or without energy recovery) to recycle and reuse. It is interesting to note that each level of this hierarchy has been subject to innovative solutions to reduce their impact on the environment, particularly at the upper levels of the pyramid. Methane recovery, wastewater management, energy recovery and generation, recycled and secondary products from wastes - for example fly-ash cement from incinerators etc. are some of the approaches adopted.

**Figure 2 - Inverted Waste Pyramid**

A second aspect to note is the technical inputs needed increases at the upper levels of the pyramid, than at the lower level. Also, the degree of partnerships needed varies along the pyramid. At the upper levels, it is almost the exclusive purview of local governments, with little inputs from other stakeholders. The bottom of the pyramid derives maximum inputs from a range of stakeholders - where everyone has a role to play.
The Inverted Waste Pyramid provides a big picture in the solid waste management process, and helps in understanding the different inputs and advantages/disadvantages of each level. There is a whole culture of waste management that needs to be put in place - from the micro-level of household and neighbourhood to the macro levels of city, state and nation. The general assumption is that SWM should be done at the city-level, and as a result, solutions tried out have been essentially end-of-pipe ('End-of-pipe' refers to finding solutions to a problem at the final stage of its cycle of causes and effects. In the case of urban waste, it means focusing on waste disposal rather than waste recycling or waste minimisation). But this approach essentially misses the forest for the trees, in attempting piece-meal and ad hoc solutions to waste problems, instead of taking a long-term holistic approach.

In reality there are a number of critical actions the need to be taken at each of the levels of household, neighbourhood, city and nation. Action to be taken can have social, technology, economic, political or administrative dimensions.

It is important that the right decision/action be taken/carried out at the right level. Thus, action at the household level are predominantly social, technology and economic in nature. Similarly action to be taken at the state and nation level are predominantly economic, political and administrative in nature. Action at the neighbourhood and city levels cuts across all five themes.

The matrix (see Figure 3) that links the dimensions of decision-making (social, technology, economic, political and administrative) with the levels of decision-making (household, neighbourhood, city, and nation) - helps in categorising the decisions, action and related activities to be undertaken.

**Figure 3 - The SWM Matrix**

<table>
<thead>
<tr>
<th>Dimensions and Levels of decision-making</th>
<th>Household</th>
<th>Neighbourhood</th>
<th>City</th>
<th>Nation</th>
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</thead>
<tbody>
<tr>
<td>Social</td>
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<td>Technology</td>
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<td>Political</td>
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<tr>
<td>Administrative</td>
<td>*</td>
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</tbody>
</table>

* = Focal areas for action

The above matrix was 'field-tested' during a training session in SWM for city government officials. During the session, city officials from Nepal, China, Philippines and Japan categorised the various SWM activities and actions in their cities within the matrix - allowing them to identify weak areas - the lacks, gaps and mismatches, in their policies, programmes and projects.
Four key issues emerge from the above discussion:

1. **The SWM Matrix**
   The advantage of the SWM matrix of scales and themes, is its essential simplicity - allowing for easy understanding and its adoption to various scales, and socio-political and cultural situations. Gaps in existing SWM programmes and initiatives can also be identified. The matrix helps in understanding the interrelationships and interconnectedness of the various issues involved.

2. **End-of-Pipe versus Life-Cycle**
   There is a gradual shift from 'end-of pipe' solutions that focus on waste disposal, to a source based approach that is aimed at 'life-cycle' analysis. This places the responsibility not only on households, but also in manufacturers and retail businesses. Greater awareness at the local and community level has forced businesses and industries to take a more environmentally friendly approach to their activities, including better management of the wastes that they produce, using a more holistic life-cycle assessment (LCA is a systematic set of procedures for compiling and examining the inputs and outputs of materials and energy and the associated environmental impacts directly attributable to the functioning of a product or service system throughout its life cycle).

3. **Community-Local Government Partnership**
   As a consequence of the above two points is the realisation that collection and processing of waste is not the exclusive domain of the local government - calling for a more comprehensive partnership between the community and local governments where each actor has a role to play towards waste minimisation, waste recycling and waste disposal.

4. **SWM and the Larger Urban Environment**
   As mentioned above, SWM is not an isolated, municipal problem that has to be 'done' by the local government. There is a need for a more comprehensive package of measures. Critical to this approach is to integrate SWM activities within the larger process of urban environmental management.
Initiatives for Source Separation and Urban Organic Waste Reuse

(Compiled by Dr. Chirs Furedy, Univ. of York)

The examples of actions for waste reduction noted here are not presented as success stories or "best practices," - these non-commercial examples are mostly very small-scale and dependent on international funds and volunteer work. They do, however, illustrate attempts to link waste reduction to: public-private partnerships, enterprise development, income generation, improved status of waste workers, consumer awareness and child education. The principles embodied in these efforts hold promise for local action for the reduction of solid wastes.

Most initiatives involve the separation and sale of common household materials, since these activities are usually "win-win" ones: householders make extra cash and waste traders get their raw materials, while employment is generated and quantities of solid wastes to be collected by the city authorities are reduced. Relatively little has been done to tackle the contamination of urban organic wastes, or to enable and improve customary reuse of decomposed wastes.

Ngo-Organised Neighbourhood Collection Systems Based on Source Separation, Sometimes Including Decentralised Composting or Vermi-Composting

These are largely projects of NGOs and community groups, often receiving some international assistance or advice. In the case of the Clean-Green Project in Metro Manila, households are asked to separate dry reusables and recyclables and sell these to registered and supervised buyers working for waste traders. This represents a revival of declining practices of sale from households.

In India, where the sale of superior materials is still extensive, some source separation projects aim to for wet-dry separation. Householders are given plastic bags or containers free or at low cost. Door-to-door collection is organised. Householders are asked to pay a small fee for this service. Street people or other unemployed persons are engaged for the collection, and given the right to sell the dry wastes. Bangalore has several groups working in this way: Clean Environ, Waste Wise (Mythri Foundation) and the Centre for Environmental Education. The Bangalore City Corporation has cooperated in allocating space in local parks for composting and vermi-composting. NGO projects for primary collection are in some cases encouraging source separation, for instance, some of the Civic Exnora groups in Madras and Ahmedabad, Rotary clubs in Bombay.

The numerous projects in India have inspired NGOs in places like Kathmandu. The Women's Environment Preservation Committee (WEPCO) in Lalitpur has waste reduction as its main objective. The group has obtained support from DANIDO for a pilot project on source separation and composting. It is already servicing 500 households with primary collection. Another NGO, Unnati Adhar Kendra, collects wastes from 200 households; the sweepers sort out the recyclables and sell them to waste traders and the organic waste is composted. The organisation sells 1200-1500 kg of compost monthly. This is not exactly separation at source; it is, rather, "sorting near to source."

Private or Municipal Compost Making at or Near Dump Sites

The Cau Dien plant, a government operation, is still functioning in Hanoi, although only at about 50% capacity. The Karnataka Compost Development Corporation operates the only plant still functioning (in an adapted low-tech manner) in India of those built in the mid-1970s. It obtains MSW free by an agreement with the Bangalore City Corporation. There are problems of quality control and marketing, but the business makes a profit and sells compost in three south Indian
states. Some vermi-composting is done to produce compost for sale in florists. Two more plants are planned for the Bangalore urban area. A private company in Bangalore - Terra Firma Biotechnics - is successfully marketing vermi-compost.

A frequently cited example of an expanding private enterprise is Excel Industries, now operating in several Indian cities. The company has processed compost from MSW obtained from dump sites without charge, by arrangement with municipal corporations in several cities. The company, which produces fertilizer has good marketing expertise.

**Assistance to Waste Dealers and Recycling Industries to Access More Recyclables (Ngo-Organised, with Some Government Support)**

Leonarda Comacho of the Metro Manila Council for the Women's Balikatan Movement (MMWBM) began working with waste traders in San Juan, Metro Manila in the 1980s. The traders (called junk shops) were assisted to form co-operatives and thus access business loans. MMWBM guided the traders in registering their buyers with the police, equipping them with uniforms as 'eco-aides,' and undertook neighbourhood awareness drives to link the traders with nearby sources of materials. International recognition of this initiative led to government support, initially from the President's Office. The Dept. of Trade and Industry and Dept. of Social Welfare and Development are preparing soft loans and livelihood assistance packages to enhance employment opportunities for eco-aides.

The Centre for Advanced Philippine Studies (CAPS), a consulting firm, created the Waste Management Resource and Information Centre in Manila in 1992. It has developed a computerised database of waste dealers, recyclers, resource persons and agencies. This systematic information has allowed dealers and manufacturers to link up for optimal trading. The database is also serves educational campaigns.

**Corporate Sector Support to Source Separation Initiatives [Bangalore, Ahmedabad, State Bank of India]**

The growing interest of corporations in sponsoring environmental improvement is providing funds to NGOs running source separation and primary collection schemes. In Bangalore, Bombay (Mumbai) and Ahmedabad, branches of national banks such as the State Bank of India, have provided collection carts and other equipment to projects of Centre for Environmental Education, Waste Wise and Civic Exnora.

In Java, the Indonesia Plastics Recycling Association (AIDUPI), formed in 1993, represents itself as "a forum for the plastics recycling industry and government to come together and develop joint strategies to deal with the social and environmental issues caused by plastic waste in Indonesia". The organisation is pressing for the coding of plastics, the separation of plastic wastes by generators, and has proposed to assist wastepicker co-operatives in collecting separated materials from households.

**Low-Tech Sorting Plants Drawing on Neighbourhoods Practising Source Separation**

Western-model sorting plants have not been successful in most cities, but there are now attempts to operate plants with more manual sorting and obtaining waste from neighbourhoods where households co-operate in more thorough separation of dry and wet wastes. One such experiment is in Santa Maria, Philippines.
School Separation and Composting Programs for Public Education

Many schools hold drives to gather recyclables to raise money for school programs. Where these are combined with education on waste problems, there is a potential for lasting impact at the household level. Composting of organics generated in schools, especially residential schools, is often combined with education. Examples are the Good Shepherd Convent and Miriam College in Manila. Malaysian city councils are encouraging Parents and Teachers Associations to form school "recycling societies".

Municipal Source Separation Programs in more Developed Cities

Apart from Japan and Korea, the only country where several local authorities have instituted source separation and collection programs is Malaysia. The record of successful extension of pilot projects is uneven, but Taiping Municipal Council has 10,000 households participating in separating glass, paper and metals since 1993 and Petaling Jaya has done extensive research and pilot work for an ambitious programme which includes school clubs organised by Parents and Teachers Associations, and separate collection by private contractors appointed by the municipal council.

Institutional Research and Promotion of Waste Reduction, Source Separation and Recycling

The Thai Packing Centre of the Thai Institute of Science and Technology Research is doing research on plastics to facilitate recycling, specifically on classification and coding systems. The Institute has produced numerous posters promoting separation and sale of household materials.

NGO-Based Public Campaigns for Awareness of Waste Problems (with Assistance from Aid Programs, Local Government, Corporate Sector)

The Magic Eyes campaign of the Thai Environment and Community Development Association in Bangkok has been very active in school programs related to recycling awareness. It has influenced the Bangkok Metropolitan Authority to promote recycling. The TECD approach of extensive corporate sponsorship has been adopted by environmental campaigns in some Latin American cities.

The Green Forum Philippines is advocating "back-to-the-bayong," bayong being the traditional shopping basket, to minimise the consumption of plastic shopping bags.
Suggested Web Resources

California Department of Conservation
http://agency.resource.ca.gov/

The Compost Resource Page
http://www.oldgrowth.org/compost/

Enviro$en$e
http://es.inel.gov/index.html

Association of Cities for Recycling
http://www.acr.be/default.htm

Air and Waste Management
http://www.awma.org/

Internet Consumer Recycling Guide
http://www.best.com/~dillon/recycle

National Materials Exchange Network
http://www.earthcycle.com/g/p/earthcycle/

Energy and Environmental Resource Center
http://www.eerc.und.nodak.edu/new/waste.htm

Global Recycling Network
http://www.grn.com

Green Plan Center
http://www.rri.org/

The Malta Institute Of Wastes Management
http://www.synapse.net.mt/miwm/

European Recycling
http://www.tecweb.com/recycle/eurorec.htm

The Recycling Council of Ontario
http://www.web.apc.org/rco
The UNEP - DTIE International Environmental Technology Centre

Established in April 1994, the International Environmental Technology Centre (IETC) is an integral part of the Division of Technology, Industry and Economics (DTIE) of the United Nations Environment Programme (UNEP). It has offices at two locations in Japan - Osaka and Shiga.

The Centre's main function is to promote the application of Environmentally Sound Technologies (ESTs) in developing countries and countries with economies in transition. IETC pays specific attention to urban problems, such as sewage, air pollution, solid waste, noise, and to the management of fresh water basins.

IETC is supported in its operations by two Japanese foundations: The Global Environment Centre Foundation (GEC), which is based in Osaka and handles urban environmental problems; and the International Lake Environment Committee Foundation (ILEC), which is located in Shiga Prefecture and contributes accumulated knowledge on sustainable management of fresh water resources.

IETC's mandate is based on Agenda 21, which came out of the UNCED process. Consequently IETC pursues a result-oriented work plan revolving around three issues, namely: (1) Improving access to information on ESTs; (2) Fostering technology cooperation, partnerships, adoption and use of ESTs; and (3) Building endogenous capacity.

IETC has secured specific results that have established it as a Centre of Excellence in its areas of specialty. Its products include: an overview on existing information sources for ESTs; a database of information on ESTs; a regular newsletter, a technical publication series and other media materials creating public awareness and disseminating information on ESTs; Local Agenda 21 documents developed for selected cities in collaboration with the UNCHS (Habitat)/UNEP Sustainable Cities Programme (SCP); training needs assessment surveys in the field of decision-making on technology transfer and management of ESTs; design and implementation of pilot training programmes for adoption, application and operation of ESTs; training materials for technology management of large cities and fresh water basins; and others.

The Centre coordinates its activities with substantive organisations within the UN system. IETC also seeks partnerships with international and bilateral finance institutions, technical assistance organisations, the private, academic and non-governmental sectors, foundations and corporations.

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