CHAPTER 5 – MUNICIPAL SOLID WASTE MANAGEMENT: TURNING WASTE INTO RESOURCES

To Establish an Ecological Civilization Oriented toward the Future

Cities should respect nature, consider the urban ecological environment as an asset, integrate environmental issues into urban planning and administration, and accelerate the transition to sustainable development. They should promote the use of renewable energy sources and build low-carbon eco-cities. They should strongly advocate for conservation of resources and promote environment-friendly manufacturing. Cities and their citizens should join together to create sustainable lifestyles and an ecological civilization in which people and environment co-exist in harmony.

Shanghai Declaration on Better Cities, Better Life

INTRODUCTION[1]

Cities are at the nexus of a further threat to the environment, namely the production of an increasing quantity and complexity of wastes. The estimated quantity of Municipal Solid Waste (MSW) generated worldwide is 1.7 – 1.9 billion metric tons.[2] In many cases, municipal wastes are not well managed in developing countries, as cities and municipalities cannot cope with the accelerated pace of waste production. Waste collection rates are often lower than 70 per cent in low-income countries. More than 50 per cent of the collected waste is often disposed of through uncontrolled landfilling and about 15 per cent is processed through unsafe and informal recycling.[3]

[1] This chapter was authored by Prasad Modak, with valuable input and contributions from Yang Jiemian, Yu Hongyuan and Choudhury Rudra Mohanty.

[2] UNEP (2010). Framework of global partnership on waste management, Note by Secretariat, http://www.unep.or.jp/Ietc/SPC/news-nov10/3_FrameworkOfGPWM.pdf

[3] Chalmin P. and Gaillochet C. (2009). From waste to resource, An abstract of world waste survey, Cyclope, Veolia Environmental Services, Edition Economica, France.

As a Mayor, you may have to face challenging waste management decisions addressing issues that require immediate attention as well as potential issues that require strategic and integrated planning and implementation.

Establishing and improving facilities for collection, recycling, treatment and disposal for MSW management can be very costly. For example, building and operating sanitary landfills and incineration plants require huge investments and incur substantial operation and maintenance costs. Furthermore, it is becoming increasingly difficult to find suitable locations for waste treatment facilities due to the prevalence of the Not In My Backyard (NIMBY) attitude amongst communities. Meanwhile, if waste is growing at 3-5 per cent a year and rural-urban migration increases a city's population at a similar rate, then a city's waste generation will double every 10 years.[4]

Urban managers are therefore encouraged to pursue the paths of Integrated Solid Waste Management (ISWM) and Reduce, Reuse and Recycle (3Rs) that place highest priority on waste prevention, waste reduction, and waste recycling instead of just trying to cope with ever-increasing amounts of waste through treatment and disposal. Such efforts will help cities to reduce the financial burden on city authorities for waste management, as well as reduce the pressure on landfill requirements.

We live in a world of increasing scarcity. Raw materials from natural resources are limited, financial resources are often insufficient, and securing land for final disposal is getting more difficult. Clearly, city authorities should set policy directions aiming for resource efficient, recycle-based society if they are to provide a clean, healthy and pleasant living environment to its citizens for current and future generations.

Although waste management responsibilities primarily lie with cities and municipalities, many of the successful cases in waste management involve a wide range of stakeholders in their implementation, as can be seen in the case studies cited here. This gives a clear message to cities and municipalities that they should not try to do everything by themselves. Rather, the key to success is to do what they are good at, and collaborate with other sectors in the society, such as private sector, communities and in some cases

[4] UN-HABITAT (2009). Solid Waste Management in the World's Cities: Pre-Publication Series, UN-HABITAT, Nairobi

with the informal sector, in the interest of expanding waste management services and improving efficiency and effectiveness.

1. ISSUES AND CHALLENGES

City leaders are faced with several challenges in their effort to streamline waste management services. A few of the pressing issues include rapidly increasing quantities and diverse characteristics of waste, the undesirable consequences of conventional methods of waste management, and failure to tap the resource value of waste.

1.1 RAPID INCREASE IN VOLUMES AND CHANGING CHARACTERISTICS OF MUNICIPAL SOLID WASTE – A GLOBAL TREND

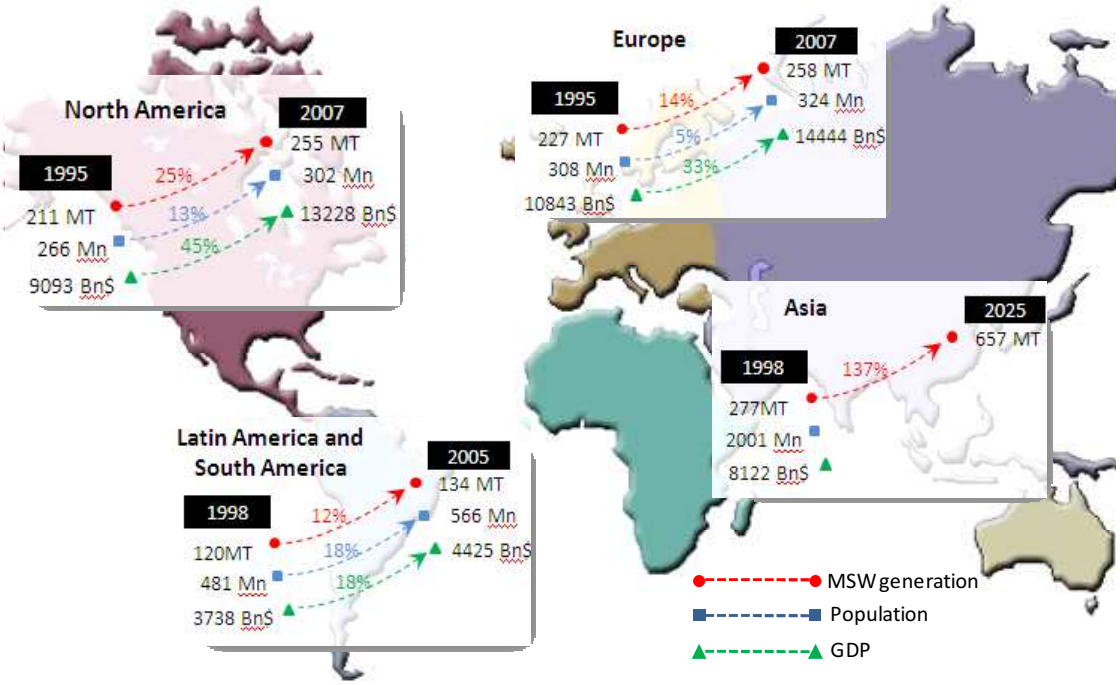
There is an overall correlation between the generation of MSW, wealth (Gross Domestic Product, GDP per capita) and urbanization[5]. Future projections estimate that the world's waste production could reach up to 27 billion tons by 2050, a third of which may be generated in Asia, with a significant percentage of that being produced in large economies such as China and India. Figure 1 shows the correlation between MSW generation, population and GDP across the world and the expected rise in generation of MSW in Asia as projected by the World Bank.[6]

The types of MSW produced change according to the standard of living in the city. Wastes generated in low- and middle- income cities have a large proportion of organic waste, whereas the wastes in high-income cities are more diversified with relatively larger shares of plastics and paper (Figure 2). The changing composition of waste in turn influences the choice of technology and waste management infrastructure, and underscores the importance of waste separation.

5 Veolia Environmental Services (2006). From Waste to Resource. An Abstract of "2006 World Waste Survey." http://veoliaes.com/resource.php?id=566 (last accessed 15 July 2010)

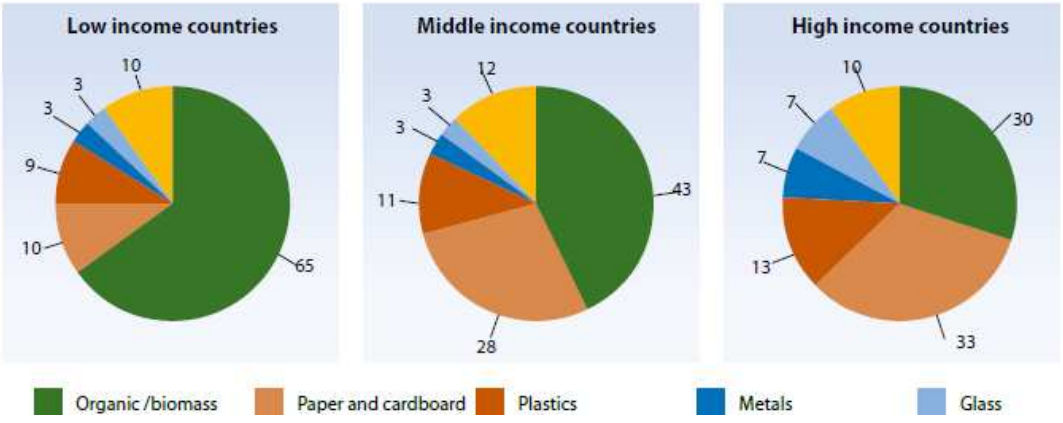
6 World Bank (2005). Waste Management in China: Issues and Recommendations, May 2005. www.go.worldbank.org/2H0VMO7ZG0

Figure 5.1. Correlation between MSW Generation, Population and GDP



Source: Modak (2011)[7]

Figure 5.2. MSW Composition in Relation to the Relative Wealth of the Countries



Source: UNEP (2011)[8]

7 Modak P. (2011). Synergizing Resource Efficiency with Informal Sector towards Sustainable Waste Management, Building Partnerships for Moving Towards Zero Waste, A Side Event for CSD19 held on 12 May 2011, Tokyo

Electrical and electronic wastes (e-waste) are rapidly growing forms of waste that are generating much concern. In 2005, 20 to 50 million tonnes of e-waste were generated worldwide, and by 2020, e-waste from used computers in emerging economies like South Africa, China and India will have increased by 200-500 per cent over 2007 levels.[9] E-wastes contain metals such as mercury, cadmium and lead that may leach into the environment and pose a health hazard to human beings, unless handled with care. Numerous cases have been reported where informal sector workers are engaged in dismantling used electrical and electronic equipment in order to recover metals, plastics and other materials for recycling, often without proper protection, exposing them to severe health risks.

Other types of waste streams of concern in the context of an urban lifestyle are construction and demolition waste and end-of-life vehicles. For example, about 10-15 per cent of waste generated in developed countries is due to construction and demolition activity,[10] while discarded vehicles generated in Germany, United Kingdom, France, Spain and Italy are responsible for approximately 75 per cent of waste generated in the European Union (EU-25).[11]

While facing the increased volumes and diverse characteristics of MSW that come with economic growth, cities responsible for urban waste management are struggling to handle the MSW produced in their jurisdictions. In developing countries, 20-50 per cent of the recurring budget of municipalities is often spent on solid waste management, although often only 50 per cent of the urban population is covered by these services. In low-income countries, collection alone drains 80-90 per cent of total waste management budgets. Open dumps and open burning continue to be the primary method of MSW disposal in most developing countries.[12] Figure 3 shows the waste management practices followed by the different parts of the world.

8 UNEP (2011), Waste – Investing in resource and energy efficiency, Towards a Green Economy, www.unep.org/greeneconomy/P ortals/88/documents/ger/GER_8_Waste.pdf

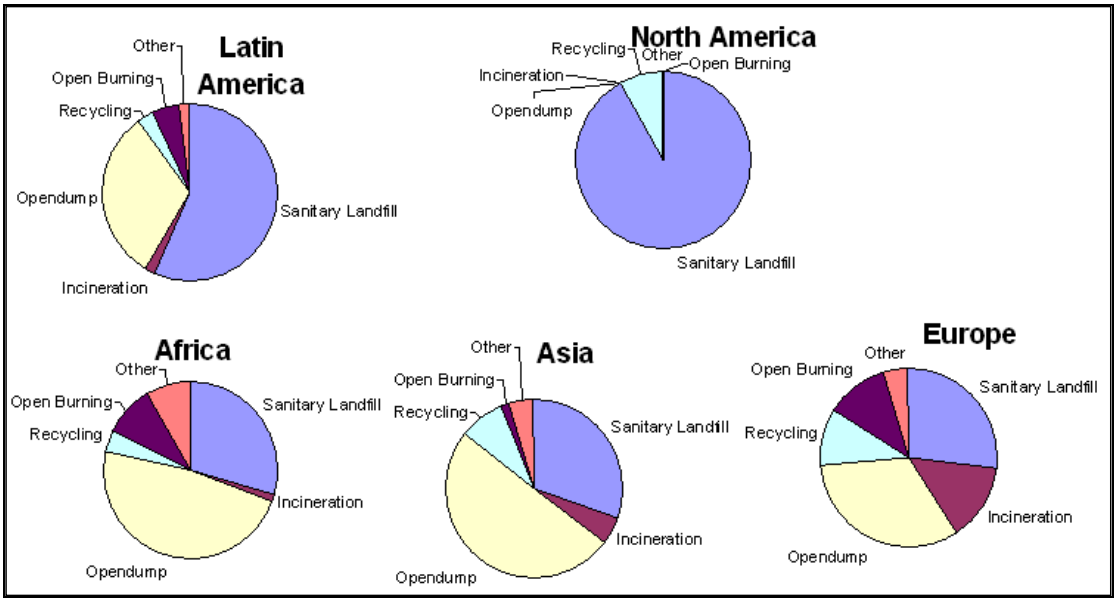
9 UNEP (2005). E-waste, the hidden side of IT equipment's manufacturing and use, Environmental Alert Bulletin, http://www.grid.unep.ch/product/publication/download/ew_ewaste.en.pdf

10 Bournay E. (2006). Vital waste graphic 2, Volume 2, Basel Convention, UNEP and GRID-Arendal, Second edition, http://www.grida.no/_res/site/File/publications/vital-waste2/VWG2_p32and33.pdf

11 Eurostat (2010). End-of-life vehicles (ELVs), Reuse and Recovery rate, last updated on 16.04.2010, http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/wastestreams/elvs

12 Chandak, S. P. (2010). Trends in Solid Waste Management – Issues, Challenges, and Opportunities presented at the International Consultative Meeting on Expanding Waste Management Services in Developing Countries, 18-19 March 2010, Tokyo, Japan.

Figure 5.3: Waste Management Practices in Different Parts of the World



Source: Adapted from Chandak (2010)[13]

1.2. CONSEQUENCES OF CONVENTIONAL WASTE MANAGEMENT

Conventional waste management focuses largely on waste collection, treatment (composting and incineration) and disposal (landfills). Only limited attempts are made to adopt integrated waste management practices that involve waste reduction at the source, resource recovery and recycling. The resource value of waste cannot be realized unless separation of wastes is practised effectively at the source.

Meanwhile, in many cities in developing countries, collection rates remain low and the quality of collection services are poor. Waste collection services are generally non-existent in poorer neighbourhoods such as slums. While there are some successful examples where the private sector and communities are involved in waste management services, in many cities of developing countries, involvement of these segments of society is still very limited. The wastes collected typically end up in open dumps, where they may be burnt,

[13] Chandak S. P. (2010). Trends in Solid Waste Management – Issues, Challenges, and Opportunities presented at the International Consultative Meeting on Expanding Waste Management Services in Developing Countries, 18-19 March 2010, Tokyo, Japan.

and in some cases are deposited in illegal dumping sites.

A paradigm shift from conventional waste management practices to Integrated Solid Waste Management (ISWM) is essential for cities in order to effectively manage the waste stream. ISWM is a comprehensive waste prevention, recycling, composting, and disposal programme. An effective ISWM system considers how to prevent, recycle, and manage solid waste in ways that most effectively protect human health and the environment. ISWM involves evaluating local needs and conditions, and then selecting and combining the most appropriate waste management activities for those conditions. As a consequence of conventional waste management practices, many cities in developing countries are facing environmental and health risks as well as losing economic opportunities in terms of the resource value of the waste. Box 1 describes the opportunities of adopting ISWM as against conventional waste management practices and Box 2 highlights the health risks for waste pickers and communities due to conventional waste management practices.

Box 5.1: Conventional Waste Management Versus Integrated Solid Waste Management

Risks due to Conventional Waste Management	**Opportunities from Integrated Solid Waste Management**
• Poor efficiencies, undesirable health impacts (such as vector-borne diseases), environmental problems (such as deterioration of ground water quality due leachate contamination) and social issues (such as informal communities working in unsafe conditions) due to centralized approach to waste management • Developmental activities and consumption driven lifestyles leading to increased generation of waste Valuable resources go unutilized • No extensions towards innovation and creation of safe jobs • Fails to involve all stakeholders , particularly neglecting the contribution of communities and private sector participation • Health hazards to waste workers and prevalence of social evils like child labour • No attention given to other newer waste streams for special handling as well as recovering resources	• Combination of centralized and decentralized options with effective pollution control systems (such as leachate treatment and gas capture systems) leading to economic gains due to improved efficiency, overall cost reduction, minimal environmental impacts and social acceptance. • Strategically planned waste minimization and green procurement programmes leading to more sustainable consumption patterns along with economic development • Facilitates recycling of valuable resources such as plastic, glass, paper and metals, recovery of alternate energy sources such as Refuse Derived Fuel (RDF) from high-calorific value fraction of waste, recovery of biogas or compost from biodegradable waste • Encourages innovative technology development in newer areas such as waste to energy and recycling and promotes green jobs that ensure safe working conditions • Ensures multi-stakeholder participation in decision-making process by involving Non-Governmental Organization (NGOs), Community Based Organization (CBOs), rag pickers, private sector, residential and commercial communities with the government • .Brings waste workers into the formal economy and providing them with safe working conditions • Addresses management of both MSW and other newer waste streams such as e-waste, construction waste and scrapped vehicles.

Box 5.2: Health Risks for Waste Pickers and Communities

Risks to Waste Pickers

Informal waste pickers, who most often operate without any protective measures, are exposed to a wide range of health risks such as:

- HIV (due to handling of hospital waste)
- Tetanus (due to handling of jagged metals)
- Respiratory problems (due to exposure to smoke)
- Neural damage (due to lead)
- Injuries
- Premature drinking
- Stress
- Skin and gastric problems

Risks to the Communities

- There is a significant increase in the incidence of sickness among children who live in households where garbage is dumped or burned in the yard.
- Uncollected solid waste clogs drains and causes flooding and subsequent water-borne diseases.
- People living downwind of a burning dumpsite will likely suffer from respiratory diseases.
- Contaminated liquids or leachate, leaking from dumpsite could pollute city's drinking water supplies.
- Waste dumps potentially serve as breeding ground for Malaria, thus having implications in achieving Millennium Development Goals (MDGs).

Source: Gunn, S. (2009),[14] UN-HABITAT (2009),[15] with modifications.

1.3. WASTES NOT BEING VIEWED AS "RESOURCES"

City leaders should try to encourage a fundamental change in mindsets and attitudes toward waste. Public information campaigns need to encourage urban populations to help reduce the waste stream and to turn what used to be considered as "waste" into "resources."

- Link between "waste" and "resource":

  Resources can be recovered from waste if they are separated at the source, and are treated properly (see Table 1, Figure 4 and 5).

[14] Gunn, S. (2009). Health and Labour Considerations are an Integral Part of 3R Promotion! presented at the Inaugural Meeting of the Regional 3R Forum in Asia in November 2009 in Tokyo, Japan

[15] UN-HABITAT (2009). Solid Waste Management in the World's Cities: Pre-Publication Series. UN-HABITAT, Nairobi

- Significance of "upstream resource management":

  Equal or higher emphasis should be given to "upstream" resource management and waste reduction efforts, as compared to "downstream" waste management options such as treatment and disposal (Figure 6).

- Resource efficiency and circular economy:

  By reducing production of wastes, and by maximising the use of reusable and recyclable materials, a city can achieve greater resource efficiency. In other words, smaller amounts of physical resources could produce the same amount of products or services while generating less waste, as in the case of a closed loop economy. (Figure 7).

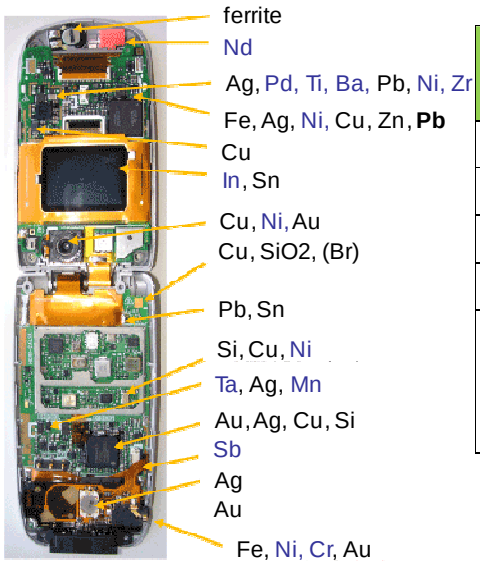
Table 5.1: Wastes and their Recycling Potential

Type of waste	Recycled products	Recycling potential
Biomass	Composts	Future of compost depends on its environmental and agronomic quality and the dynamism of its market.
Paper and cardboard	Recovered paper (recycled paper)	Increasing demand in Asia, particularly in PRC.
Plastics	Recovered plastics	Increasingly stringent regulations and growing demand for recovered plastics in Asia, favoring development and internationalization of this market. Cost of collection system and volatile prices are limiting factors.
Ferrous Metals	Steel	In 2004, world production of scrap metal rose to 450Mt and consumption reached 405.5Mt. Can be recovered from MSW, construction waste, etc.
E-wastes	Recoverable materials	Estimated that 10million computers contain 135,000 metric tons of recoverable materials, such as base metals, silicon, glass, plastic, and precious metals.

Source: ADB and IGES (2008),[16] with modifications.

[16] ADB and IGES (2008). Toward Resource-Efficient Economics in Asia and the Pacific: Reduce Reuse Recycle. Asian Development Bank, Manila

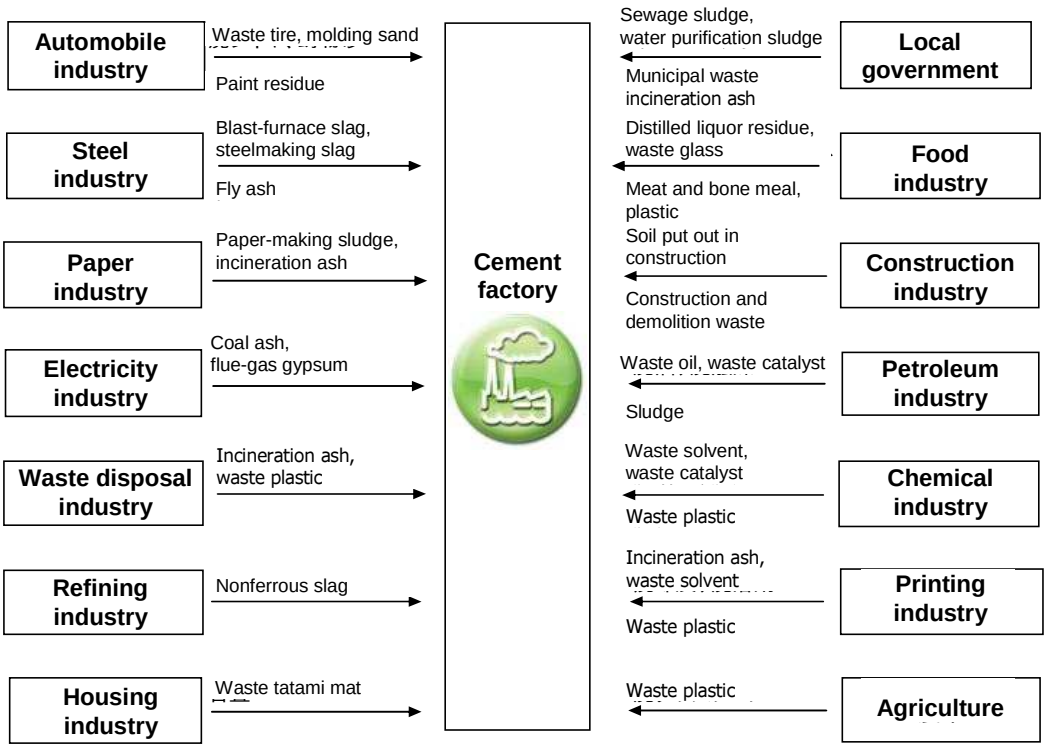
Figure 5.4: Valuable Metals That Could be Recovered from a Mobile Phone



Quantity of Non-ferrous Metals Included in One Mobile Phone (Unit: g)	
Gold	0.028
Silver	0.189
Copper	13.71
Palladium	0.014
Source: http://www.rieti.go.jp/jp/events/bbl/05060701.html	

Source: DOWA Eco-System Co., Ltd, http://www.coden.jp/rare-metal/use.html,

Figure 5.5: Effective Utilization of Waste and By-product Leveraging In a Cement Factory



Source: Sameshima (2009),[17] with modifications.

There are a number of reasons why cities should aim to improve resource efficiency in the local economy. From an environmental point of view, efficient use of resources can lessen environmental burdens at local level, such as urban air/water pollution, floods induced by solid waste clogging drainage canals, reduced availability and quality of freshwater supplies, and land degradation. High pollution levels, which may put public health at risk and translate into economic costs, can be reduced. From a global perspective, efficiency measures can greatly reduce green house gas (GHG) emissions from energy generation and use, materials extraction and processing, transportation, and waste disposal. This means that cities and countries that excel in resource efficiency could take advantages of win-win solutions to meet international obligations on climate change. Resource efficiency also contributes to improving energy security. Dependence on fossil fuel and inefficient use of energy supplies can expose cities to price and supply fluctuations. Cities can dampen their demand for oil, electricity and natural gas by implementing energy efficiency measures and thus insulate themselves from fossil fuel supply risks.

Figure 5.6: "Reduce" at Various Stages of Product Lifecycle

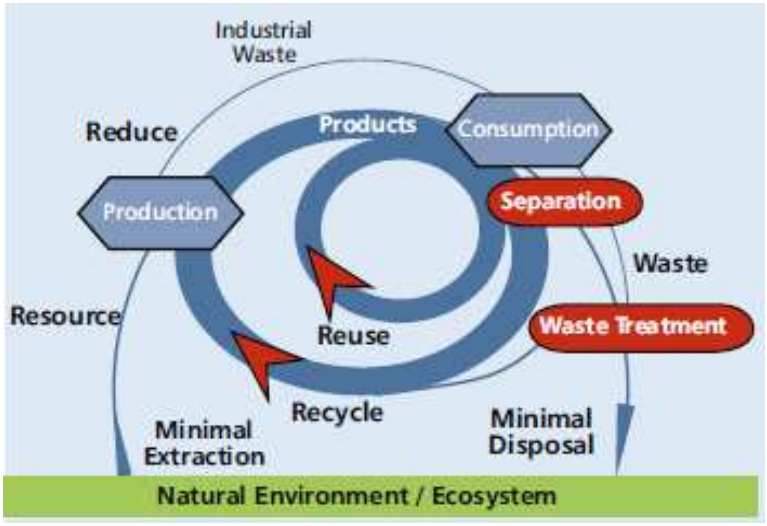
Upstream	Development and Production	• Resource-saving design	Reducing size/thinning of parts, using recycled materials
		• Long-life design	Adopting durable materials and structures, upgradeable design
		• Resource-saving production system	Reduce byproducts and losses, promote reuse
	Distribution and Sales	• Reduction of packaging materials in logistics	Use of returnable containers
		• Servisizing (Product Service System)	Shifting from selling "products" to services that provide "functions"
		• Avoid excessive packaging	Reduce plastic bags, promote simple packaging, selling by measure
	Purchase and Use	•Purchase only the essential goods	Promote 4Rs, including "Refuse"
		• Long use of products	Extend life of product by repair and maintenance
		• Wise use of second hand goods	Flea market, recycling shops
		• Sharing	Sharing cars, equipments
		• Recycling, reduction of wastes	Composting of organic wastes, at-source waste separation
Down-stream	Disposal	• Charging waste treating cost	Promote reduction of waste by introducing economic incentives

Lifecycle of the product

[17] Sameshima, F. (2009). Activities of Nippon Keidanren for Creating a Recycling Society presented at the Inaugural Meeting of the Regional 3R Forum in Asia in November 2009 in Tokyo

Source: Takada, Tanaka and Souma (2006)[18]

Figure 5.7: The Closed-Loop Economy[19]



One aspect that tends to be overlooked is the economic competitiveness that can be enhanced with resource efficiency. In view of the long-term upward trend and volatility of commodity prices, resource efficiency has become a major factor that determines the competitiveness of firms, cities and countries. Many profitable new business opportunities are available both in input-efficient production and in environmentally responsible recycling and waste disposal. Meanwhile, cities should also be mindful of the fact that over-reliance on conventional waste collection, treatment and disposal is not sustainable and it is too costly. Waste management should be designed and planned in a holistic, integrated way on the principles of ISWM and practices of 3Rs, with disposal

[18] Takada, K., Tanaka, T., and Souma, T. (2006). Reduce no sokojikara (The Real Strength of "Reduce") in Nikkei Ecology 2006.4: 38-53

[19] ADB and IGES (2008). Toward Resource-Efficient Economics in Asia and the Pacific: Reduce Reuse Recycle. Asian Development Bank, Manila

being just the last resort or least preferred option.

From the social perspective, developing countries can benefit from viewing the environmental technology industry as a potential source of employment or "green jobs" and long-term asset protection. The number of people involved in waste management in both formal and informal sectors is a significant number. Providing a better occupational environment and protective measures, and by formalising the informal sector workers, cities can contribute in a meaningful way to raising the living standards of its citizens. Improved resource efficiency could also lessen potential pressures and avoid root causes of social conflicts that could arise from resource competition.

2. POLICY OPTIONS FOR URBAN SOLID WASTE MANAGEMENT

City leaders are faced with a decision for the future. Either they continue with conventional methods of waste management and face the resulting impacts, or they pursue an alternative path that attempts to prevent problems by adopting ISWM and 3Rs. To work towards the transition to more sustainable cities, city leaders should first address the existing problem by reorganizing allotment of municipal budgets to upgrade waste infrastructure and services.

The lack of an adequate policy and regulatory framework complicates matters even further. Experience has shown that the command and control approach alone cannot and will not improve waste management practices. Command and control should be supplemented by market based instruments with incentives and disincentives so as to stimulate investments and entrepreneurship to transform waste management into an environmentally sound and socially acceptable business.

Some countries lack regulations on certain waste streams such as e-waste and construction waste. Certain countries (for example Brazil and India) that do not have formal infrastructures for recyclables collection, have only recently started legally recognizing the huge numbers of waste pickers who perform such a crucial service for the sector. By doing so, they are not only protecting and empowering the poor, but are also proceeding towards meeting relevant MDGs.

Therefore, cities should adopt appropriate policy options to work towards long term goals and provide an enabling framework to promote ISWM.

2.1 DEVELOPING MEANINGFUL PARTNERSHIPS WITH PRIVATE SECTOR, INFORMAL WORKERS AND COMMUNITIES FOR EFFECTIVE IMPLEMENTATION OF ISWM AND 3RS

A critical deficiency in waste management infrastructure has been a serious problem for many city leaders. Depending on the circumstances, a centralized approach necessitating the use of common waste management infrastructure and/or decentralized waste management infrastructure should be chosen. Public Private Partnerships (PPPs) could help implement waste management infrastructure projects that can not be financed wholly by the city leaders. For waste related infrastructure to be "accepted" by communities, it is critical to engage with the communities from the outset, to determine their needs and address their concerns with such projects. Further, preconditions such as capital investments, future financial sustainability and institutional mechanisms should also be satisfied so as to ensure the proper maintenance and functioning of these facilities. Additionally, the need for "resource management infrastructure" will assume added significance in the future. Examples of such infrastructure could include for example, product disassembly and recycling depots.

In order to capitalize on the experience and knowledge of informal waste pickers, it is important to formalize and organize them and involve existing waste recycling cooperatives and waste-picker associations in the recycling activities (see Case Studies 1 and 2). Once formalized, the waste pickers would receive required health-care, social security, safety equipment and dignity during their work. Micro-finance could also be provided to support entrepreneurship and recognize innovation.

Businesses in a city can come together to set up Eco Industrial Parks, where they can achieve enhanced environmental and economic performance through joint management of environmental and resource issues including energy, water, and materials. City leaders should also strengthen institutional capacity for skill development and awareness-raising. Some examples of the application of this strategy include funding institutions for research into environmentally sound and safe disposal of healthcare waste, mining of landfills, additional study into reverse logistics and closed loop supply chain processes for resources management, and so on.

It is also increasingly evident that waste, as a sector, assumes an added complexity given the various stakeholders which are part of it. Apart from city leaders, the waste sector

includes a range of other key stakeholders such as waste generators, industry, financing institutions, national governments and regulators, waste technology providers, academia, NGOs, community based organizations, international finance institutions and United Nations entities. Therefore, perfecting the "right" balance with the needs and aspirations of all stakeholders becomes quite challenging. See Box 3 on recently launched International Partnership for Expanding Waste Management Services of Local Authorities (IPLA) that brings together stakeholders associated with waste management on a common platform for networking and knowledge sharing. IPLA is a dynamic platform for exchange of knowledge across multiple stakeholders for putting ISWM and 3Rs into practice.

2.2 REDUCING MSW AND AIMING FOR "ZERO WASTE"

Policy instruments such as "volume based fees" for solid waste collection could lead to reduction of MSW generation. For example, effective implementation of volume based fees in Korea led to a 21.5 per cent reduction of MSW generation from 1994 to 2009.[21]

Cities striving to reduce their wastes should set clear indicators or quantifiable measurements that reflect the performance of the cities with regard to solid waste management. Indicators should be compared against targets in order to gain a reference point for whether the action being assessed was successfully implemented and to what degree. Some examples of indicators include resource efficiency, recycling rates and amount of waste landfilled.

[21] Ministry of Environment (2010), Republic of Korea, Annual Report of Volume Based Waste Fee.

Box 5.3. International Partnership for Expanding Waste Management Services of Local Authorities (IPLA)

IPLA is an international waste management network created to address the gaps in urban waste management due to weak capacities of City leaders. IPLA has been created to enable networking the City leaders across the world, stressing on the link between waste and resources and aiming to connect all key stakeholders through knowledge networks following the principles of ISWM and 3Rs.

The mission of IPLA is "to share knowledge, communicate across national boundaries and work to spread best practice in order to accelerate the uptake of waste-related infrastructure and services at various stages of waste management such as avoidance, prevention, minimization, separation, collection, transport, recycling, recovery, reuse treatment, and disposal".

IPLA was endorsed at the CSD-19 Intersessional Conference on Building Partnerships for Moving Towards Zero Waste held on 16-18 Feb 2011 in Tokyo, Japan. The Asian Institute of Technology in Thailand was chosen to be its global secretariat. Since its launch at CSD-19, there has been a worldwide expression of strong interest to join IPLA. More than one hundred partners, including cities and local governments, have officially registered with IPLA.

For further information, visit http://www.uncrd.or.jp/env/ipla/index.htm

2.3 INCREASING REUSE AND RECYCLING OF RESOURCES

Cities should strive to reconfigure businesses and infrastructure to deliver better returns on natural, human and economic capital investments, while at the same time reducing GHGs, extracting and using less natural resources, creating less waste and reducing social disparities. By promoting reuse and recycling of resources to displace virgin inputs for manufacture of a product, city leaders can ensure resource savings (see Case Study 3). Citizens have an important role to play in separating waste at the source in order to facilitate collection of waste streams. It is important to promote recycling businesses as they have also long been known to be a substantial job provider to various sections of society. Reducing generation, promoting reuse and recycling of wastes reflects the concept of balancing environmental conservation and economic growth through the effective use

of resources. City leaders should enforce market instruments such Extended Producer Responsibility (highlighted in Case Study 3) to ensure that producers take responsibility for recycling products. The rates of recycling in cities can be increased by establishing recycling facilities in collaboration with the private sector**.**

2.4 EFFECTIVELY MANAGING SPECIFIC TYPES OF WASTE STREAMS SUCH AS ORGANIC WASTE, E-WASTE, CONSTRUCTION WASTE AND END-OF-LIFE VEHICLES

Policies should address special waste streams such as organic waste, construction and demolition waste, e-waste and end-of-life vehicles. City leaders need to adopt specific acts and regulations with strong enforcement mechanisms to govern their end-use. Waste streams that require urgent attention such as non-biodegradable waste should be identified and measures should be taken to put the appropriate technology in place to manage them and derive economic value. In the case of organic waste streams that constitute a major portion of MSW, subsidies may be offered for adopting proven locally available technologies (see Case Study 4). Special attention should be given to waste management in slums and other low-income areas and disaster-prone regions. Policies should address upstream challenges that can help support effective management downstream. For example, with growing emphasis on the green economy, sustainable production and resource efficiency, new improved forms of technology will be required to allow for sustainable design. Design for Sustainability (DfS), Eco-Design, Design for Environment (DfE) and Design for Disassembly (DfD) all refer to an approach to design, manufacture, use and disassembly that allows for easy recyclability of used products, thereby widening the scope of materials suitable for recycling. This would be included under a comprehensive policy framework encouraging reuse and recycling of special waste streams as resources.

2.5 EXPLORING RISKS AND OPPORTUNITIES DUE TO CLIMATE CHANGE AND THE CLEAN DEVELOPMENT MECHANISM

City leaders should start recognizing risks to the waste sector from climate change and also capitalize on opportunities arising from climate change for the sector. It is important to identify and implement mitigation and adaptation measures to combat risks to the sector due to climate change impacts such as floods and proliferation of disease vectors

The waste sector is a significant contributor to GHG emissions accountable for

approximately 5 per cent of the global greenhouse budget with total emissions of approximately 1,300 metric tonnes of CO_2-equivalent as reported by the Intergovernmental Panel on Climate Change (IPCC). Existing waste-management practices offer a fairly decent GHG emissions mitigation potential. Dumpsites are the largest GHG emitters in the waste sector. Capitalising on the methane generated from the dumpsites, several landfill gas capture projects have been initiated and proved successful. The waste sector therefore offers opportunities for avoidance of GHG emissions that could be monetized in the form of carbon credits or Certified Emission Reductions (CERs). Although waste minimization, recycling and re-use are not eligible activities under the Clean Development Mechanism (CDM), they provide opportunities to reduce GHG emissions through the conservation of raw materials, improved energy and resource efficiency and fossil fuel avoidance. Very often, city leaders are pressed with other issues and local development imperatives that prevent any preference being given to investments in innovative waste management practices. Importantly, traditional policies and regulatory frameworks do not encourage, but rather disallow, private sector investments in such innovative approaches. However, the overall landscape is changing and innovative business models are emerging (see Case Study 4).

3. CASE STUDIES

3.1 Empowering and Formalizing the Informal Sector through a Trade Union and a Ragpicker Cooperative, Pune, India[22,23,24,25]

Pune is the second largest city in the state of Maharashtra in India and has a population of 3 million. The city's population increased by 40 per cent during the first decade of this century and 50 per cent of the population increase has been attributed to immigration.

The city contains 564 slums and, with the growing economic activity, the population of slum dwellers immigrating into the city is expected to increase at the rate of 6 per cent per year. The increase in population has put tremendous pressure on the city authorities to expand their waste management services. Further, informal waste picking and selling activities are rampant amongst the slum dwellers as a means of earning livelihood. The rag pickers, including women and children, were very often socially discriminated for the nature of activity they indulged in for survival.

Two individuals, Poornima Chikarmane and Laxmi Narayan, who were deeply affected by the dismal condition of the child waste-pickers in Mumbai, wanted to address discrimination and labour right issues and recognize the value of picking and recycling activity that had the potential of resulting substantial savings to city authorities. They realized the need for bringing together rag pickers through a mass movement and hence organized a "Convention of waste-pickers" called Kagad Kach Patra Kashtakari Panchayat (KKPKP) in May 1993. The convention served as a platform for rag pickers to voice their

[22] Chikarmane, P. and Narayan, L. (undated). Organising the Unorganised: A Case Study of the Kagad Kach Patra Kashtakari Panchayat (Trade Union of Waste-pickers). Women In Informal Employment Globalizing and Organizing (WIEGO), http://www.wiego.org/program_areas/org_rep/ (last accessed 11 August 2010)

[23] Medina, M. (2008). The Informal Recycling Sector in Developing Countries. Organizing waste pickers to enhance their impact. Gridlines Note 44. http://www.ppiaf.org/ppiaf/sites/ppiaf.org/files/publication/Gridlines-44-Informal per cent20Recycling per cent20- per cent20MMedina.pdf (last accessed 15 July 2010)

[24] Scheinberg, A. (2009). A Horse of Different Colour Presented at the Inaugural Meeting of the Regional 3R Forum in Asia, November 2009, Tokyo, Japan

[25] Kilby, P. (2009). From Rags to Respect: the Role of a Ragpicker Cooperative in Pune's (India) Household Solid Waste Management System. Presented at the World Vision Conference on "Measuring Effectiveness." World Vision, Australia http://210.247.227.129/Learn/Conferences/MeasuringEffectiveness/2009_Presentations.aspx (last accessed 15 July 2010)

grievances and hence received an overwhelming response from rag picking communities. Over 800 rag pickers from across the city attended the convention. It was agreed at the convention that KKPKP would be formed as a registered trade union to represent the collective identity and interests of scrap collectors. The news about the success of the convention spread fast across the networks of waste pickers and as a result KKPKP was formally registered in the year 1997. The trade union fought for the rights of rag pickers to a safe workplace and systematically built support for rag pickers among citizens.

KKPKP has 5025 members to date, a slate of officers, a Governing Board and a Representatives Council. The membership of the Union is drawn from among scrap collectors living in slums geographically spread across the City of Pune. The Representatives Council, consisting of 80 elected Representatives (75 women and 5 men), and the officers govern the Union. The Council follows a consensus approach and meets every month to deliberate, review, plan and take decisions on current issues.

Since 1996, Representatives have been selected through an election process, which ensures replacement of ineffective and unethical members. Representatives are not entitled to any remuneration or benefits from the Union other than those applicable to other members.

KKPKP functions as a savings-linked credit programme for the poor. Financial operations are centrally managed to minimise administrative costs and operationally the cooperative functions along the lines of self-help groups. The Credit Co-operative did not receive any external financial assistance for provision of credit in the first fifteen months of operation ending March 31, 1999. The entire loan requirement of members was met through savings. Group leaders appointed in the cooperative collected the savings and deposited it with the office of the co-operative. From May 1999, a sum of US$ 6522 in the form of interest free deposits had been collected from citizens who were willing to pay. Loans approved by group members are also disbursed centrally. Lending is to the extent of three times the amount saved and the two other members of the co-operative are required to be guarantors. The lending limit is US$ 543 and the rate of interest is 12 per cent per annum with an additional 12 per cent social security charge towards social security schemes for members. The payment of the annual premium to the New India Assurance Company is part of the annual municipal budget. Hospitalization costs of up to US$ 108 are reimbursed by the insurance company and claims are processed through KKPKP.

The formation of a trade union type organization faced strong opposition from retail scrap traders. Within months of the formation of KKPKP, the scrap traders tried to resurrect an otherwise defunct “Association of Scrap Traders”. However, because of intense competition within the retail segment of the scrap trade, the attempt to revive the association failed.

KKPKP organized and mobilised scrap collectors through public rallies and demonstrations in order to convince the city authorities and the state government to recognize scrap collectors as “workers”. They put forth a demand for the municipal endorsement of photo-identity cards issued by the Union in 1993 through several public demonstrations in which thousands of members participated. The Pune city government accepted the demand in 1995-1996 and became the first city authority in the country to officially register waste-pickers in recognition of their contribution to the management of urban solid waste.

KKPKP stands out as a unique workers organization that mobilized unprotected and unorganized waste pickers and itinerant buyers who are the poorest and most marginalized among urban workers. The organization integrated the informal workers into the formal waste management sector and addressed a range of issues surrounding waste picking activities such as exploitation, confronting extortion, fighting injustice, ensuring safe working conditions, child labour, economic and political issues associated with the activity, and lack of state recognition and labour rights. Following the endorsement by city authorities and recognising the easy replicability of the model, the Maharashtra State Government directed other city authorities in the state to follow KKPKP’s approach to formalize waste pickers.

Lessons Learned

- KKPKP is an example of how community mobilization can comprehensively and effectively succeed in uplifting the livelihoods of waste pickers by integrating these most vulnerable workers into a legally recognizable, structured and protective system.
- It further highlights how city authorities can work together with the informal sector to create a mutually beneficial relationship towards the realization of an integrated waste management plan.
- Through a combination of consensual, methodical and mature approaches to organizing waste pickers, and through the use of peaceful and disciplined methods of

social agitation (rallies, demonstrations, sit ins, etc.), it was possible to establish credibility with the government, private sector and citizens.

- Other than work-related economic issues, focusing on social development activities such as credit provision, education and child labour helped build KKPKP's credibility.

Impacts:

In 2002-03 the Pune Municipal Corporation became the first municipality in the country to institutionalize a *Scheme for Medical Insurance for all Registered Waste-pickers* in its jurisdiction.

Other Related Examples from the World:

- Brazil – A national campaign launched in Brazil had great success in reducing child labour in waste picking. The campaign has parents of child waste pickers enrolled in Bolsa Familia, a conditional cash transfer programme that gives parents a monthly stipend as long as they send their children to school, get them vaccinated, and obtain prenatal care. The stipend compensates families for the loss of income from child labour. Through this programme, supported by World Bank credits, more than 40,000 children left waste picking and are now attending school.
- Sao Paulo, Brazil – COOPAMARE (Cooperativa de Catadores Autonomos de Papel, Aparas e Materiais Reprovitaveis) was founded in Sao Paulo in 1989. It has 80 members along with about 200 independent waste pickers who sell its materials. COOPAMARE collects and sells about 100 tons of recyclables a month, at a lower cost than the city recycling programme. Its members earn $300 a month, twice the minimum wage.

3.2 HANDLING CONFLICTS BETWEEN FORMAL AND INFORMAL PRIVATE SECTORS IN CONTRACTING MUNICIPAL SOLID WASTE MANAGEMENT SERVICES, BOGOTÁ, COLOMBIA[26,27]

Bogotá, the capital city of Colombia has a population of 7 million inhabitants including the metropolitan areas. On an average, the city generates 6000 metric tonnes of MSW every day. Initially, MSW management services such as collection, transport, recycling and disposal were wholly taken care by the city authority with poor results.

The first attempt to streamline MSW management services in the city was initiated by the Asociacion de Recicladores de Bogotá (ARB). ARB is an association of recyclers that was formed in 1990. The Association resulted from the coming together of four recycling cooperatives that wanted to be recognized for their services. Currently, 24 recycling cooperatives in the city of Bogotá are members of ARB.

Waste management services were initially the responsibility of the city's department for public cleansing, called EDIS. Employees of EDIS went on strike in 1994 in order to convey their dissent with the decision of the city authority of Bogotá for privatization of waste management services in the city. At the request of the city authority, members of ARB stepped in during this period to offer their services to clean up the waste that was accumulating in the streets of Bogotá due to the suspension of work by EDIS. About 700 tons of waste was collected by ARB every day during this period.

The city authority did not meet the demands of EDIS and went ahead with the privatization process. Between 1994 and 1996 various private entities provided public waste services in Bogotá. The services were shared jointly by EDIS (45 per cent), private entities (45 per cent) and a foundation (Fundacion Social), and provided support to recycling organizations across Colombia. ARB was contracted to provide 10 per cent of the waste management services of the city.

During this time, EDIS was also in the process of being liquidated. It was completely shut down in 1996, leading to 100 per cent management of public waste management services (collection, transport and final disposal) by private entities. During the privatization

[26] Samson, M. (2009), Refusing to be Cast Aside: Waste Pickers Organizing Around the World, Cambridge MA, WIEGO

[27] Juber Martinez Hernandez, Direction of Monitoring and Evaluation, Special Administrative Unit for Public Services, Bogotá, Colombia

process, city authorities were faced with opposition from ARB since the Association was unable to compete in the tendering process. ARB did not meet the qualifying criteria outlined in the policy for contracting private entities for residential public services in Colombia, which allowed only stock holding corporations to compete. However, considering that it was important to allow inclusion of poor rag-pickers into the formal and mainstream economy, a few corrections in the policy requirement for bidders were made to allow organizations like ARB to bid in the tendering process.

City leaders should therefore take precautionary measures in framing policy guidelines and bidding criteria for public-private partnerships in order to ensure that the bidding process provides a level-playing field for both for-profit and not-for-profit organizations.

Lessons learned:

- The case study on outsourcing waste management services to private entities in Bogotá demonstrates the importance of including social and livelihood aspects when considering full-scale privatization of waste management services.
- The terms of contracts offered by the city authorities should ensure equal opportunity for recycling cooperatives to bid along with private entities, particularly in services such as collection and recycling where the recycling cooperatives have rich experience.
- Privatization of waste management services should not be encouraged at the cost of depriving rag-pickers of their livelihoods.

Impacts:

- Successful initial streamlining of solid waste management services in the city with the involvement of private entities.
- Apart from ensuring better living and working conditions for the rag-pickers, the initiative safeguarded the labour rights and successfully addressed the issue of child labour in waste-picking activities

Other Related Examples from the World:

- Private sector involvement has reduced the waste service cost by at least 25 per cent in countries such as United Kingdom, United States and Canada and at least 20 per cent in Malaysia.
- A World Bank project in Mauritius tested and proved that a new sanitary landfill should be constructed and operated by the private sector and that one company should

be responsible for all stages. Involving different private players for each stage such as design, construction and operation may lead to legal disputes over the adequacy of the construction in case of a leakage.

- In Stockholm, Sweden, five different private companies have been contracted to deliver 85 per cent of collection services while the remaining 15 per cent is taken care by the government.
- Dakar, Senegal developed experience with a public/private joint venture which, at first, was a monopoly but later transitioned to a more competitive privatization arrangement of multiple service contracts.
- In Surat, India, contracting of selected services such as night sweeping, waste collection and transportation to private companies increased the collection coverage to more than 90 per cent and reduced the number of road side garbage containers by 36 per cent.

3.3 PET Bottle Recovery and Recycling - Extended Producer Responsibility in Mauritius[28]

Plastic containers of beverages are abundant in modern society. Reuse and recycling of plastic bottles not only reduces virgin material input but also reduces wastes that land in final disposal sites. For example, a glass refillable bottle can be refilled and circulated over 50 times before it goes into recycling. A PET refillable bottle is refilled and circulated around 13 times before going into recycling, thereby reducing the material used in packaging.

Recycling of polyethylene terephthalate (PET) bottles is practiced widely in developed countries. Recycled PET flakes find a second life when being used as material inputs for fibre/textiles (42 per cent), sheets (50 per cent), bottles (5 per cent) and moulded products and others (4 per cent). While recycling is certainly an option, there are concerns that the amount of energy used for recycling could be considerably high, and whether these costs might be borne by city authorities. .

Recovery and recycling of PET bottles in Mauritius is a good example of enforcement of

[28] Contribution through communication with Professor T Ramjeawon, University of Mauritius

government regulation on Extended Producer Responsibility leading to stimulation of recycling. Being an ecologically sensitive small island developing State, Mauritius faces inherent challenges in management of rising volumes of MSW due to scarcity of appropriate space for disposal and treatment facilities, financial constraints and lack of capacity. Further, due to the growth of tourism establishments and inflow of tourists, the generation of solid waste is expected to rise in the island.

In an initiative to address the growing problem of plastic waste, the Ministry of Environment promulgated an Environment Protection Regulation related to PET bottles in 2001. Under the requirements of the regulation, the bottling companies had to establish a deposit-refund system to encourage the return of the maximum number of PET bottles. They were also required to set up a collecting/compacting system for the collected PET bottles so that these could be recycled / exported.

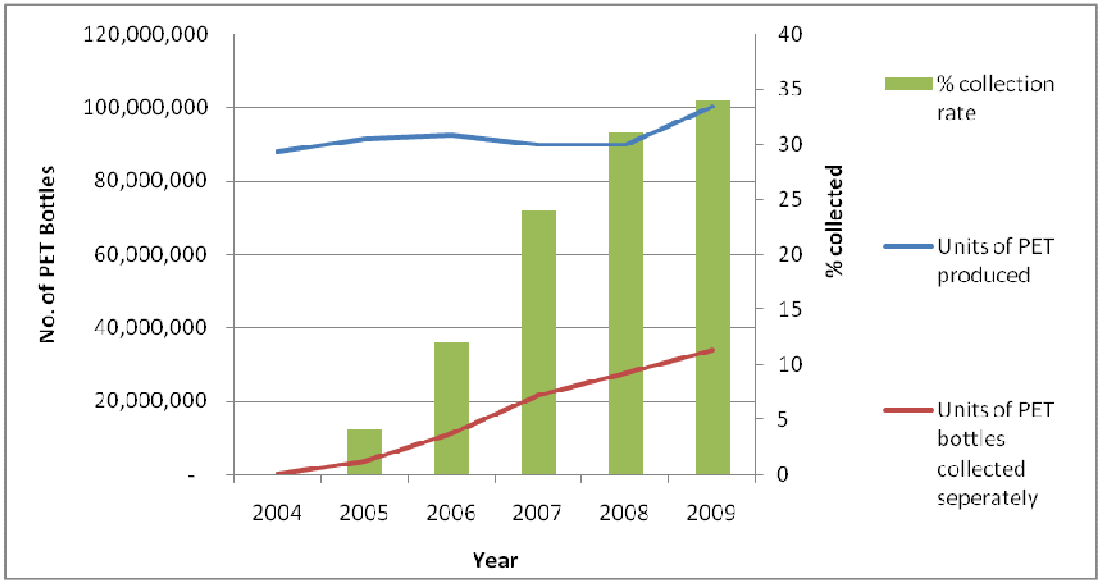
In response to the regulation, the four big producers of soft drinks in Mauritius, Phoenix Camp Mineral, Quality Beverages Limited and Compagnie Industrielle des Pailles, regrouped themselves into the Mauritius Bottlers' Association and hired a firm, Steel Scrap Ltd., to initially set up a collection mechanism for used PET bottles based on a voluntary take-back system. As part of the collection system, fifty-nine special bins were placed at strategic spots (beaches, market places, hypermarkets, etc.) throughout the island. This initiative was supported by a sensitization campaign where consumers were invited to dispose their used PET bottles in these bins. With the voluntary take back system in place, the collection rate was as low as 4 per cent in 2005.

To improve the collection rate, in 2005 the Bottlers' Association contracted the collection, processing and recycling of PET bottles to a private company called Polypet Recyclers. Since then, the private company has been purchasing used PET bottles from individuals, NGOs, schools and other organizations. The private company has a recycling capacity of 1200 metric tonnes per day. It owns and operates 6 trucks and charges the bottling companies at an average rate of US$ 396 per ton (depending on the market share). Further, the Bottlers' Association also promotes community initiatives with NGOs to create an opportunity for local residents to get additional revenue obtained from reselling PET waste. The private company purchases PET bottles from such collectors at the rate of Rs 7.00 per kg. For example, even housewives of low income families organized themselves and went from house to house to nearby communities in order to collect used PET bottles, since this gave them a fair source of income in return. The initiative was also supported by the

Ministry of Environment which further promoted separation of waste in all primary and secondary schools. Four different bins were distributed and the school community was encouraged to separate their wastes into plastic bottles, paper, biodegradable waste and other wastes. The schools entered into an agreement with the private company for collection of used PET bottles.

The collected PET waste is then collected, baled and sorted out according to colour and specific number. The waste is washed, granulated, re-washed and dried in specially designed machines. They are then ground and fed into other machines which melt them under heat and pressure. The PET waste is finally processed into pellets for export to South Africa. The private recycling company is required to show the customs proof of the amount of PET exported. The PET recycling initiative is thus easily replicable across other cities. It should be noted that with the involvement of the private company, the city authority could increase the collection rate of PET bottles from 4 per cent in 2005 to 34 per cent in 2009 (see Figure 8 below).

Figure 5.8. Increase in Collection Rate of PET Bottles



Source: Ministry of Environment, Mauritius

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Lessons Learnt:

- City leaders can promote reuse and recycling of beverage containers by establishing deposit systems and/or imposing fees on one-way bottles.

- Viability of a reuse and recycling industry depends on the size of the local economy. A study estimates that an industry could become profitable if there are more than 200,000 consumers in the city (METI-Japan, 2006).
- Privatization of recycling activity put into place systems, collection and recycling infrastructure. The private company also collaborated and networked with other recycling initiatives and the initiative led to a 30 per cent increase in recycling rate in the island in a period of 4 years.
- For recycling to be successfully implemented in cities, the process should be economically attractive.

Impacts:

- Up to 34 per cent of the 3000 metric tonnes of PET used on the island (or about 80 million bottles) are being successfully recycled.
- The initiative created about 100 indirect jobs on the collection side and also hired more than 30 workers directly in the recycling company.

Other Related Examples from the World:

- Many countries in Europe, such as Finland, Germany, Sweden, Austria, Demark, and Netherlands, have active “reuse” systems, through which beverage containers are collected and reused. Scandinavian countries are world leaders in reusing beverage bottles, with the rate exceeding 90 per cent.
- In Germany, deposit for non-refillable beverage containers is mandatory (at a deposit value of 0.25 Euro regardless of the volume) and regulated in the Green Packaging Ordinance, as means to promote the reuse/refillable system. Further, 161,000 jobs are directly connected to the manufacture, filling, distribution and selling of packaged beverages in Germany and 73 per cent of the jobs are associated with refillable containers. The initiative dramatically increased the bottle return rate to 95-98 per cent by imposing mandatory deposit on one-way bottles. PET bottles that end up in final disposal have been reduced to a minimal amount
- In Japan, the recycling rate of PET bottles reached 87.7 per cent in 2007.

3.4 COMMUNITY BASED COMPOSTING TO CONVERT ORGANIC WASTE TO RESOURCE AND GENERATE CARBON CREDITS, DHAKA BANGLADESH[29]

Due to rapid economic development, population growth and increasingly urbanized lifestyles, city authorities of Bangladesh are confronted with the issue of managing rising quantities and diverse streams of MSW with limited urban infrastructure and capability. The capital city of Dhaka generates 3500 metric tonnes of MSW every day. The city's waste is transported to a sanitary landfill at the Matuail site in Dhaka. Uncontrolled landfilling has been a common practice in the city. The city lacks adequate facilities for treatment, recycling and disposal of hazardous waste.

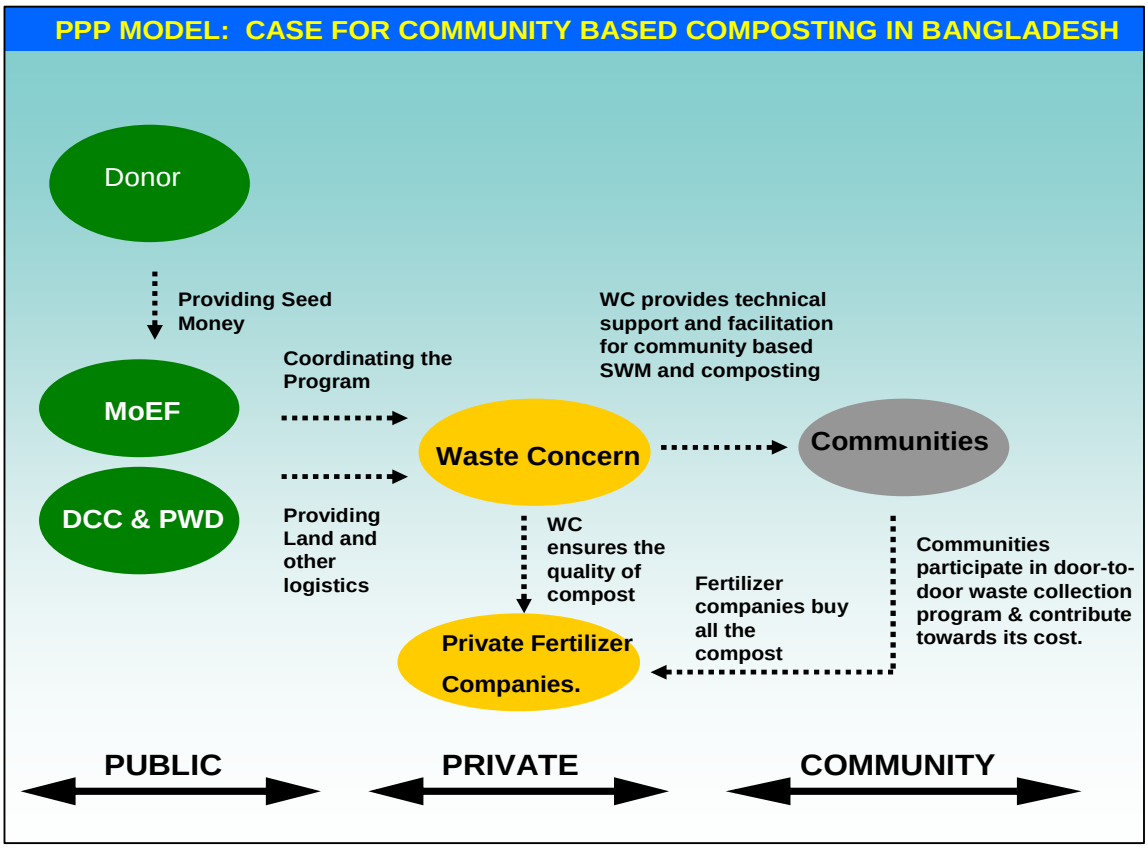
A major portion (about 80 per cent) of MSW generated in the city is organic in nature with a moisture content ideal for recycling into compost. Waste Concern, a local research organization and non-governmental organization, works in close partnership with the government, private sector, international agencies and local communities to implement community-based composting. It has successfully replicated the community based model of composting across several cities and towns in Bangladesh.

Since its launch of solid waste management projects in September 1998, Waste Concern has served 30,000 people in Dhaka city and 100,000 people in 14 other cities and towns in Bangladesh, including slums and low and middle-income communities. Its services include waste collection, separation and composting.

The centralized composting project in the city of Dhaka warrants special mention. The composting plant has a capacity of 700 tons per day and processes organic waste from the city of Dhaka in three phases. The project has led to many economic, social and environmental benefits such as new job opportunities to the communities and better livelihoods in the region. The public-private partnership model followed by Waste Concern is illustrated in Figure 5.7.

[29] Sinha, M. (2010). Community-based Waste Management and Composting for Climate/Co-benefits – Case of Bangladesh (2d) presented at the International Consultative Meeting on expanding Waste Management Services in Developing Countries, 18-19 March 2010, Tokyo, Japan

Figure 5.7. Partnership Model for Centralized Composting in Dhaka



The project included very interesting financial features which made it viable through community involvement and public private cooperation. The communities received door-to-door collection service and shared the cost of waste collection by paying a monthly fee based on their affordability. The private stakeholder had joint venture partners that included Waste Concern and its financial partners (banking institutions). The total investment required for the project was Euro 12 million. The mode of finance was 38 per cent equity, 45 per cent as soft loan and 17 per cent as loan from a local bank in Bangladesh.

A private sector company was involved to ensure the sale of compost by carrying out enrichment of the compost with nutrients and its subsequent distribution in the market. As a result, 75 per cent of the total revenue of the project came from sale of compost. The project was also successfully registered as a Clean Development Mechanism (CDM) project under United Nations Framework Convention on Climate Change (UNFCCC). A new methodology for accounting of emission reductions was developed by Waste Concern and its partners and was subsequently approved by the UNFCCC. Thus, the remaining 25

per cent of the project revenue came from community contributions in the form of a user fee and sale of certified emission reductions (CERs), making the project financially viable.

The main challenges to the project were the lack of a policy mechanism to create opportunities for developing public-private partnerships and absence of the practice of source separation of waste at the household level. The policy barrier was overcome by initiating a public-private cooperation by convincing the city government to grant a concession agreement to a private fertilizer company to collect and process waste. The private stakeholder self-financed collection and processing activities, including purchase of vehicle fleet and building the compost plant. Being a fertilizer company, the private stakeholder could also produce and sell quality compost to farmers.

The project is strongly reliant on close community partnership and is firmly integrated with house-to-house waste collection efforts. The community members of Dhaka collected and separated their organic waste at source and deposited it at local collection points. From here the organic waste was collected and transported by the private stakeholder to the main plant.

Dhaka's centralized composting plant serves as a successful working model of how combined effort and partnership among public, private and civil sectors can lead to the successful implementation of 3R activities that have direct and far reaching benefits for the environment, community, government and small business.

Lessons Learned

- Partnerships among local communities, private sector and civil sectors can lead to the successful implementation of 3Rs.
- Centralized organic waste composting can be a cost-effective method to manage biodegradable organic waste that otherwise releases undesirable greenhouse gases such as methane when disposed in a landfill.
- The success of composting projects rests on the extent of involvement of the communities and their cooperation with the city authority.
- An important aspect of the project was that it was not fully mechanized, due to which it could employ people from the informal sector. Avoiding mechanization led to savings in capital cost. Consequently, workers could be provided with better salary rates, good working conditions, health insurance, day-care facility and free meals.

Impacts

- The project reduced the landfilling budget of the city
- Valuable resource was recovered from organic waste in the form of compost and the project also created assured revenue for 10 years through sale of compost and CERs.
- 800 jobs were created for poor urban residents
- 50,000 metric tonnes of compost is produced every year for more sustainable farming.
- The project avoids greenhouse gas emissions in the amount of 89,000 tonnes of CO_2-equivalent per year.
- The project resulted in behavioural changes in urban communities that were actively involved in the project as they became convinced about the resource value of waste.

Other Related Examples from the World:

- The closure of the 25-year-old dumping ground and development of landfill gas recovery at the Gorai creek in Borivli has earned the city of Brihanmumbai, India US$ 5.7 million by trading of an estimated 31,000 CERs a year. The Asian Development Bank has been purchasing the carbon credits from the civic body as per market prices when the trading takes place. Dumpsite closure and methane capture projects are not uncommon. However, the initiative to capitalise on the methane generated and convert it to monetary terms is rare in many developing countries. The city's Gorai dumping ground closure and landfill gas project can be seen as a forerunner in this genre of projects.

4. BETTER CITY, BETTER LIFE: POLICY OPTIONS AND MEASURES FOR URBAN WASTE MANAGEMENT

The policy options and measures summarized below represent a menu of possible actions that city leaders may consider to improve their municipal waste management practices, which will in turn contribute to improving the living environment of its citizens. While specific programmes/projects and the scale of interventions may differ from city to city depending on their unique characteristics (geography, population, waste streams, etc.), overarching policy directions may apply regardless of such differences.

This is not an exclusive list, and there could be more options – the idea is to focus on the most critical and fundamental goals and policy options that could make significant, positive changes to cities and the lives of citizens.

Strategy 1: Develop meaningful partnerships with private sector, informal workers and communities for effective implementation of ISWM and 3Rs	
Policy Option 1	Promote public-private partnerships to implement infrastructure projects in different stages of municipal waste management such as collection, transport, recycling, composting, waste to energy, etc.
Policy Option 2	Organize informal waste collectors and recyclers into recycling cooperatives and associations and integrate them into the formal solid waste management programmes.
Strategy 2: Reduce municipal solid waste and aim for Zero Waste	
Policy Option 1	Create policy instruments such as “volume based fee collection” to make the polluter pay for the amount of waste generated
Policy Option 2	Set targets to achieve “Zero Waste” by using relevant indicators such as resource efficiency, recycling rate and waste landfilled in order to track the city’s performance over time
Strategy 3: Increase reuse and recycle of “resources”	
Policy Option 1	Enforce “separation of wastes at source” by creating incentives for efficient separation and disincentives for mixing
Policy Option 2	Introduce market instruments such as Extended Producer Responsibility and establish recycling facilities
Strategy 4: Effectively manage specific types of waste streams such as organic waste, e-waste, construction waste and end-of-life vehicles	
Policy Option 1	Support/subsidize proven local technologies for management of special waste streams that need immediate attention such as composting for organic waste management
Policy Option 2	Promote state-of-the-art technologies to facilitate sustainable design principles in manufacturing that could help improve recycling of special waste streams such as e-waste and scrapped vehicles
Strategy 5: Explore risks and opportunities due to climate change and the Clean Development Mechanism	
Policy Option 1	Take mitigation and adaptation measures to combat threats to waste sector from climate change
Policy Option 2	Explore opportunities such as CDM to monetize GHG emission reduction in waste management projects such as composting, landfill gas recovery and recycling.

5. LINKS FOR FURTHER INFORMATION

1. ADB and IGES (2008). Toward Resource-Efficient Economics in Asia and the Pacific: Reduce Reuse Recycle. Asian Development Bank, Manila

2. Chalmin P. and Gaillochet C. (2009). From Waste to Resource, An Abstract of World Waste Survey, Cyclope, Veolia Environmental Services, Edition Economica, France.

3. Chandak, S. (2010), Community-based Waste Management and Composting for Climate/Co-benefits – Case of Bangladesh (2d) presented at the International Consultative Meeting on expanding Waste Management Services in Developing Countries, 18-19 March 2010, Tokyo, Japan, http://www.un.org/esa/dsd/susdevtopics/sdt_pdfs/meetings2010/icm0310/1a_Surya_Chandak.pdf

4. Chikarmane P. and Narayan L. (undated). Organising the Unorganised: A Case Study of the Kagad Kach Patra Kashtakari Panchayat (Trade Union of Waste-pickers). Women In Informal Employment Globalizing and Organizing (WIEGO), http://www.wiego.org/program_areas/org_rep/

5. Eurostat (2010). End-of-life vehicles (ELVs), Reuse and Recovery rate, Last updated on 16.04.2010, http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/data/wastestreams/elvs

6. Medina M. (2008). The Informal Recycling Sector in Developing Countries. Organizing waste pickers to enhance their impact. Gridlines Note 44, http://www.ppiaf.org/ppiaf/sites/ppiaf.org/files/publication/Gridlines-44-Informal%20Recycling%20-%20MMedina.pdf

7. Ministry of Environment (2010), Republic of Korea, Annual Report of Volume Based Waste Fee.

8. Modak, P. (2010), Community-based Waste Management and Composting for Climate/Co-benefits – Case of Bangladesh (2d) presented at the International Consultative Meeting on expanding Waste Management Services in Developing Countries, 18-19 March 2010, Tokyo, Japan, http://www.un.org/esa/dsd/susdevtopics/sdt_pdfs/meetings2010/icm0310/1b_Prasad_Modak.pdf

9. Samson M. (2009), Refusing to be Cast Aside: Waste Pickers Organizing Around the World, Cambridge MA, WIEGO

10. Sinha M. (2010). Community-based Waste Management and Composting for Climate/Co-benefits – Case of Bangladesh (2d) presented at the International Consultative Meeting on expanding Waste Management Services in Developing Countries, 18-19 March 2010, Tokyo, Japan, http://www.un.org/esa/dsd/susdevtopics/sdt_pdfs/meetings2010/icm0310/2d_Maqsood_Sinha.pdf

11. UNEP (2005). E-waste, the Hidden Side of IT equipment's Manufacturing and Use, Environmental Alert Bulletin, http://www.grid.unep.ch/product/publication/download/ew_ewaste.en.pdf

12. UNEP (2010). Framework of Global Partnership on Waste Management, Note by Secretariat, http://www.unep.or.jp/Ietc/SPC/news-nov10/3_FrameworkOfGPWM.pdf

13. UNEP (2011). Waste – Investing in Resource and Energy Efficiency, Towards a Green Economy, www.unep.org/greeneconomy/P ortals/88/documents/ger/GER_8_Waste.pdf

14. UN Habitat (2010), Solid Waste Management in the World's Cities, EarthScan

15. Veolia Environmental Services (2006). From Waste to Resource. An Abstract of "2006 World Waste Survey", http://veoliaes.com/resource.php?id=566