FINAL TECHNICAL REPORT

RUSD2012-01CMY(R)-Surjan

Advancing Locally Based Green Practices to realize establishment of Sound Material Cycle Society in Asian Cities

UNITED NATIONS UNIVERSITY

ĐẠI HỌC HUẾ
HUE UNIVERSITY

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Project Reference Number: RUSD2011-02CMY(R)-Surjan

Abbreviations and Acronyms

CP	Cleaner Production
DoH	Department of Health
DoI	Department of Industry
DoNRE	Department of Natural Resources and Environment
DoSTE	Department of Science, Technology and Environment
EEE	Electrical and Electronic Equipment
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
GC	Green consumption
HCMC	Ho Chi Minh City
JICA	Japan International Cooperation Agency
IZMB	Industrial Zone Management Board
MoNRE	Ministry of Natural Resources and Environment
MoC	Ministry of Construction
MoF	Ministry of Finance
MoH	Ministry of Health
MoI	Ministry of Industry
MoPI	Ministry of Planning and Investment
MoSTE	Ministry of Science, Technology and Environment
PPC	Provincial People Committee
SME	Small and Medium Enterprises
SWM	Solid Waste Management
UNEP	United Nations Environment Program
UNIDO	United Nations Industrial Development Organization
URENCO	Public Urban Environment Company
VND	Vietnamese Dong

Final Technical Report - RUSD2012-01CMY(R)-Surjan

1. Introduction and background:

Industrial, urban and economic 'growth phenomenon' started with industrial revolution from the global north has now spread to Asia and Africa, albeit at varying magnitude. Existing model of development based on 'mass production-consumption-disposal society' leads to severe environmental degradation, pollution, global warming, disturbance of natural material cycle etc. Since 2000, Japan introduced idea of 'Sound Material-Cycle (SMC) Society' as a smart-solution to the problem. For over 250 years, during Edo-era (from the year1603 to 1868), Japanese society was a community-based SMC society. However, such a historical perspective of identifying 'green-practices' of the society is neither documented nor conserved in other countries of Asia which are now experiencing fast economic growth. One of the important goals of this study is to research about such local manifestations, believing that reviving old eco-friendly practices is easier than introducing new ones. This study also recognizes that the present research on SMC Society is mainly being carried out by natural scientists (experts from material science, chemistry, life-cycle assessment, environmental engineering background). Since, societal and social science perspectives are also equally important to transfer the SMC ideas from 'laboratory to real life'; this research bridging the gap by establishing partnerships with local governments, academia, NGOs, communities and SMC experts.

2. Participating countries:

Participating Countries- Japan, India, Indonesia and Vietnam

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3. Objectives:

This study is supplementing ongoing Japanese efforts to establish SMC Society (including 3R and Material Flows) in Asia by highlighting: [i] Urban systems (because urban areas contribute over 2/3rd of region's GDP) [ii] Green local practices (because communities are 'key to success of SMC Society') [iii] Partnerships (because local government, NGOs, communities and academia must work hand in hand with SMC experts). The specific objectives include: **(a)** Stimulate multidisciplinary, context-based and community centered perspective (which are basic ingredients for advancing SMC-Society vision) in selected countries of Asia **(b)** Substantiate scientific SMC research by combining inputs from natural and social science practitioners to demonstrate that SMC can help urban-regions to achieve waste reduction/resource efficiency, move towards low-carbon society and reduce pollution **(c)** Identify, analyze and document 'modest, frugal and green living practices' of citizens; find the challenges to these practices and revitalize them by participatory mechanism; and integrate them with SMC approaches in selected case study cities of Asia **(d)** Promote interaction and interest of 'local academia-government-NGOs-businesses-citizens' in SMC by:- organizing consultation

meetings, providing better scientific information, sharing perspectives from Japan and progress from other case study areas for knowledge sharing/mutual learning, and thereby, gradually influencing national and regional policies.

4. Funding received
US$82,000

5. Outcomes and products against original proposal objectives:
Spanning across four countries with different socio-economic structures, varying consumption patterns and local governance system, this study unfolds interesting facets of material cycle practices. This is the second progress report for the project. As per the agreed framework during the first year of the study, research partners from India, Japan, Indonesia and Vietnam agreed for to further research on common agreed material sectors and waste-categories with some modification the broad structure of the study.

It was decided that the study shall focus on the methods of segregating and regulating the waste disposal and the prevalent reuse and recycle practices along with possible practices that would help in reducing the waste. In doing so it was discussed that contribution of formal as well as informal processes shall be documented. Some of the outcomes are as follows:

INDIA

Summary: First task of the project was to understand community's existing consumption and recycling practices and social struggle to keep pace with the rapid economic growth in India. This task was accomplished by documenting the existing consumption and recycling practices in India, observations and data were primarily from the secondary sources.

While the first stage talks about the waste at household level, the second stage is about waste generated from commercial and office establishments. The observations here are based on both primary and secondary sources which include the existing literature on Waste Management practices in India, government reports and other data bases.

For understanding the existing waste management practices at commercial and office establishments' primary survey was conducted among selected commercial and office centres within the city. This was aimed at understanding the contextual issues for the selected case study city of Bhopal. The perceptions on the issues and concerns regarding 3R's (Reduce, Reuse, Recycle) have been investigated in particular. An attempt has also been made to explore the perceptions among various stakeholders about the issues related to 3R's.

A review of the 3R practices at various levels has also been investigated. This detailed review through various surveys was carried out and the existing practices that are prevailing were documented. In order to understand the community's existing consumption and recycling practices a preliminary survey was conducted.

Each of the modes of recycling associated with commercial and office establishments was documented here and an attempt was made to explore all the modes through which various stakeholders are involved in the waste recycling.

This report deals with the findings and the outcome of the work carried out till date and specially deals with the study and outcome for commercial and office establishments. The report makes an

attempt to elaborate upon the existing scenario in commercial and office centres at the national level and then attempts to give a brief description on the existing practices in the city of Bhopal.

CHAPTER 1: INTRODUCTION

India's population as per 2011 census is 1210 million, of which 377 million people live in urban areas. The level of urbanization has increased from 27.81% in 2001 Census to 31.16% in 2011 Census. It is for the first time since Independence that the absolute increase in population is more in urban areas than that in rural areas. India is facing a jagged contrast between its increasing urban population and available services and resources. Solid waste management (SWM) is one such service where India has a vast gap to fill and numerous challenges to face. The increasing level of urbanization leads to increased levels of waste generation and thus poses serious threats and challenges for those associated with its management. India's growth story, especially in the last few decades has also resulted in a rapid increase in the amount of waste generated. The main driver for domestic waste is the rapid urbanisation that is slated to change India from a largely rural to a majority urban country in the next decade (2020) (EBTC, 2012).

Urban waste management is a challenging task in India also due to its spatial spread across 5161 Urban-Local-Bodies and a variety of problems faced in setting up for systems for collection, transportation and disposal of waste. Besides, the existing solid waste management structure in India is extremely inefficient, still using the age old and outmoded practices and technology. The practice of waste segregation is also not present and solid waste is usually dumped in a mixed form in an unscientific manner on open waste land or low lying areas even near creeks, forests, rivers, ponds and other ecological sensitive regions. There is no formal organized system of segregation of biodegradable and non biodegradable solid waste present. The recovery and recycling or segregation of waste is only done by scavengers and scrap dealers which is highly hazardous to those which are involved in this job.

The per capita waste generation rate in India has increased from 0.44 kg/day in 2001 to 0.5 kg/day in 2011, as a result of changing lifestyles and increased purchasing power of urban Indians (Annepu, 2012). The total MSW generated in urban India is estimated to be 68.8 million tons per year (TPY) or 188,500 tons per day (TPD). Such a vast increase has posed serious challenges on all available natural, infrastructural and budgetary resources related to solid waste management, leaving alone the challenges of formalizing segregation and recycling of waste.

Recycling is invariably an informal activity across India. Most of the recyclable waste is collected by the informal recycling sector in India. Amount of recyclables collected by informal sector prior to formal collection are generally not accounted for. This is also because in India, reuse is a preferred phenomenon over recycling of products. But Informal recycling system is lately receiving its due recognition world-wide for its role in waste management in developing nations. In India, government policy and non-governmental organizations (NGOs) are expected to organize the sector present in different regions, and to help integrating it into the overall formal system but a concrete change is yet to come. Recyclable materials constitute between 17.5% of municipal solid waste and the informal sector retrieves 56% of that (Annepu 2012). Most of the recyclable materials collected and handled by the informal waste sector fall within the broad categories of paper, plastic, metal, glass and rags.

This report deals with the above mentioned issues relating to household , commercial and office establishments and the waste practices associated here with. The objective of the research is to understand their existing consumption and recycling practices and social struggle to keep pace with the rapid economic growth.

Objective of the study

The research is intended to study green local practices (because communities are 'key to success of SMC Society'), stimulating multidisciplinary, context-based and community centred perspective (which are the basic ingredients for advancing SMC-Society vision). Also to substantiate scientific SMC research by combining inputs from natural and social science practitioners to demonstrate that SMC can help urban-regions to achieve waste reduction/resource efficiency, move towards low-carbon society and reduce pollution. Further to Identify, analyze and document 'modest, economical and green living practices' of citizens; find the challenges to these practices and revitalize them by participatory mechanism; and integrated them with SMC approaches in selected case study cities of Asia Promote interaction and interest of 'local academia-government-NGOs-businesses-citizens' in SMC by:- organizing consultation meetings, providing better scientific information, sharing perspectives from Japan and progress from other case study areas for knowledge sharing/mutual learning, and thereby, gradually influencing national and regional policies.

It was decided that the study shall focus on the methods of segregating and regulating the waste disposal. Attempt will be made to document the possible practices that help in reducing the generation of waste. It was discussed that contribution of formal as well as informal processes shall be documented.

The study aims to explore **seven material** categories of waste that will be documented in **four stages** from **six sources**:

A. Overall material cycle will be analyzed in these key-material sectors in selected case-study city :

1) Textile
2) Metal
3) Glass
4) Plastic
5) Paper
6) Bio-degradable waste (including food ,kitchen and garden waste)
7) E-waste

B. The documentation will be carried out through following stages:

1) Generation of waste
2) Reuse of waste
3) Recycling of waste
4) Disposing of waste

C. Sources of waste generation:

i. Documentation of waste from the following sources will be carried out for the materials specified in POINT-A and stages given in POINT B. Depending on the source category, some materials or stages may not be required for a particular source.
ii. This will be documented through prevailing lifestyle in identified case study cities of respective countries.

The six sources of waste generation under which the study would be documented are:

1. Household Waste:
2. Commercial and Office Establishments:
3. Industrial Waste:

4. Hospital waste:
5. Construction waste:
6. Waste from Public/semi-public areas

Scope of the study

This stage of the study focuses on the solid waste from household, commercial and office establishments. The waste practices associated viz. Generation, storage, collection, reuse; recycle, disposal etc. have been studied, investigated and documented here in. The existing Scenario of Solid Waste Management from commercial and office establishments has been studied both at nation and at the case study level. Primary survey has been undertaken for the selected case study i.e. Bhopal City. For this purpose, selected office and commercial centres were surveyed by means of a detailed questionnaire and the results were analysed and documented. The results for this stage are based both on primary and secondary sources of data collection.

CHAPTER 2: SOLID WASTE MANAGEMENT IN INDIA

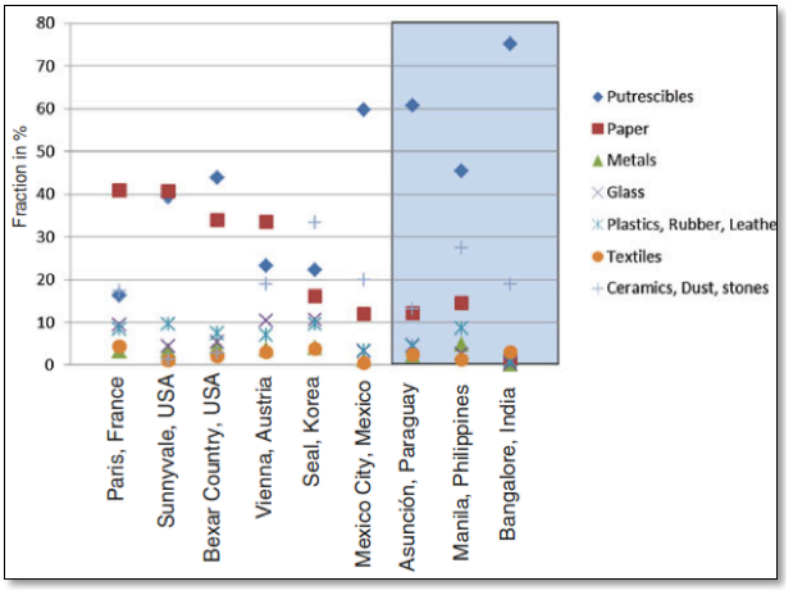
Solid Waste Management has been one of the neglected areas of urban management activities in India. By and large, in cities and towns hardly 50 per cent of the solid wastes generated are collected, transported and disposed off, giving rise to insanitary conditions and diseases, especially amongst the urban poor who constitute about 35 per cent of the urban population.

In India the biodegradable portion dominates the bulk of Municipal Solid Waste. Generally the biodegradable portion is mainly due to food and yard waste.

Municipal Solid Waste Generation Per Capita Per Day, in Select Asian Countries

Country	1995	2025
Mongolia	0.6	0.9
China	0.79	0.9
Nepal	0.5	0.6
India	0.46	0.7
Bangladesh	0.49	0.6
Sri Lanka	0.89	1.0
Burma	0.45	0.6
Thailand	1.1	1.5
Laos	0.69	0.8
Vietnam	0.55	0.7
Singapore	1.1	1.1
Malaysia	0.81	1.4
Indonesia	0.76	1.0
Hong Kong	5.07	4.5
South Korea	1.59	1.4
Japan	1.47	1.3
Philippines	0.52	0.8

Source: Basel Convention Secretariat.
Note: Figures are kilograms per person per day.

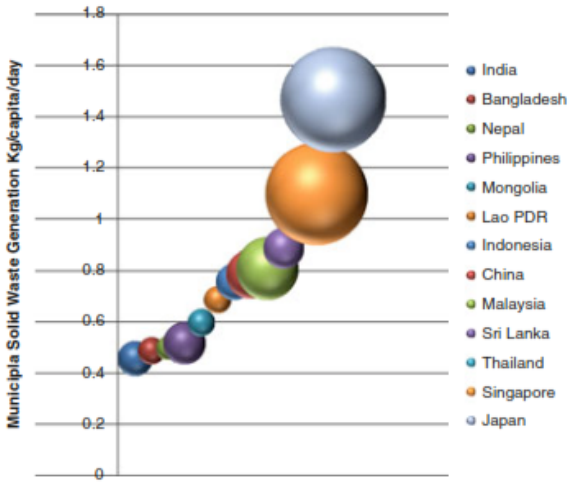


Source: Waste quantities & characteristics, UNDP, 2007

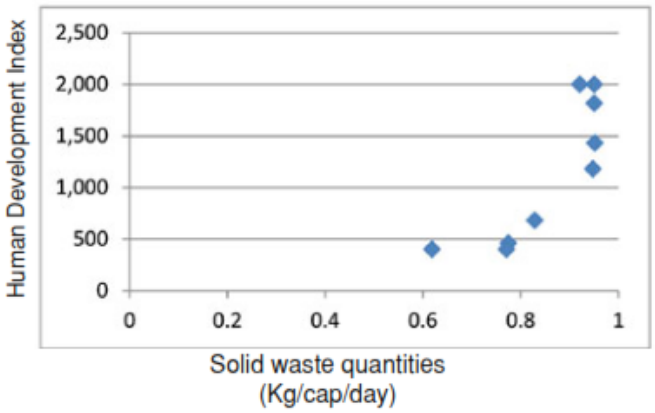
The municipal solid waste characteristics and quantity is also attributed to the lifestyle and living standard of the region's inhabitants. This not only affects the quantity of waste produced but also impacts the composition and nature of waste produced. Waste from high human development show higher fraction of non-degradable waste comparable to medium human development. The reason for such fraction is due to high spending of rich countries on packaging material, absence of rag picking, and low number of scrap dealers, etc.

Developing countries like India use newspaper and other unsoiled paper for packaging including food item. It is not uncommon to see small restaurants and road side merchants packing food items, fruits and vegetables in newspapers. The number of old scrap merchants in India is high and house and offices sell old paper to these dealers. These dealers in turn sell them to recyclers and other end users. The huge number of rag pickers is one of the reasons for very low amounts of paper, plastic, glass and metals in the wastes. Rag pickers can be seen at residential, commercial, industrial and waste dump areas trying to pick all recyclable fractions of waste.

Country	Municipal Solid Waste Generation (kg/capita/day)	GDP Per capita (2005 US $)
India	0.46	3452
Bangladesh	0.49	2053
Nepal	0.5	1550
Philippines	0.52	5137
Mongolia	0.6	2107
Lao PDR	0.69	2039
Indonesia	0.76	3843
China	0.79	6757
Malaysia	0.81	10882
Sri Lanka	0.89	4595
Thailand	1.1	8677
Singapore	1.1	29663
Japan	1.47	31267



Source: Waste quantities & characteristics, UNDP, 2007

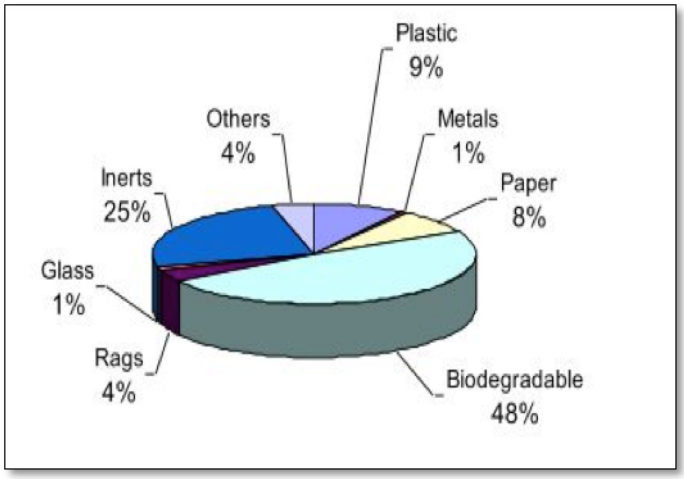


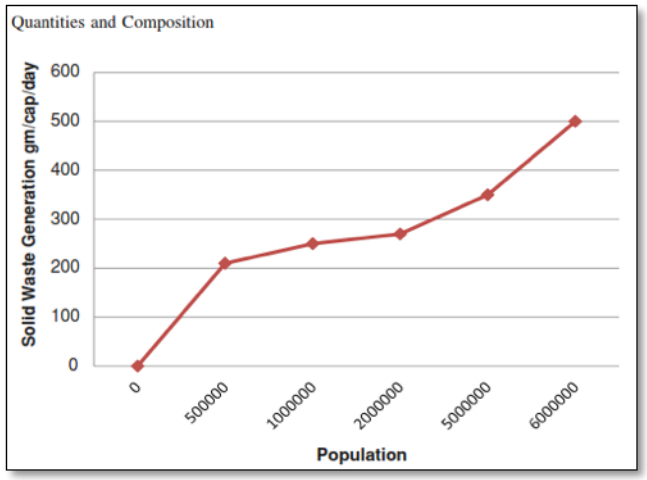
The quantity of municipal waste generated from urban settlement is a function of human development index which in turn depends on the life expectancy, gross domestic product and education indices.

The quantity of municipal solid waste is invariably higher in the developed nations compared to the developing nations.

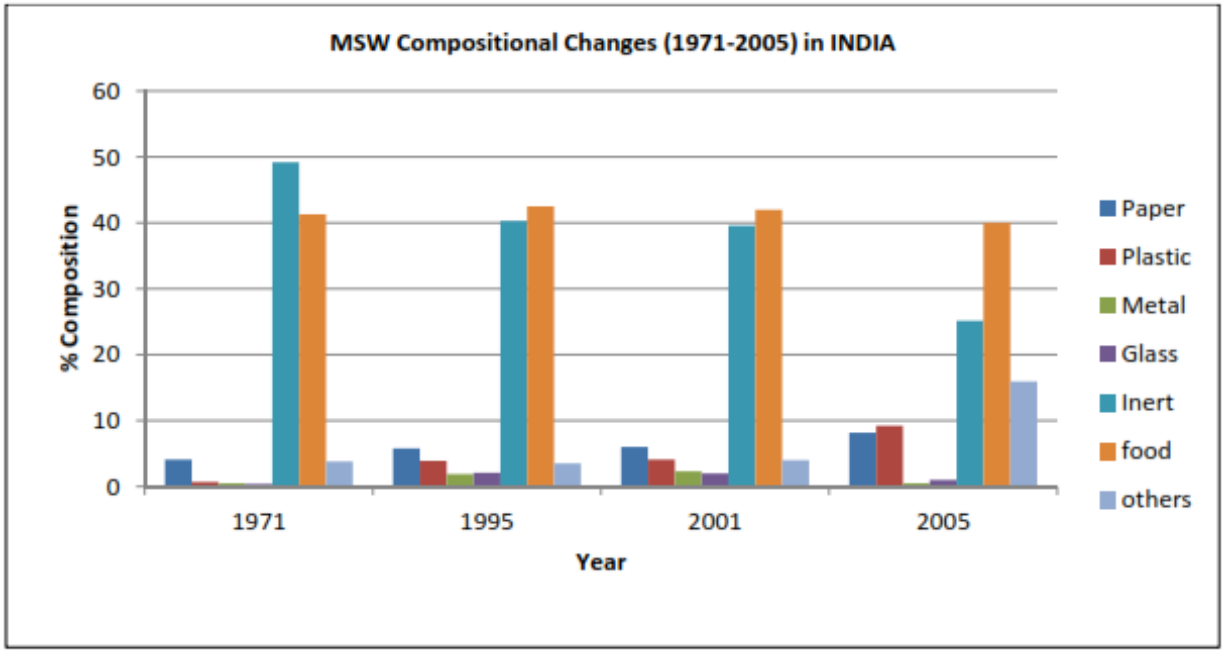
Existing Scenario

It is estimated that about 1, 00,000 Metric Tonnes of Municipal Solid Waste is generated daily in the country. Per capita waste generation in major cities ranges from 0.20 Kg to 0.6 Kg. Generally the collection efficiency ranges between 70 to 90% in major metro cities whereas in several smaller cities the collection efficiency is below 50%. It is also estimated that the Urban Local Bodies spend about Rs.500 to Rs.1500 per tonne on solid waste for collection, transportation, treatment and disposal. About 60-70% of this amount is spent on street sweeping of waste collection, 20 to 30% on transportation and less than 5% on final disposal of waste, which shows that hardly any attention is given to scientific and safe disposal of waste (CPCB)



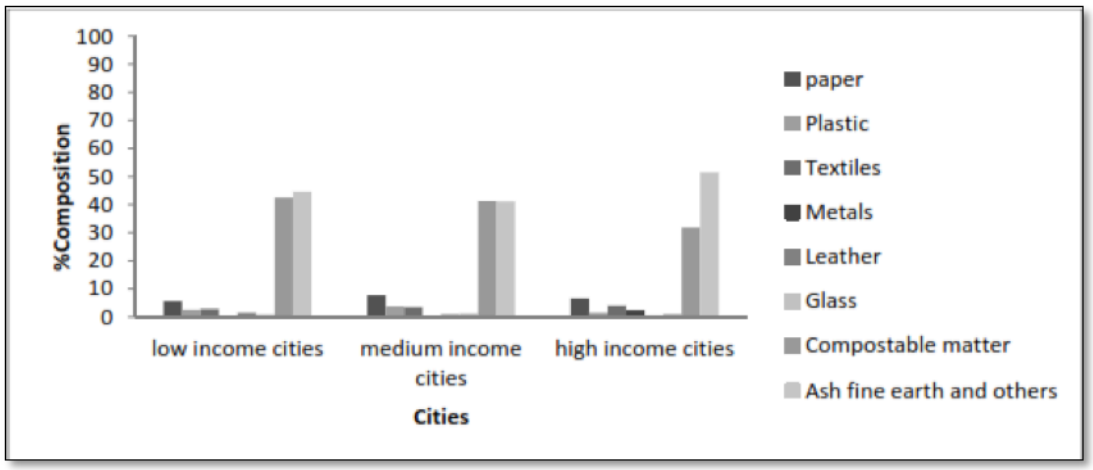


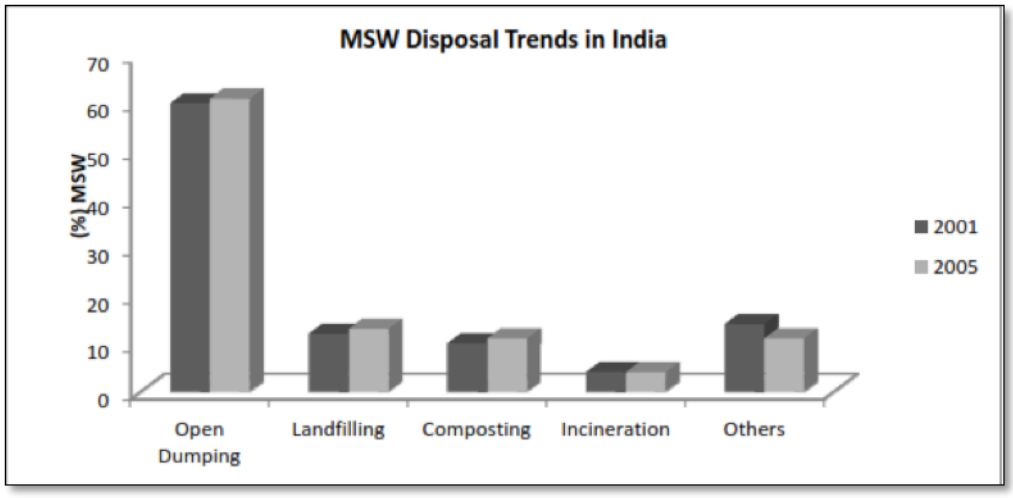
Solid waste generation v/s population of urban settlement in India (UNDP, 2007)



Source: Solid waste generation v/s population of urban settlement in India (UNDP, 2007)

A compositional change on the basis of income of people in low, medium and high income cities has been shown here below. It suggest that as country gets richer, the organic share decreases whereas the paper and plastic increases.





(International Journal of Engineering Science and Technology (IJEST), 2012)

Issues

Poor solid waste management (SWM) policies and practices heavily impact the environment, well-being, and quality of life. Despite municipalities in India spending up to 50% of their budgets on SWM, they are often not prepared to address mounting quantities of wastes. Due to the urgency of urban environmental problems and the growing recognition that improper solid waste disposal is a contributor to local disease episodes, regional water resource pollution, and global greenhouse gases; municipal SWM has become a top development and environmental priority in India.

The most well known cause for bad sewages and waste management in India recently is due to a large influx of people from rural areas that have flocked to the cities of India. This means that the infrastructure of waste management as it is now, cannot cope with the extra people and therefore, has created havoc within India in terms of environmental cleanliness or in this case, a lack of.

It has been estimated that the waste generation in Indian cities is expected to increase by five times in comparison with today's figures. This could be appalling for the residents of India as well as the Government and responsible authorities. Currently, bad waste management and infrastructure has reported to be so severe that wildlife species often found in marshlands, have died out. Wildlife such as frogs, have been amongst those affected by waste and sewage. This is how bad it is now for wildlife, which makes it a severe issue for India to solve and manage effectively.

In most of the major cities of India more than half of the waste produced in the city is un-treated. This is a serious and pressing issue which needs immediate attention of the authorities else these scenarios could seriously jeopardize the future of the country in several different ways.

Legislation for waste management in India

Ministry of Environment and Forests (MoEF) had not enacted laws/rules that would govern the management of all kinds of waste in India. MoEF had enacted the following rules:

- Management and Handling of Municipal Solid Waste (2000),
- Management and Handling of Bio-Medical Waste (1998, amendment 2003),
- Management and Handling of Hazardous Waste (1989, amended in 2000 and 2003),
- Recycled Plastics Manufacture and Usage Rules (1999),
- Notifications for the disposal of fly ash, and
- Management and Handling of batteries.

In addition, it has circulated draft guidelines for the management of e-waste (2007).

Solid waste management legislation

In view of the continuing inheritance of poor SWM, the Ministry of Environment and Forests (MoEF), Government of India (GoI) passed the Municipal Solid Waste Management (Management and Handling) Rules, in 2000 under the Environment Protection Act of 1986. The Rules mandate, not only class I cities of India, but all municipal authorities, to implement improved systems of SWM. Still implementation remains extremely weak (Climate Change, Environment and natural Resource management)

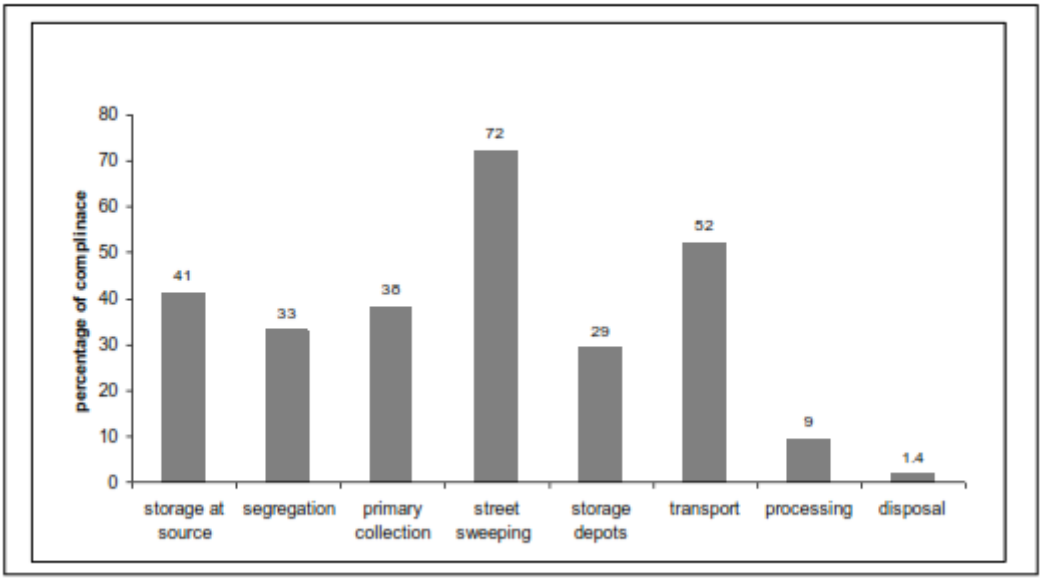
To ensure compliance, the principal recommendations of the Supreme Court appointed committee have been incorporated in the Municipal Solid Waste (Management and Handling Rules 2000) notified by Ministry of Environment and Forests in September, 2000. To improve the system, the following seven directions were issued:

1) Prohibit littering on the streets by ensuring storage of waste at source in two bins: one for biodegradable waste and another for recyclable material.
2) Primary collection of biodegradable and non biodegradable waste from the doorsteps at pre-informed time on a day-to day basis using containerized tricycles/handcart/pickup vans.
3) Street sweeping covering all the residential and commercial areas on all the days of the week irrespective of Sundays and holidays.
4) Abolition of open waste storage depots.
5) Transportation of waste in covered vehicles on a day-to-day basis.
6) Treatment of biodegradable waste using composting or waste to energy technologies meeting the standards lay down.
7) Minimize the waste going to the landfill and dispose of only rejects from the treatment plants and inert material at the landfills as per the standards laid down in the rules.

The entire responsibility of implementation as well as development of required infrastructure lies with Municipal authorities. They are directed to obtain authorization from the state Pollution Control Boards/committees for setting up waste processing and disposal facilities and furnish annual report of compliance. (www.pppinindia.com)

Status of compliance of municipal solid waste management 2000 rules prepared by expert committee constituted by the ministry of urban development and poverty alleviation, government of India. No consolidated official data are available about the status of compliance of MSW. However, figure shows estimated percentages of compliance. Municipal authorities report numerous reasons for non-compliance with the 2000 rules.

Figure-1: Compliance with the 2000 Rules



Source: Asnani 2004a.

Reasons for Noncompliance with the 2000 Rules:

Area of compliance	**Reasons for noncompliance**
Storage of waste at source	• Lack of public awareness, motivation and education • Lack of civic sense and bad habits of people to litter • Lack of cooperation from households, trade and commerce • Lack of stringent panel provision • Lack of powers to levy spot fines • Lack of litter bins in the city • Long distance between community bins • Resistance to change in attitude
Segregation of recyclable waste	• Lack of wide publicity through electronic and print media • Lack of public awareness and motivation, resulting in poor response from citizens • Lack of citizen's understanding about how to use separate bins for • storage of recyclables • Lack of sufficient knowledge of benefits of segregation • Lack of cooperation and negative attitude of people • Lack of finances to create awareness • Difficulty of educating slum dwellers • Lack of effective legal remedy
Collection of waste from doorstep	• Lack of awareness and motivation • Unavailability of primary collection vehicles and equipment • Insufficient response from citizens

	• Lack of financial resources • Difficulty of motivation slum dwellers • Lack of personnel for door-to-door collection • Lack of suitable containers
Daily sweeping of streets	• Excessive leave and absenteeism of sanitary workers • Unavailability of workers on Sundays and public holidays • Kachha (unpaved) roads • Lack of financial resources
Abolition of open waste storage depots and placement of containers	• Shortage of containers • Lack of financial resources • Lack of planning for waste storage depots • Inaccessible areas and narrow lanes that do not allow sufficient space for containers
Transportation of waste in covered vehicles	• Old vehicles that are difficult to replace
Processing of waste	• Lack of financial resources • Lack of technical know-how • Lack of skilled personnel • Unavailability of appropriate land • Lack of basic facilities to set up treatment plants • Lack of institutional capacity
Disposal of waste at the engineered landfill	• Lack of financial resources • Lack of technical personnel • Lack of technical know-how for scientific disposal of waste • Unavailability of appropriate land • Lack of institutional capacity

Source: www.tn.gov.in/cma/swm_in_india.pdf

Drawbacks

Municipal Solid Waste (Management and Handling) Rules, 2000 does not contain any provision for levying penalty on the generator of wastes or the operator of the facility for the collection, segregation, transportation, processing and disposal of municipal solid wastes, if the wastes are not disposed in the prescribed manner. Similarly, the Rules prescribe no penalty if the incinerator or landfills disposing municipal solid waste do not meet operating standards. Thus, there is no disincentive provided in the rules for the unsafe disposal of waste.

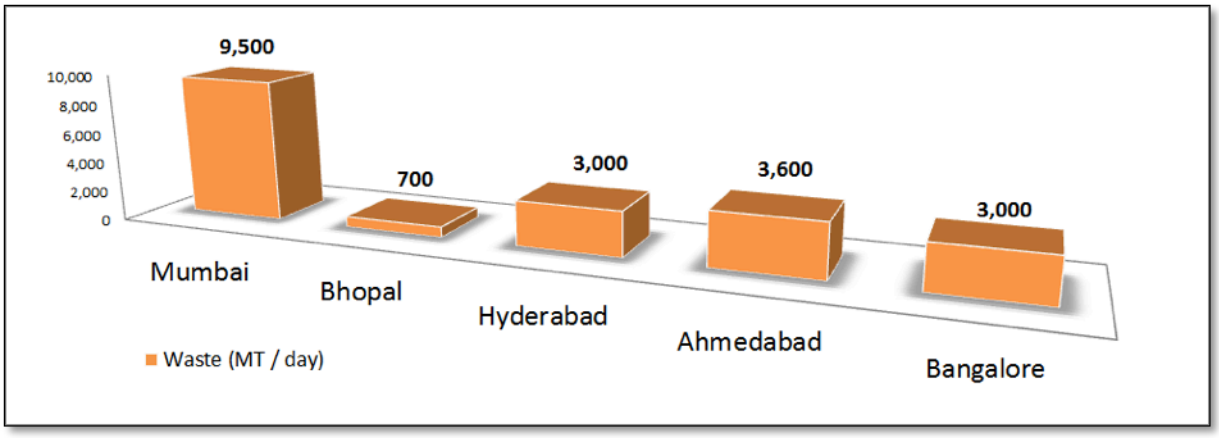
CHAPTER 3: SOLID WASTE MANAGEMENT IN BHOPAL

Bhopal city generates an estimated 814 tonnes per day of solid waste daily. As per projection, the waste generation quantities are estimated to increase from 427 metric tonnes per day in 2001 to 569 metric tonnes in 2011 and 886.5 metric tonnes per day in year 2021, in Bhopal (IJSET, 2013)

The bulk of the waste comprises inert and biodegradables. The quantity of solid waste transported by the BMC is estimated to be 610 t/day (Kulshrestha, 2011).

The only landfill of this city, the Bhanpur Dumpsite is located at around 15 km away from the city limits. There are proposals of opening three more new landfills around the city. These landfills of 64

acres are expected to serve for a period of 20 years. The project cost is estimated to be around €5,550,000, which is roughly around 400,000,000 INR. These projects will involve waste processing, along with deriving compost manure



Waste generation in MT/Day (Kulshrestha, 2011)

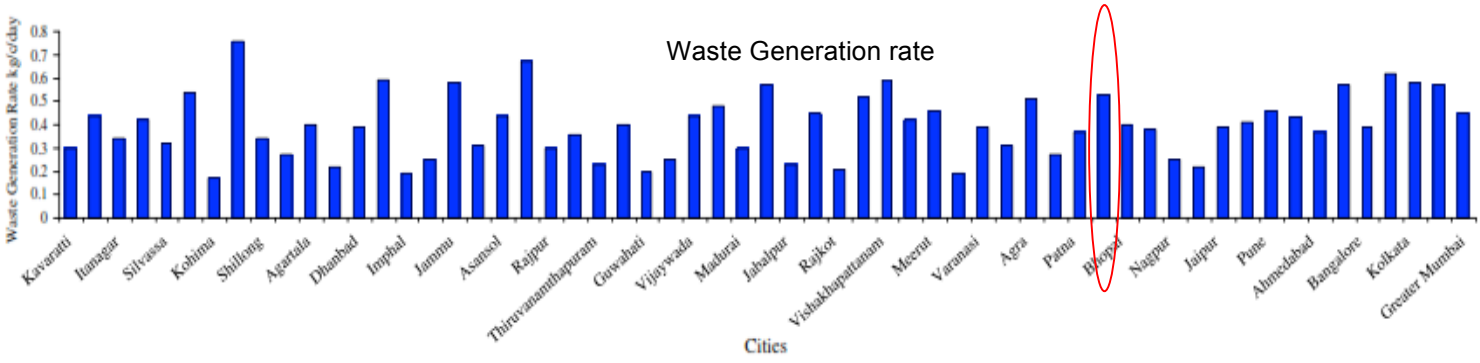
Composition of MSW for Bhopal:

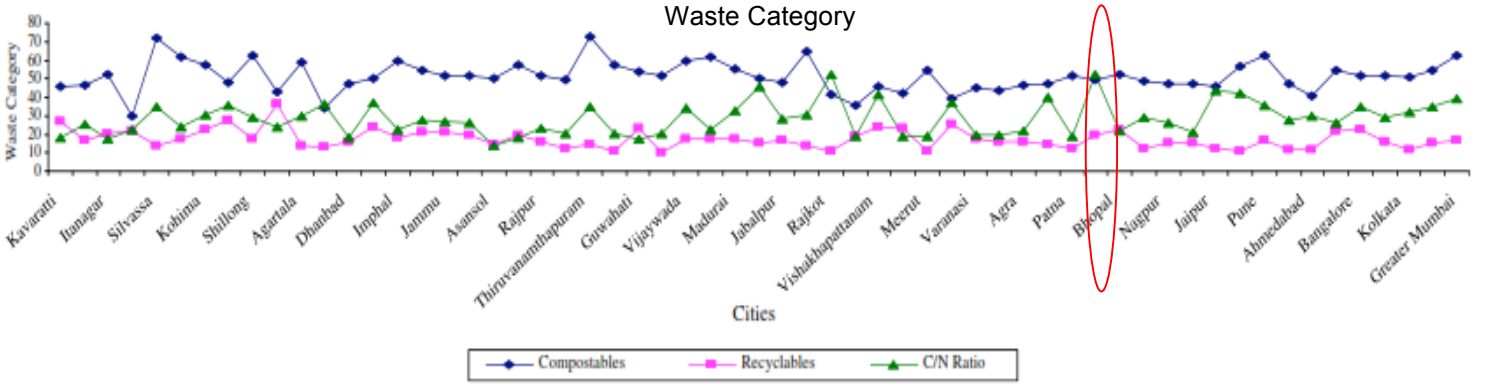
• Physical characteristics	
○ Biodegradable (%)	52.44
○ Paper (%)	8.5
○ Plastic (%)	3.5
○ Glass (%)	1.0
○ Metal (%)	1.5
○ Inert, ash, debris (%)	30

• Chemical characteristics	
○ Carbon (%)	21.72
○ Nitrogen (%)	0.70
○ Phosphorous as P_2O_5 (%)	0.65
○ Potassium as K_2O (%)	0.98
○ C/N ratio	28.57
○ High Calorific value (kCal/kg)	1421
○ Moisture (%)	43

Source: National solid waste association of India

Name of City	Waste Qty. (TPD)	MSW Management Scenario			Collection of MSW			Transportation of MSW				Processing of MSW				Disposal of MSW – Situation Analysis at Landfill Site						
		Organization in charge	Penalty clause	Manual handling	Community bin system	House to house collection	Segregation by rag pickers at community bin/landfill	Municipal vehicles	Private vehicles	Provision of tarpaulin/ good quality cover	Transfer station facility	Composting (TPD)	Vermicomposting (TPD)	Pelletization & waste to energy	Biomethanation & any other	Uncontrolled dumping	Sanitary landfill site	Earth cover	Compaction of SW	Leachate collection & treatment facility	Biogas recovery facility	Remaining useful life of landfill (yr)
Nagpur	504	HO	✓	×	×	Fully	×	✓	×	✓	×	*	30	×	×	✓	×	×	×	×	×	7
Patna	511	CEO	×	✓	✓	No	×	✓	×	×	×	*	×	×	×	✓	×	×	×	×	×	1
Indore	557	CHO	×	✓	✓	Partially	×	✓	×	✓	×	×	1.25	×	×	✓	×	×	✓	×	×	N
Vadodara	357	MC	×	✓	✓	Partially	✓	✓	×	×	✓	×	×	×	×	✓	×	✓	×	×	×	N
Bhopal	574	DMC	×	✓	✓	Partially	×	✓	×	×	×	100	×	×	×	✓	×	×	✓	×	×	N
Coimbatore	530	HO	×	✓	✓	Partially	×	✓	×	×	×	*	×	×	×	✓	×	✓	×	×	×	N
Ludhiana	735	HO	×	✓	✓	Partially	✓	✓	×	×	×	×	×	×	×	✓	×	×	×	×	×	N
Kochi	400	HO	×	✓	✓	Partially	×	✓	✓	×	×	×	×	×	×	✓	×	×	×	×	×	N
Vishakha-pattanam	584	HO	×	✓	✓	Partially	×	✓	×	×	×	×	×	×	×	✓	×	×	✓	×	×	N
Agra	654	HO	×	✓	✓	Partially	×	×	×	×	×	×	×	×	×	✓	×	×	✓	×	×	N
Varanasi	425	HO	×	✓	✓	Partially	✓	✓	×	×	×	×	×	×	×	✓	×	×	×	×	×	N
Madurai	275	HO	×	✓	✓	Partially	✓	✓	×	×	×	×	×	×	×	✓	×	×	×	×	×	N





Source: National solid waste association of India

Waste from Households

Bhopal having a million plus population and representative of waste management problems of typical medium size Indian city is selected for the case study. The practices identified from the research study can be used in any other city of India. Municipal Corporation Area of Bhopal is 285.88 sq.km and is predominantly divided into four distinct areas characterized as:

- Old City: 41.58 sq. Km
- BHEL : 44.18 sq.km
- New City: 77.97 sq.km
- Village Area: 122.15 sq.km

Out of the total municipal area, only 77.25 Sq. Kms is classified as the developed area. The rest consist of open spaces, water bodies and other unplanned peripheral areas some of which are being used as a dumping ground for the solid waste (Bhopal Municipal Corporation, 2009)

The practice of recycling is not well organised and segregation of recyclable waste at source has not yet been adopted. Recyclable waste gets intermixed with garbage disposed at different places. The emphasis of the municipal corporation is on the collection and transportation of solid waste. The issue of disposal is of less priority. Solid waste in Bhopal is composed of materials that can be composted (approximately 50%); However, composting plants in Bhopal compost only about 20% of the total waste. The Municipal Corporation has paid special attention to legal impediments and labour concerns for private sector participation.

Waste from commercial establishments

Commercial waste can be defined as any waste generated as a result of carrying out a business, including associated lawn and garden clippings from normal maintenance of the business premises. Commercial waste also includes rubbish produced by customers i.e. food wrappers and containers (***Waste Reduction and Recycling Act 2011). Commercial waste is waste arising from the activities of wholesalers, catering establishments, and shops.***

Shopping centres and other retail outlets have become mainstays in Indian culture. While all the people in these centres contribute to our nation's economy, they also are generating a large amount of trash. The amount and type of waste that is generated from commercial establishments is different from those at household's level. The type and scale of activities undergoing at a commercial centre define the waste generation characteristics at these places. Unlike household waste the waste generated from commercial centres is disposed, stored, treated and collected in a different manner. The type of activity undertaken at a particular commercial centre determines the waste management practice adopted there in.

Commercial waste being generated can be said to be comprised of three types of wastes:

a) *Commercial Putrecible waste: waste containing organic matter and having a tendency to decompose into Malodorous – by – products*
b) *Commercial non Putrecible waste: waste that does not contain organic matter and hence does not have a tendency to decompose into Malodorous – by – products*
c) *Filling materials: sub set of non Putrecible waste, comparatively clean materials like ash, dirt etc.*

Quantity of generated Commercial refuse: 0.1 to 0.2 kg/cap/day

Almost 40% of domestic waste, 25% hotel waste, and 25% of commercial waste which is organic in nature can be segregated, collected and treated separately. BMC is having separate truck arrangement for hotels and commercial complexes but segregation is not done at source. Similarly in case of domestic waste, nearly 40% of the total waste is not segregated at source and collected with dry waste. (IJSET, 2013).

Solid waste generated from markets and commercial activities are either put to the adjacent community containers wherever available or thrown to the nearby open spaces, drains and streets. The shops, markets and other commercial establishments normally start business after 9.30—10.00am. These timing do not synchronize with the work schedule of the sweepers as by this time most of the collection procedure is over after collection of solid waste from main streets and roads. Therefore, the solid wastes from these sources are thrown on road side, drains and nearby open areas. Hence the solid waste litters on roads and streets in these areas for whole day before sweeper cleans it on the next day. The city does not appear clean. The same is true in the case of hotels, restaurants and vegetable markets also (Rajesh Babu Katiyar, *et al., 2013)*

Types of commercial establishments taken into consideration for study are:

1. Eateries (restaurants and Hotels)
2. Vegetable Market
3. Repair Workshops (including oil-grease etc., Mechanical, automobile, non-electronic-appliances, scrap-parts, etc.)
4. Supermarkets, shopping malls, etc.
5. Slaughter Houses
6. Hardware shops

Eateries (restaurants and Hotels)

There are a large number of restaurants and hotels in India. These hotels contribute substantially to the generation of waste .Hotel and restaurant waste contributes to around 25-30 % of the total waste generated. Much of the waste created in hotels is generated from within the kitchen (organic food waste, packaging, aluminium cans, glass bottles, corks and cooking oils), or from the housekeeping department (cleaning materials and plastic packaging). Waste is not only created in guest rooms but also in public areas, hotel gardens (engine oils, pesticides, paints and preservatives to grass and hedge trimmings) and offices (toner cartridges, paper and cardboard waste). Refurbishment and renovation projects undertaken at the hotel contribute further to the waste generated by the property.

At present waste generated by small restaurants is disposed off directly at nearby collection spots. The substantial quantity of food waste dumped at these collection spots gets mixed with all the other kinds of dry and wet waste and gives an ugly look to the collection spots with lot of dirt and stink. In case of large 4 and 5 star hotels, the hotel waste is disposed off through private contractors to the dumping ground. These private contractors make frequent trips to collect waste as the generation frequencies at the source.

Some private contractors charges Trade Refuse Charge (TRC) to the hotels for the waste generated by them. The TRC is charged in multiples of license fees which is directly based on the area of the hotel and the grade. The grade one hotels are generally bars and permit rooms which do peak business during evening hours. The waste generated by the restaurants with bars and permit rooms is much less as compared to that generated by the food restaurants. However the TRC charged for

the bars and restaurants is much higher than that charged for the ordinary restaurants which generate much more quantity of waste.

Around 70 to 75 % of the hotel waste is biodegradable and gets mixed with all the other type of waste when dumped at the collection spots. Also the waste which is collected directly by the private contractors gets mixed with all the other type of non biodegradable waste at the dumping ground.

Bhopal too has a large number of eateries; both hotels and restaurants. These range from 4 stars, 3 star hotels to small food joints. There are two 4 star hotels i.e. Noor –uss-sabah and The Residency. The other hotels in Bhopal are:

Three Star Hotels:

1. Amer Palace, Bhopal.
2. Arch Manor, Bhopal.
3. Hotel Nayak Palace.
4. Jehanuma Palace, Bhopal.
5. Lake View Ashoka, Bhopal.
6. Motel Shiraz, Bhopal.
7. Nisarga, Bhopal.
8. Palash Residency, Bhopal.
9. Sarthak, Bhopal.
10. Surendra Vilas, MP Nagar, Bhopal.
11. The Mark Hotel & Club, Bhopal.

Other main hotels:

1. Hotel Ganpati , M.P. Nagar Zone - 2 Bhopal.
2. Aashirwad Regency, M.P. Nagar Zone - 2 Bhopal.
3. Blue Star, Bhopal.
4. Classic Hotel, Bhopal.
5. Copper Bells, Bhopal.
6. Crescent Resort & Club, Bhopal.
7. Jain's Rajhans, Bhopal.
8. Lake Princess, Bhopal.
9. Mayur, Bhopal.
10. Panchanan, Bhopal.
11. Pleasure Palace
12. Ramsons International, Bhopal.
13. Reva Regency, MP Nagar, Bhopal.
14. Sangat Plaza, MP Nagar, Bhopal.
15. Signature, Bhopal.
16. Silver Inn, Bhopal.
17. Skylark, Bhopal.
18. Hakeem, Bhopal

Apart from these there are around 35 restaurants, 20 ice cream joints and bakeries in Bhopal. The waste generation and collection scenario in the city from these is same, with some higher end hotels taking services of private contractors, while others dumping their wastes to common dumping points. Be it higher end hotels or small restaurants and eateries, segregation at source is entirely absent at all levels.

Vegetable Market

Most fish and vegetable markets generate huge quantities of organic waste that serve as the medium in which bacteria can grow. Especially true for fish markets which generates waste that's primarily animal matter like fins, scales, blood, flesh, etc. Several species of pathogenic bacteria like Salmonella, Pseudomonas, Clostridium, Proteus, etc can grow on these media. Some of the gases that are liberated due to decomposition by these micro-organisms are Methane, Ammonia, Carbon-dioxide, and Hydrogen; all of which pollute the air and give out stench smell. People can get infected if somehow they come in contact with these micro-organisms.

These wastes can also facilitate the growth of fungi and sustain viruses for long periods. The areas are regularly visited by street animals like dogs, cats, and even birds, crows and others. When these animals move in the yards or compounds of the nearby houses, they can spread infection easily. ***In Bhopal weekly vegetable markets are a common phenomenon; these are held all around the city. The main weekly vegetable markets in Bhopal and the week days when they are held are:***

1. Anand Nagar Haat, Bhopal. : Days - Daily, Morning to evening.
2. Bittan - Vegetable Market : Monday, Thursday, Saturday.
3. Gandhi Market Piplani Haat, Bhopal : Sunday, Thursday.
4. Govindpura Haat, Bhopal : Monday, Friday.
5. Habibganj Vegetable Market, Bhopal : Tuesday.
6. Nehru Nagar Vegetables Market : Wednesday.
7. T. T. Nagar Vegetables Market : Sunday.

Apart from these there some other small vegetable markets also present in Bhopal these serve only the surrounding locality or a particular colony. Some of them are Begamganj vegetable market, Baag Sewaniya Vegetable Market, Kolar Vegetable Market Mahabali Nagar Ashoka Garden Sabzi Mandi New Ashoka Garden, Ashok Nagar, Bhopal, Indus Towne vegetable market, Srikrishnapuram, Bhopal etc.

The waste generated from these vegetable markets is mostly bio degradable waste. This waste is thrown on road side, drains and nearby open areas surrounding the vegetable market. Hence the solid waste litters on roads and streets in these areas before getting cleaned by the Municipality workers. The condition becomes even worse in rainy season.

The problem of odour, nuisance of flies and dogs etc. has become a common phenomenon due to this. Though some of the vegetable markets are held in the areas having posh shopping areas and residential colonies nearby still there is no proper disposal and collection mechanism in place.

Repair Workshops (including oil-grease etc., Mechanical, automobile, non-electronic-appliances, scrap-parts, etc.)

Repair shops produce many types of waste -- some hazardous, some not necessarily hazardous but still potentially damaging to the environment if not handled properly, and all requiring proper treatment and/or disposal at significant cost to the business. A list of the types of waste that the shop owner or manager must contend with would include:

- solvents (paints and paint thinners)
- antifreeze
- scrap metal

- batteries and other auto parts
- oils and oil filters
- fuels of various types
- acids and alkalis (contaminated rags and towels)

There are numerous repair shops in Bhopal from computer, AC, electronic workshops to motor repair shops.

Supermarkets and shopping malls

Shopping centres and other retail outlets have become mainstays in Indian culture. While all these people in shopping centres contribute to our nation's economy, they also are generating a large amount of trash. Shopping malls and retail shops can create a large amount of waste. Most of this is packaging material such as plastic, paper and cardboard that has to be recycled.

A typical supermarket will see about 35 percent of the overall trash compactor is organic food waste, whether that's produce, bakery, dairy, fruits or vegetables.

When conventional waste handling is used, a significant amount of space is allocated to storing the packaging material; this may be both in the shops and also in the central storage room before it is collected by the collection company. The waste handling can often get into a logistical conflict with the delivery of new goods to the shops. In addition, staff who are not employed to handle or sort the waste end up spending valuable time transporting the waste from the shop as well as spending time when the storage surfaces need to be cleaned. Consequently, the waste handling becomes costly and the working environment poorer.

Bhopal has a flourishing commercial sector. There are around 7 supermarkets, around 4 shopping malls and numerous retail shops and markets.

Slaughter house

While the slaughter houses come under the purview of the animal husbandry division of Ministry of Agriculture mainly for the purpose of funding towards expansion and modernization activities, the respective local bodies are mainly responsible for day-to-day operation/maintenance of the slaughter houses. Most of the slaughter houses in the country are service-oriented and, as such, perform only the killing and dressing of animals without an onsite rendering operations. Most of the slaughter houses are more than 50 years old without adequate basic amenities viz. proper flooring, ventilation, water supply, lair age, transport etc. In addition to these deficiencies, slaughter houses suffer from very low hygiene standard posing a major public health and environmental hazards due to discrete disposal of waste and highly polluted effluent discharge. Unauthorised and illicit slaughtering has also increased manifold and thus the related problems.

The type of waste produced by the slaughter houses are shown as under:

Source	**Waste**
Stockyard	manure
Killing floor	blood
Dehairing	hair and dirt
Insides removal	paunch manure and liquor
Carcass dressing	flesh, grease, blood, manure

Sl.No.	Type of slaughter house	Capacity Annual	Daily Waste Generated
1.	Large	Large animals>40,000 Small animals>6,00,000	6-7 Tonnes/day
2.	Medium	Large animals = 10,001-40,000 Small animals = 1,00,001-6,00,000	2-6 Tonnes/day
3.	Small	Large animals upto 10,000 Small animals upto 1,00,000	0.5-1 Tonne/day

Source: Department of Animal Husbandry, www. *urbanindia.nic.in*

Waste from office establishments

The waste generated from offices and business centres comes under the category of office waste. The type of activities undergoing at any office or business establishment determine the amount and characteristics of waste generated therein. While waste composition will vary from office to office most waste bins compose of the following:

Computer Printout	29%
Mixed Papers	23%
Corrugated Containers	8%
Newspapers	10%
Total Paper	**70%**
Other Wastes - glass, metals, plastics, food, etc.	30%
Total Office Wastes	**100%**

It has been estimated that 90 percent of all office waste by weight is paper and up to 77 percent of the solid waste generated in an office building can be recycled. This portion is made up of reams of discarded computer printouts, white and coloured stationery, scratch paper, copier paper, outdated information, memos, flyers and reports.

Bhopal predominantly being an administrative city has various government offices established here. Apart from the government offices there are numerous private offices as well.

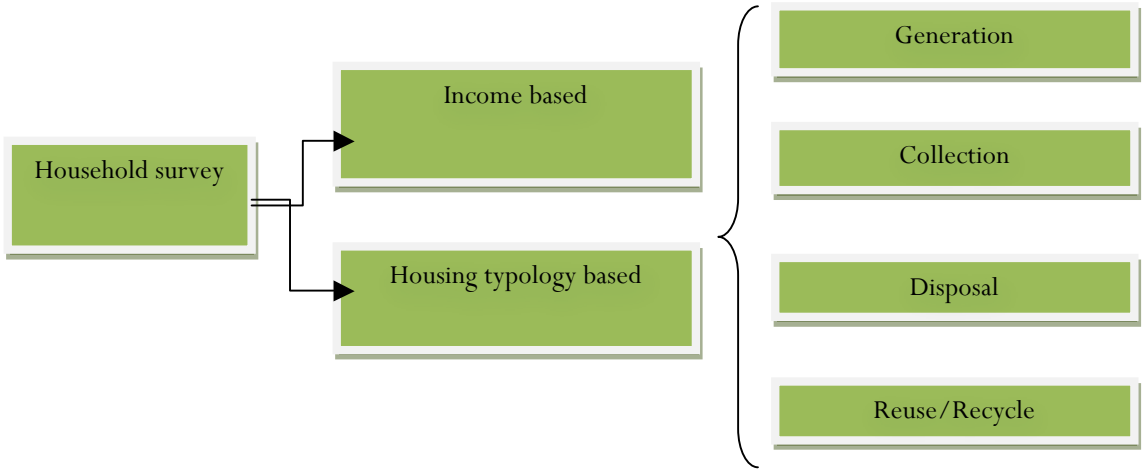
CHAPTER 4: SURVEY METHODOLOGY

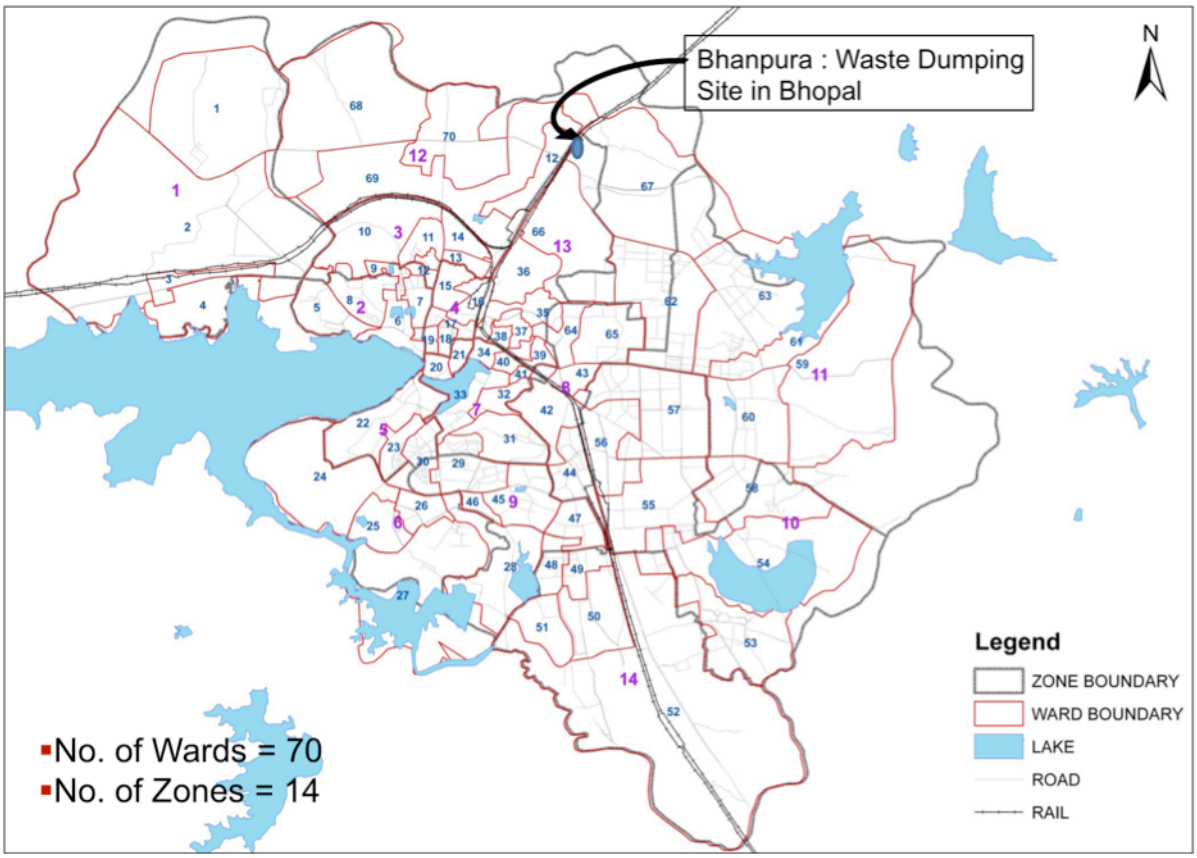
Primary survey was conducted to understand the scenario of waste management in commercial and office establishments and at household level. The samples were collected from different locations of commercial area, fruit and vegetable markets, weekly market, slaughter house, fish and meat market, hotels, restaurant, various office establishments, both were also included in the survey. For office establishment's survey only private offices were included in the survey. Also banks, both government and private were included in the survey of office establishments. For household survey, the survey was conducted ward wise comprising of different income groups and spanning across

different household levels. Primary survey was conducted by means of questionnaires prepared separately for Household, office and commercial establishment's survey. (Questionnaires attached as annexure)

Household survey:

There are 14 zones and 70 wards in Bhopal. For household survey, the sample size was taken as 0.4% of the total households from each ward. There are around 283168 households (2001 census) out of which the actual samples collected were 1235 against 0.4% sample size. The Questionnaire was intended to cover different income patterns and different housing typology to understand and examine the connection between waste generation and life style. Details of samples are given in Annexure 1.





WARD MAP OF BHOPAL

The ward wise sample details and the samples collected from each ward are given in the following table:

WARD NO.	NO OF HOUSEHOLDS (2001)	SAMPLES TO BE COLLECTED (0.4%)	ACTUAL SAMPLES COLLECTED
1	6332	25	30
2	3266	13	15
3	2974	12	12
4	4535	18	18
5	3364	13	13
6	2815	11	11
7	2362	9	10
8	2713	11	11
9	4585	18	20
10	2706	11	11
11	6588	26	30
12	3703	15	15
13	3226	13	15
14	3211	13	15
15	3733	15	15
16	2515	10	10
17	3932	16	20
18	2294	9	9
19	2001	8	8
20	2049	8	8
21	2117	8	8
22	1764	7	7
23	2939	12	12
24	1745	7	7
25	2806	11	11
26	2860	11	11
27	4151	17	17

28	4869	19	20
29	5391	22	25
30	3275	13	15
31	7374	29	30
32	3636	15	15
33	2181	9	10
34	2540	10	10
35	5975	24	24
36	3456	14	14
37	3171	13	13
38	3001	12	12
39	3349	13	13
40	4878	20	20
41	5294	21	21
42	6339	25	25
43	2400	10	10
44	2290	9	10
45	3536	14	15
46	4890	20	20
47	3331	13	15
48	4507	18	20
49	6011	24	25
50	5125	21	20
51	5290	21	20
52	9450	38	40
53	7206	29	30
54	6540	26	30
55	3104	12	15
56	4158	17	20
57	2485	10	10
58	2667	11	15

59	2721	11	15
60	4473	18	20
61	2550	10	10
62	7732	31	50
63	9798	39	50
64	7389	30	30
65	6818	27	30
66	11993	48	50
67	2402	10	10
68	939	4	5
69	470	2	5
70	745	3	5
71	133	1	5
TOTAL	283168	1133	1235

Commercial Establishments:

For commercial establishment's survey, the categories of commercial establishments listed below were surveyed and around 10 samples were collected from each category. A total of 105 samples were collected from different commercial establishments.

S.No.	Commercial Establishments Surveyed	Samples to be collected	Actual samples collected
1	Eateries	10	15
2	Vegetable Markets	10	5
3	Repair Shops, Service Centre	10	10
4	Supermarket	10	5
5	Malls	10	5
6	Slaughter Houses	10	5
7	Hardware Shops	10	10
8	General Stores, Ration Shops	10	10
9	Showrooms, Emporiums	10	10

10	Medical Shops	10	5
11	Bookstores	10	5
12	Boutiques, Cloth Shops	10	10
13	Salons	10	5
14	Printing Shops	10	5
		140	105

Office establishments:

For office establishment's survey, around 15 offices were surveyed, having different employee strength. The survey was intended to span across different types of office establishments. Bhopal mostly has an administrative setup and also substantial amount of private offices as well. There are significant number of banks also present, both private and government in the city, these were also included in the survey. The offices surveyed are listed below.

.No.	Office Establishments Surveyed
1	LIC , Bhopal Division , MP Nagar
2	Bajaj Finserv leading , MP Nagar
3	Make my Trip , Bittan Market
4	Thomas Cook, Bittan Market
5	Thomas Cook, MP Nagar
6	Agrawal Investment Services
7	Bharat Matrimonial
8	Edelweis Tokyo, MP Nagar
9	Muthoot Finance
10	Nokia Care
11	UCO Bank , New Market
12	Vision Infinity, MP Nagar
13	SBI, Traders Branch , MP Nagar
14	SBI ,Main Branch, Shaymla hills
15	Central Beauro of Investigation

CHAPTER 5: SURVEY FINDINGS AND ANALYSIS

Household survey

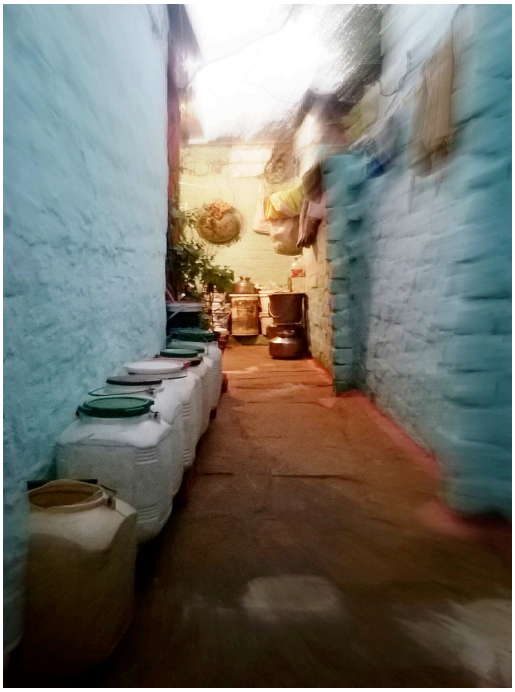
In terms of the characteristics of the population surveyed for household study, it was found that of the total households surveyed, 45% of the people were such who have been staying in Bhopal for more than 10 years. The survey was carried across different typology of houses to understand their waste generation scenarios like detached, semi detached, flats, informal housing etc. and across different income levels. Of the total samples collected, had the following income characteristics:

S.No.	Yearly Income	Income Groups	Samples	Percentage
1	< 50,000	Slums	99	8%
2	50,000-1, 50,000	EWS	368	30%
3	1,50,000- 3,00,000	LIG	439	36%
4	3,00,000-10,00,000	MIG	220	18%
5	>10,00,000	HIG	108	9%
	Total		1235	100%

The survey findings were analysed under five income groups as stated above to understand their waste generation characteristics and it's linkages with their living standards and life styles.

The survey of households having yearly income of less than Rupees 50,000/- were analysed first and were mostly composed of samples from slum dwellings. The most frequently generated wastes under this income category were paper, plastic and kitchen wastes which are generated on daily to weekly basis. While the generation of wastes such as garden waste, e-waste and appliances waste is nil. Proper waste collection and disposal facilities and awareness among people towards these are not found under this income category. Open dumping is the most commonly adopted method of waste disposal adopted for almost all types of wastes generated. But the reusability of wastes such as textile, plastic and metals is quite high. Kitchen waste and portions of paper and plastic wastes that do not have any reuse value are thrown away directly while those which have even a smaller percentage of reusability are put to various uses.

Some of the commonly adopted methods of reuse include the re use of cooking oil containers for transporting water from water source to house, reuse of cooking oil containers for storing water, re using empty cement bags for covering roofs of kachha houses, Gunny bags as doormats during rainy season or for some other purposes and re using discarded electric cables for hanging cloths.



Reuse of cooking oil containers for transporting water from water source to house and for storing water

Gunny bags as doormats during rainy season or for some other purposes and re using discarded electric cables for hanging cloths.

The second income category is that of EWS (Economically Weaker Section) comprising of people having income between 50,000 to 1,50,000. These people mostly live in informal housing. Their waste disposal and generation frequencies and characteristics are slightly different from the above class while the practice of reuse of waste material is more profound in this category. Paper, plastic and kitchen waste are generated on monthly, weekly and daily basis. Wastes such as textile, glass and metals are generated on occasional basis. While wastes such as garden waste, e-waste and appliances wastes are hardly generated, 1-0.5% that too from some formal housing dwellers.

The reuse methods adopted include the above stated methods along with some other methods like recycling of old cloths to get various usable products like shopping bags, quilts, Bag/ Basket to keep soiled cloths, cushion covers, covers for appliances, decorative hand bags etc. and exchanging old clothes for utensils. (These cloths are in turn sold at very low price in second hand market for poor people.)

Recycling of old cloths to get various usable products

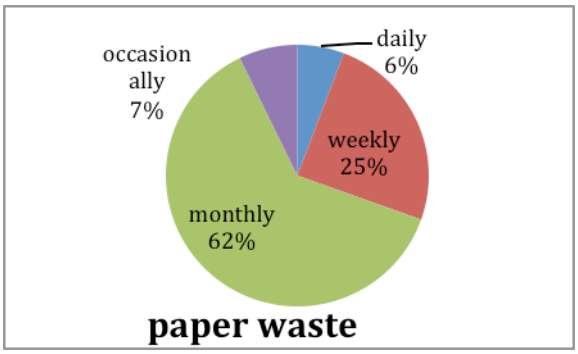
The third category is that of LIG (Lower income group) falling under the income category of 1, 50, 000- 3, 00,000. The housing typology under this category of population was found be as follows:

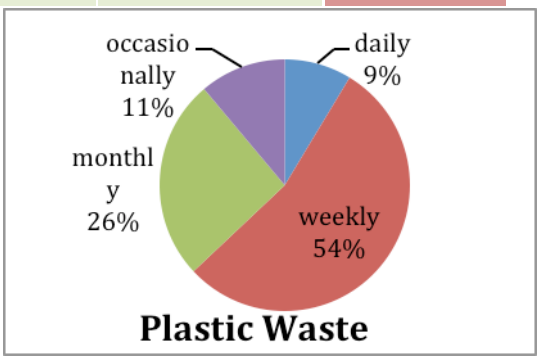
S.No.	Housing Typology	Percentage of population
1	Detached (1-2 BHK)	**1%**
2	Semi detached (1-2 BHK)	**3%**
3	Apartments/ Flats(1-2 BHK)	**11%**
4	Informal Housing- Kachha	**15%**
5	Informal Housing- Semi Puckka	**37%**
6	Informal Housing- Puckka	**33%**

The survey showed that about 85% of the population falling under this income group lives in informal housing, only 11% in flats and 4% in other formal housing.

TYPE OF WASTE	FREQUENCY OF GENERATION				
	daily	**weekly**	**monthly**	**occasionally**	**Never**
TEXTILE				77%	23%
METAL				81%	19%
GLASS		6%	7%	80%	7%
PAPER	6%	25%	62%	7%	
PLASTIC	9%	54%	26%	11%	
KITCHEN WASTE	75%	25%			

GARDEN WASTE				8%	92%
E-WASTE				1%	99%
APPLIANCES				1%	99%





Frequency of generation of different types of waste in this category show that, the most commonly and frequently generated wastes are paper, plastic and kitchen wastes, generated on monthly, weekly and daily basis respectively. Glass, metal and textile are generated on occasional basis while wastes such as garden waste, e-waste and appliances are not generated by this category.

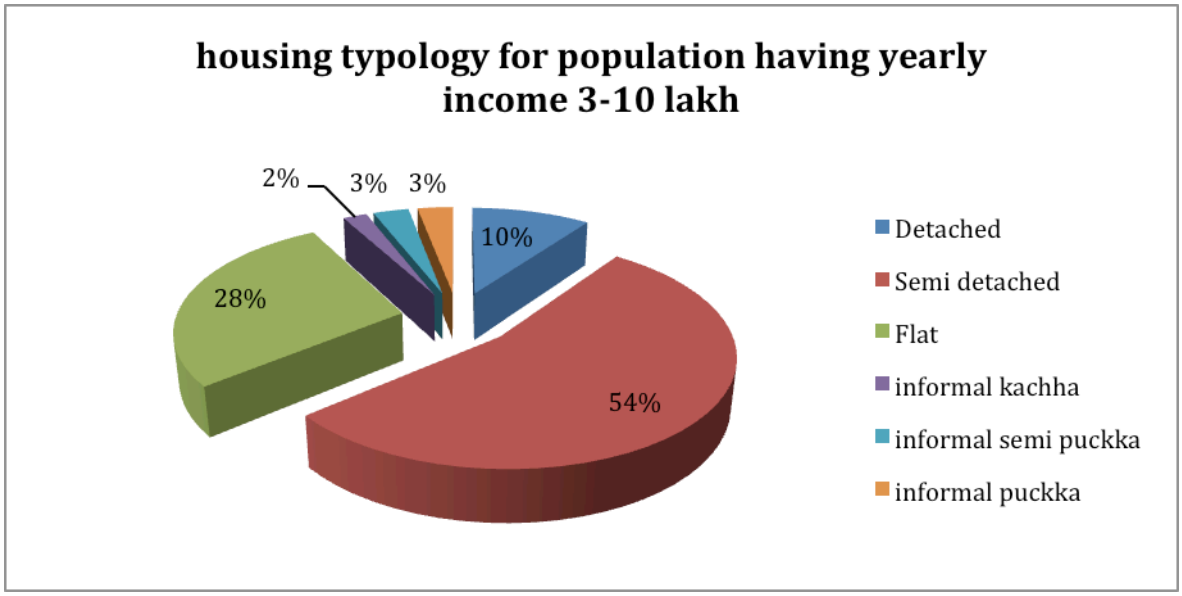
Talking in terms of disposal frequency of the waste generated, paper and plastic are mostly disposed of weekly and kitchen waste on daily basis, while textile metal and glass which are generated occasionally are disposed of once in a year. Also the small portions of garden waste, E-waste and appliances that are usually generated from formal housings are disposed once in a year.

TYPE OF WASTE	DISPOSAL FREQUENCY					
	daily	weekly	fortnightly	monthly	thrice in a year	once in a year
textile						
metal						
glass						
paper						
plastic						
kitchen waste						
garden waste						
e-waste						
appliances						

The disposal methods adopted here are those for paper, plastic and textile waste. Textile metal glass and plastic wastes are given to waste bulk dealers. About 60% of the total paper waste generated is

sold to waste dealer while the rest is thrown away directly. Kitchen waste and small amounts of garden and e-waste are also thrown away directly. The practice of reuse of any type of waste is absent in this category of population. Only a very small portion, around 2% of the plastic and textile waste generated is used in some other purpose like storage, cleaning etc. the most commonly adopted reuse methods consist of using waste paper for packing purpose, using plastic bags for carrying food, other items etc. another important reuse practice adopted by informal housing dwellers is that of using big plastic cans for storing water for different purpose. Similarly waste segregation and willingness to pay to pay for waste disposal and collection facilities is absent

For the next stage of analysis, households under income category of 3 to 10 Lakh were analysed. Talking in terms of the generation frequency of different types of waste, the survey revealed that paper and kitchen waste are the most common types of wastes generated at household levels. Textile, metals and garden waste were found to have least generation frequencies.



The various types of wastes and their generation frequencies are given below:

Type of Waste	Frequency of generation				
	daily	**weekly**	**monthly**	**occasionally**	**never**
TEXTILE				15%	85%
METAL				6%	94%
GLASS		16%	75%	8%	
PAPER			100%		
PLASTIC				100%	
KITCHEN WASTE	97%			1%	2%
GARDEN WASTE		9%	10%	12%	69%

E-WASTE		4%	7%	82%	8%
APPLIANCES				60%	40%

Disposal of these wastes is done in accordance with their generation frequencies. Kitchen waste is usually disposed off on daily basis. Some portions of paper, plastic and garden waste is also disposed of daily. While metals, plastics, e-waste and used appliances are disposed of once in a year. Paper is disposed usually on monthly basis. Textile waste is also disposed off once in a year or thrice in a year, but before finally disposing it, it is put to different uses within the house, and this makes its disposal frequency very less.

Details of disposal frequencies as per the survey are given below:

Type of waste	**disposal frequency**					
	daily	**weekly**	**fortnightly**	**monthly**	**thrice in a year**	**once in a year**
textile				2%	59%	38%
metal				4%	1%	95%
glass			31%	60%	7%	2%
paper	7%			91%		2%
plastic	3%				43%	53%
kitchen waste	95%					5%
garden waste	3%	33%	7%	5%		52%
e-waste				4%	26%	70%
appliances						100%

Disposal methods on the other hand vary depending upon the reusability of a particular type of waste, as at household level in India the practice of reusing certain materials is very common, before regarding it as totally waste which cannot be put to any other use.

Of all the types of waste listed above that are usually generated at household level, paper, textile and appliances have highest percentages of reusability. 90-95% of glass garden waste and kitchen waste produced is thrown away directly in community bins, open areas etc. About 60% of the e-waste produced at household level which is usually used cd's DVD's and batteries etc are also thrown directly. While the remaining is sold off to waste dealers. About 90-80% of plastics and metal waste is also sold to waste dealers and the rest is reused in some form for storage purpose generally. 75% of textile waste and 85% of paper waste is reused at household level and remaining is sold off.

As seen that there is high reusability of certain materials at household level, the different types of reuse practices adopted were also studied and examined through the survey. The most commonly adopted practice for textile waste is that of using it as kitchen mob or duster and secondly using it as

filtering material. Metal, glass and plastic bottles and jars are reused for storage purposes at household level.

Thick plastic is used is often used for carrying Tiffin boxes, shoes, clothes etc. or for carrying cooked food.

Paper which is also reused extensively at household level is usually reused for packing and covering purpose, for lining shelves and drawers etc. Textbooks are also reused by siblings, which can be listed as another form of reuse of paper. Appliances are also reused by repairing them or getting some parts replaced at nominal cost rather than discarding them and buying new ones.

In comparison to office and commercial establishments, the practice of waste segregation is slightly seen at household level, though the level of segregation is not much prominent, still about 30% of households follow waste segregation in some form. This is usually separating the waste that is thrown away directly and that which is to be sold off.
At household level people are not paying for disposal and collection of waste and are not even willing to pay for waste disposal and collection if services are provided to them.

The last category is that of Higher income group (HIG) having income more than 10 lakh. These mostly reside in formal housing, apartments, detached and semi detached housing. Their waste generation characteristics are not much different from that of the above given income groups. Only garden waste and e-waste generation and disposal frequencies are much higher than any other income group. The disposal methods adopted are quite scientific as compared to those adopted by other income groups like donating items like cloths etc. for charity, selling of used appliances and desktops etc while the reusability percentage in this category is very low. Some reuse methods adopted are - Kitchen utensils which are not in use are sold to shopkeepers who in turn would send these for recycling.

Commercial Establishment's Survey

Generation frequency

The generation frequency of various types of waste such as paper, plastic, glass, textile etc. were surveyed in terms of whether the waste is generated on a daily, weekly, monthly basis or occasionally. The survey findings revealed that paper, which is the most common type of waste, is generated mostly on daily basis. Out the total samples surveyed, paper and plastic wastes are generated most frequently i.e. on daily basis followed by glass, bio degradable and metal wastes. E-waste and textile wastes have the least generation frequency. Most of the e-waste is generated on occasional basis.

Case Study: Noor-Us-Sabah Hotel

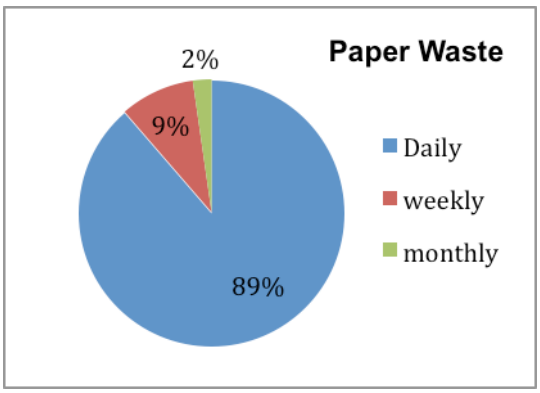
Waste generation: Main source of waste generation is kitchen in the form of waste food and other kitchen waste (plastic and metal), tissues, and paper caps used by chefs. Around 2 rolls of aluminium is used per day, 500 plastic containers are used per month for food packaging; waste disposed is 3 garbage bins (25kg each) per day.

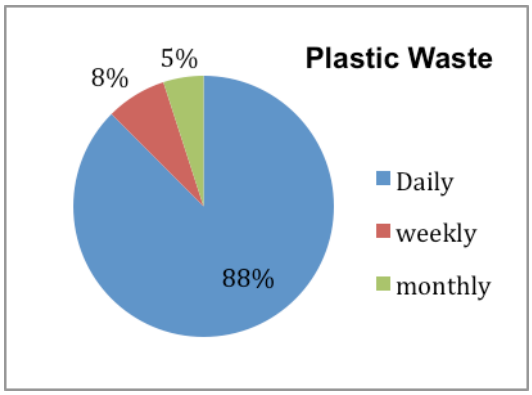
Waste Collection & segregation: It is performed at source point using 3 different garbage bins i.e. Red colour bin for non-veg waste (bones and skins), Yellow colour bin for scraps (tins, plastic and glass bottles) and Blue colour bin for gravies. A proper garbage room is made for storing the dry waste and wet waste is regularly collected by the municipality.

Reuse/ Recycling practices Adopted:

1. Crockery (glass bone china): Quarterly 15 percent are broken by dripping and are disposed by giving in scrap.
2. Cloth waste (bed-sheets and table cloth): Reused in wiping, mopping and dusting and then recycled.
3. Electrical waste: There is a company tie up which returns 10 percent of original cost of the non-working LED lights.
4. Recycling process: All the tissues, chef caps, reused cloth are recycled by putting into the boiler which is used to produce steam for the Air-conditioners.

Out of the total paper waste, 89% is that which is generated on a daily basis, 9% on weekly and rest 2% on monthly basis, this is mostly excessive packaging that is returned monthly. Similar is the case with plastic waste, 88% is generated on daily basis, 8% on weekly basis and rest 5% on monthly basis. The disposables of different types, packaging, and tissue papers etc. form the major part of these types of wastes generated daily.





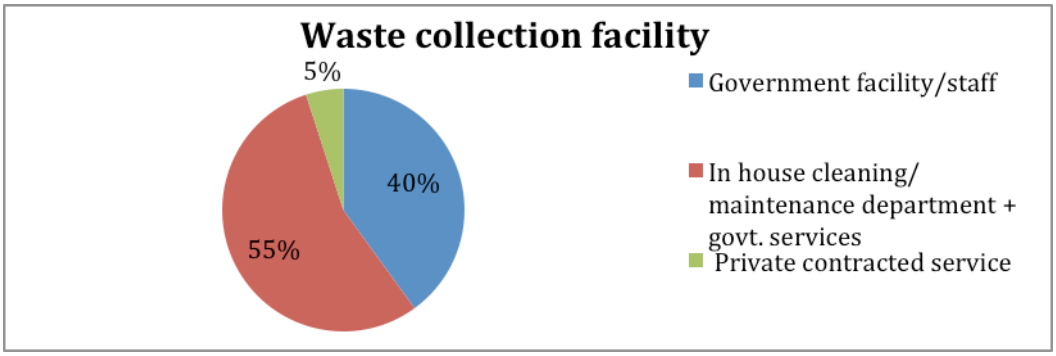
Waste generation in commercial establishments

The quantity of metal, bio degradable and glass waste is less as compared to the paper and plastic waste generated at the commercial centres surveyed. These are the wastes which are generated on daily basis as a result of the activity taking place at the commercial establishments but as compared to paper or plastic wastes are less in quantity. While textile and e-wastes are hardly generated, even if they do it is occasionally.

Waste Collection

As per the samples surveyed, more than 80% of the waste collection is on daily basis, around 12% on weekly basis and rest on monthly basis or other. Presently around 1380 municipal sweepers and 400 sweepers on daily wages are involved in street sweeping and collection of solid wastes from various locations of the city. There are about 2628 collection points in the city where waste accumulates. Solid waste generated from markets and commercial activities are either put to the adjacent community containers wherever available or thrown to the nearby open spaces, drains and streets.

The samples surveyed suggest that about 40% of the commercial establishments depend entirely on municipal staff and collection facility for waste collection while 55% are those which have their own In house cleaning/maintenance department and are dependent partially on municipality services for waste collection. There are also some higher end hotels and commercial establishments, around 5%, which hire private contractors to take care of waste collection from their establishment.



Another major point of concern in the study of waste collection is the provision of waste collection points within the commercial facility. The survey examined that 33% of the commercial establishments surveyed had at least one waste collection point located inside their premises/centre etc; around 91% establishments had 2 or more collection points whereas 9% of the establishments surveyed were such which had no waste collection points at all.

Waste Disposal

Paper and plastic wastes that form the major part of the total wastes generated are majorly disposed of on daily basis. Around 60% of paper and 80% of the plastic waste generated at any commercial centre is disposed off daily while the rest is disposed on monthly or weekly basis. Also biodegradables, which are mostly generated from hotels and restaurants, are disposed off daily. Glass and metal wastes are disposed on weekly or monthly basis and not on a daily basis like that of paper and plastic waste. While e-waste and textile waste which have even less generation frequencies are disposed as and when generated and this is usually on occasional basis or once in a year.

60% of the total paper waste generated in commercial establishments is thrown away directly either in adjacent community containers wherever available or thrown to the nearby open spaces, drains and streets and only 20% is sold to the waste bulk dealer and rest 20% is reused. A major portion i.e. 75% of the plastic waste is also thrown away directly, 10% is it reused and 15% is given to waste dealer. The reuse methods adopted for these wastes are discussed in later sections.

Major portions, 70-60%, of glass and metal wastes are usually sold to bulk waste dealers. The rest of it is thrown directly to bins, open spaces etc. Biodegradables also are thrown away directly. Even the biodegradable waste coming from slaughter houses are thrown away in community bins along with the other wastes. A very small portion of biodegradables which is in the form of leftovers are given in charity or to the needy, forming only a small portion, 5% of the total bio degradable wastes generated.

E-waste which forms a very small portion of the total wastes generated at any commercial centre is disposed as per the type and quality of e-waste generated. Used batteries etc are thrown away directly. In case of replacements of batteries , computers etc, these are given to bulk dealers who replace the old ones by new or are even given to charity if they are in working conditions. Another type of waste i.e. textile waste is usually put to different uses before disposing it off finally.

85% of the total commercial establishments surveyed dispose of 10 kg or less waste on daily basis and around 10% establishments are such that dispose of 50kg or more on daily basis, these are usually higher end restaurants and hotels, shopping malls etc. while the rest 5% have fluctuating quantities of wastes disposed.

When surveyed about the charges related to waste disposal it was found that around 89% people pay for waste disposal at present and the charges range from Rs.50 to Rs.100 whereas there are still 11% people who do not pay any charges for waste disposal service.

Waste dumping without segregation in markets

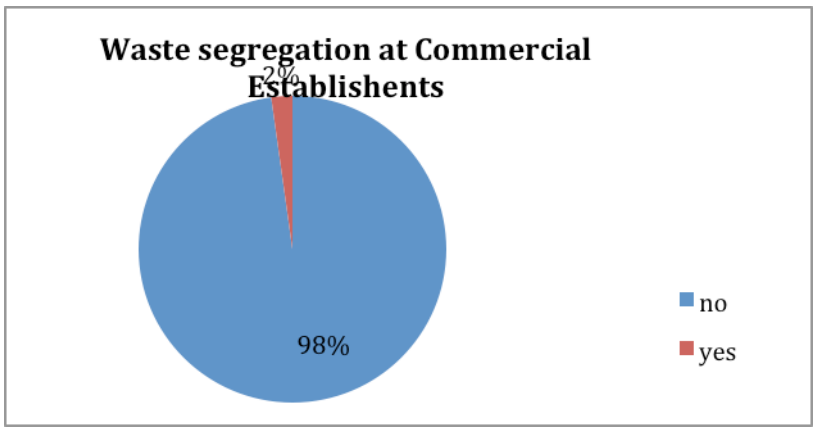

Waste collection by Nagar Nigam

Waste segregation

One of the major aspects related to waste collection and disposal is that of waste segregation. The practice of waste segregation is almost absent and solid waste is usually dumped in a mixed form in an unscientific manner in community bins or on open waste land.

Waste dumping without segregation in near residential area.

The survey conducted revealed that almost 98% commercial establishments were such which do not follow waste segregation at all and dump the entire waste generated by their facility in mixed form. Only 2% are such which follow waste segregation to some level. There is no formal organized system of segregation of biodegradable and non biodegradable solid waste present. The recovery and recycling or segregation of waste is only done by scavengers and scrap dealers which is highly hazardous to those which are involved in this job.



Apart from the findings related to waste generation, collection and disposal, the survey also focussed on the perception of both the suppliers/owners and the customers towards waste management in commercial establishments.

The survey revealed that the awareness among both suppliers and customers towards environmental friendly products is very poor. Only 1% of the total commercial establishments were such which selected their suppliers against environmental criteria. Rest 99 % does not have any such criteria. The survey also examined the perception of people towards products made from reusable and recyclable materials. Only 9% of the commercial establishments suggested that their customers

prefer buying products made from reusable and recyclable materials rest 91% were not concerned in this regard.

Case study: Manyawar , New market

Raw Materials: They purchase raw material from Bombay, Calcutta, Delhi, Ahmadabad and Chapra. Materials like cotton, silk, woollen, terracotta, etc. is brought from these places. Thread and zari is taken locally from dealers. Total quantity of cloth used every month is 5000m.

Waste reduction: No such waste is generated. A practice of least generation of waste is adopted and even if some waste is generated it is thrown in dustbins which are cleared in municipal trucks.

The pieces of cloth leftovers are either sent back to the company or it is thrown as it so small in size that it cannot be used. In Bombay, these small pieces of different cloths are put together to make one type of a cloth.

Case study: DB Mall, Arera Hills, Bhopal

Waste generation: Total amount of waste generated by the entire establishment is around ***1 tonne (approx) per day***. It has 12 anchor stores, a hypermarket and other multiple stores, most of which are major fashion brands and around 31 eateries of different types. All these generate different volumes and types of waste.

Recyclable garbage bags are used to store this waste which costs Rs. 110 per kg of bag. For the entire mall area, 200kg of big size bags and 100kg of small size bags are used by housekeeping department per month and 30kg bags by outlets per month. Thus the total expenditure for bin bags is around Rs. 40,000 per month.

Reuse/ recycle practices adopted: *All trays in the food court are reusable and disposables are only used to serve food. Also due to awareness regarding paper wastage and reuse, practice of using tray mats (paper) has been stopped recently. Another noteworthy practice adopted is that of donating waste food to pig farm. There is also an inventory store which sells-off all the non-working electrical fixtures.*

Disposal and segregation: Waste segregation is done by a hired agency and then handed over to Nagar Nigam. There are separate garbage rooms for storing wet and dry waste. Ideal temperature of these garbage store rooms' ranges from -7 degree to 6 degree, but the actual temperature they are able to maintain is 17 degree. Cleaning time is from 7am to 10:30am which includes waste transportation (2-3 rounds of a mini-truck)

In order to spread awareness among people regarding the ill effects of use of plastic bags and to encourage the usage of environmental friendly products, some commercial establishments have started charging their customers for plastic bags. At present only 4% of the total commercial establishments' surveyed charge their customers for plastic bags and the charges are between rs.2 to 10. The survey examined the perception of customers in response of these charges and it was found that only 33% people are such who have started bringing their own shopping bags instead of purchasing new plastic bags every time but still there are 67% of people who have had no effect of these charges and are still readily paying and buying plastic bags.

Reuse Methods Adopted

In India more attention is paid towards reusing the waste produced rather than recycling it. Mostly the paper and plastic wastes produced at commercial establishments as surveyed is in large quantities as compared to the other types of wastes. It was estimated that 20% of the total paper waste generated is reused in some or the other way while about 5% of the total plastics waste is reused. The survey questionnaire was also intended to find out the common reuse practices adopted for these types of waste at commercial establishments. It was thus found out that for the paper waste produced there are two types of reuse practices commonly adopted by commercial establishments, these are, firstly; making note pads out of print overruns, computer printouts, outdated forms and stationery and secondly, reusing the waste paper to line shelves & drawers. Similarly for plastic waste also there two commonly adopted reuse practices, these are, providing basket, backpack, box or reusable shopping bag instead of plastic bags. Small shop keepers have started providing fabric bags to their permanent customers which they can take home and carry again at the time of next visit/purchase. Another practice is that of reuse water bottles within the shop/centre etc by means of refilling.

Carry Bags in Mall

- Implementation of buyer pay policy for carry bags introduced nearly one and half year ago in DB mall and many other shops has contributed towards meeting the requirement of SMC vision.
- According to survey conducted in the month of September 2013 in Hyper City it was found that 33% customers now deny paying extra for carry bags and get their own bags for shopping.

Office Establishment's Survey

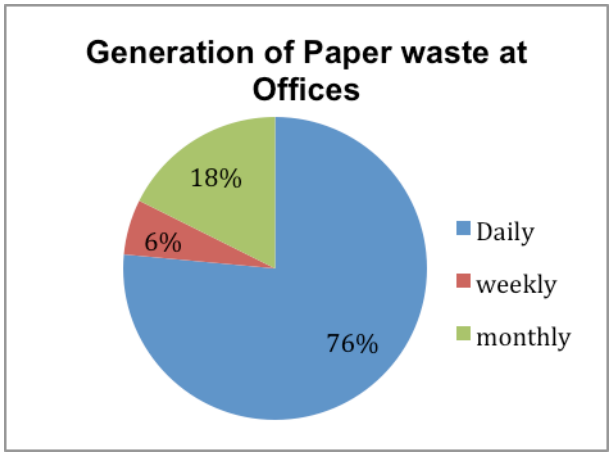
At office establishments, paper waste is the most common and most frequently generated waste. Out of the total paper waste generated at the office establishments surveyed, 76% is generated on daily basis, 18% on monthly and rest 6% is generated on weekly basis. This mostly comprises of office paper, newspaper, magazines and glossies, tissue paper, food wrappers, cardboards etc. This is mostly disposed of on daily and monthly basis except the paper that is reused in some manner.

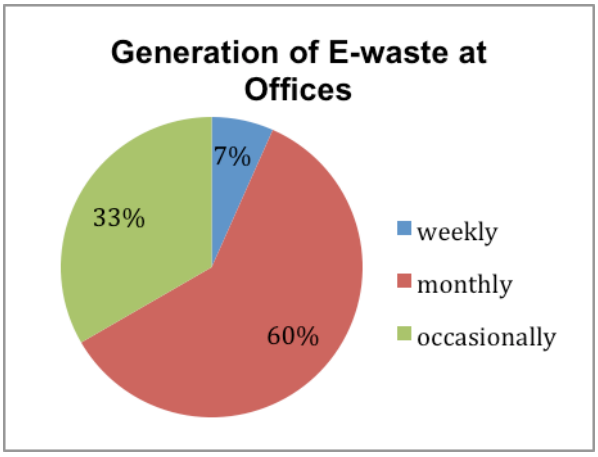
E-waste is the second category of waste that is generated quite frequently at the office establishments. These are generally batteries, printer and fax cartridges. Maximum e-waste is generated on monthly (60%) and occasionally (33%) basis and a small portion, 7% is generated on weekly basis. Most of the offices especially banks have proper e-waste policies which govern the

collection and disposal of e-waste generated under their facility. Banks have separate storage rooms to store the e-waste generated and are disposed of by private contractors as per their need and quality. Computer batteries which are the most common e-waste at office establishments are given to the dealer in return of new battery. 60% of the e-waste generated is disposed of on monthly basis while rest 40% is that which is disposed occasionally.

Talking in terms of the quantity of waste produced; 91% office establishments were such which have waste generation of about 3-4kg per month while the rest 9% offices were such which have waste generation ranging from 40-50kg per month.

Biodegradables and plastics are some of the other wastes generated at office establishments. Bio degradable waste mostly comes from kitchen and canteens present in offices and disposables used form the plastic waste. This type of waste is generated on daily basis and their quantities may increase in situations like functions, meetings, seminars etc. hence these are generated on daily basis, their disposal is also made on daily basis. A major portion of this waste i.e. around 93% is collected either by municipal services or by private contractors on daily basis while the collection of the rest 7% of waste is on monthly basis.





Talking in terms of at source collection of the waste generated, 70% of the office establishments surveyed, having employee strength of 10-25 had about 10-15 collection points/ bins present in their premises. 30% were such which had only 5-6 collection points and having employee strength of 25-50. But the practice of waste segregation, provision of separate bins for different type of wastes is entirely absent.

For collection at the other end, about 70% of the office establishments depend entirely on government facility and services for collection and disposal of waste generated by their premises. 22% are such which have their in house cleaning staff but for collection and disposal they depend on municipal services and about 8% offices have taken services of private contractors who take care of waste collection and disposal from the office premises.
Almost all the office establishments surveyed pay for availing waste disposal facility, either to government or to private contractors. The charges paid by office establishments per month are more than Rs. 100.

About 63% of the total paper waste produced at offices is reused; rest 37% is given directly to waste bulk dealers. E-waste which another major type of waste produced is either replaced by dealers by new equipments or is given to bulk dealers. Other types of waste like biodegradables and plastic waste are thrown away directly.

Case Study: State Bank of India (SBI, Local Head Office)

Waste generation: With a total working staff of 600 people divided into 75 departments, waste generation in bulk be it furniture, tables, partitions, sofas, cabins, electrical fittings, smoke detectors, paper etc. Infrastructure of the controlling office is changed in every 7 years; this also results in bulk waste generation. The cleaning department is outsourced which takes care of the at source collection and storage of waste.

Waste Disposal: Charity of usable items like steel almirah, fans, computers, furniture, etc and other items sold to empanelled scrap dealers. Other items like windows, doors, etc go through valuation and then a tender is floated and given away in the best deal.

Waste management policies adopted:

Record policy: Paper waste (records) is kept for a specific time period and then empanelled agencies dispose it off through paper mills.

Replacement policy: Batteries are supplied and lifted in every 3 years.

E-waste management policy: A space is identified for making a proper inventory where the waste is staged and is auctioned in every 6 months. All the offices and branches follow the same policy.

Re-use policy: Rough paper is reuse by printing on the reverse side. It is practiced at individual level.

IBM technology helps in saving paper wastage as it reduces paper prints and helps in transferring the data internally through software.

The most commonly adopted reuse methods at office establishments include, making note pads out of print overruns, computer printouts, outdated forms and stationery, using one side printed pages for draft printing, using used paper to line shelves and drawers etc. The survey examined that at present around 56% of the offices are practicing these methods of waste reduction. Some offices have also started using some waste reduction methods like checking and reviewing draft letters and documents in soft copy before final printing. These are generally reuse and reducing methods adopted for paper waste. In case of e-waste, the most commonly adopted practice is that of donating used printer cartridges for recycling.

Giving Jute Bag as Carry Bag

In some of the shops surveyed in local retail market shopkeepers have started giving away Jute bags to their customers with a request to bring it along in their next visit

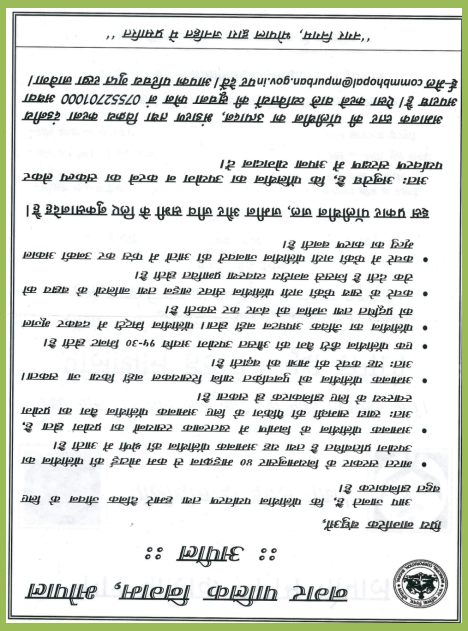
The awareness level of people at office establishments regarding the reuse practices is quite high. The survey examined that 99% of the office establishments and their staffs is aware of reuse practices and their benefits. But inclination and awareness towards use of paper and other products made of recycled materials and environmentally friendly products is entirely absent.

Rationing in Election Expenditure: The control in election expenditure has contributed in reduction of paper waste as was noticed during the recently concluded legislative assembly election. The posters and pamphlets which used to be an integral part of election campaign was missing in this election thereby saving on wastage of paper.

CHAPTER 6: CONCLUSION

The survey for household, commercial and office establishments revealed various important outcomes related to waste management practices adopted in the city. Waste generation, collection and disposal practices at these three sectors were studied in detail and how these practices are associated and dependent on the type of sector in case of commercial and office establishments, and on the living standards of people in case of household sector were studied and analysed. Also the reuse/recycle practices adopted for different type of wastes and the extent of usage of such practices in all the three sectors were studied.

Plant saplings in Exchange of Polythenes : Bhopal Municipal Corporation had initiated a unique practice for discouraging people from throwing thin polythenes in garbage. In exchange for 250 gms of polythenes at their listed centres they have started giving one plant sapling. They already had distributed 7000 plants within a period of one month. This practice has not only contributed in reducing the quantity of waste polythenes but also helped in adding to the greenery in city.



The household survey assessed the above discussed features primarily based on income characteristics and housing typology of the population surveyed. This also proved helpful in assessing the connection between living standards and their waste generation characteristics. The population residing in informal housing and belonging to lower income groups mostly generate paper, plastic and kitchen waste; whereas metal, glass and e-waste generation is very less in this

category. At source segregation is not practised. People usually throw the waste generated in community bins or in open dumping places without segregating it in any form. This is the most common disposal method adopted. Paper and plastics reused, but in very small magnitude. Paper is mostly using for packing purpose and for lining shelves and drawers while plastic bags are reused for carrying, food, clothes and other such stuff. Slum dwellers also use big plastic jars and cans for storing water. Small portions of metal and glass wastes are either thrown away directly or are sold to waste dealers.

At higher income group level, the scenario was slightly different. Glass, garden waste, e-waste and appliances (used) also formed a major portion of the total wastes generated. Also the methods of disposal adopted were different for different types of waste. Glass, metal, plastic and paper were separately sold to waste bulk dealers while kitchen waste, garden waste, and portions of paper, glass and plastic wastes which can neither be reused nor sold of are thrown away directly in community bins, open dumping spaces etc. paper, plastic, appliances and textile waste had the highest reuse percentage under this category. Paper is reused mostly in packing and lining shelves, plastic, glass and metal jars, cans, bottles are used for storage purpose in huge quantities. Textile waste though generated in small quantity is reused in the form of kitchen mob or duster. It is put to different such uses before discarding it completely, after which it is thrown away.

At commercial establishments, paper and plastic form the major portion of the total wastes generated, they are generated on daily basis and are even disposed of daily. The quantity of metal, bio degradable and glass waste is comparatively less. Textile and e-wastes are hardly generated; even if they do it is occasionally. Biodegradables are mostly generated from hotels and restaurants and are disposed daily. Glass and metal wastes are disposed on weekly or monthly basis and not on a daily basis like that of paper and plastic waste. While e-waste and textile waste which have even less generation frequencies are disposed as and when generated and this is usually on occasional basis or once in a year.

Bhopal Municipal Corporation Initiatives

Rag Pickers are involved for door to door waste collection and they also perform the task of waste segregation and are paid on per day basis by BMC. The plastic and polythene segregated by them is purchased by BMC at the rate of RS.3.5/- per kg.

BMC has facilities for plastic, paper and biodegradable waste processing:

Plastic waste	• Baling plant located at Bhanpur • Plastic is compressed and sold to cement industries • Cement industries used this compressed plastic as fuel • ***Plant for Polyethene initiative***: 1 plant for every 250gm polyethene is given by BMC
Paper Waste	• Paper processing plant of EPCO (Environmental Planning & Coordination Organisation) • Paper waste is shredded and recycled
Bio Degradable waste	• Organic Manure Plant set up by BMC at Bhanpur • Biodegradable waste from assured locations like vegetable markets and slaughter collected daily and sent to plant • Plant Capacity: 50 TPD • Waste is converted into enriched soil

BMC has also launched a toll free complaint number from 1st December 2013 where any citizen can complaint about waste accumulation in public spaces which would be cleaned on the same business day by BMC . There are also provisions for spot fines.

As per the samples surveyed, more than 80% of the waste collection is on daily basis, around 12% on weekly basis and rest on monthly basis or other. The samples surveyed suggest that about 40% of the commercial establishments depend entirely on municipal staff and collection facility for waste collection while 55% are those which have their own In house cleaning/maintenance department and are dependent partially on municipality services for waste collection. There are also some higher end hotels and commercial establishments, around 5%, which hire private contractors to take care of waste collection from their establishment.

Study of common reuse practices adopted for different types of waste at commercial establishments revealed that for the paper waste produced there are two types of reuse practices commonly adopted by commercial establishments, these are, firstly; making note pads out of print overruns, computer printouts, outdated forms and stationery and secondly, reusing the waste paper to line shelves & drawers. Similarly for plastic waste also there two commonly adopted reuse practices, these are, providing basket, backpack, box or reusable shopping bag instead of plastic bags. Small shop keepers have started providing fabric bags to their permanent customers which they can take home and carry again at the time of next visit/purchase. Another practice is that of reuse water bottles within the shop/centre etc by means of refilling.

At office establishments, paper waste is the most common and most frequently generated waste. This mostly comprises of office paper, newspaper, magazines and glossies, tissue paper, food wrappers, cardboards etc. This is mostly disposed of on daily and monthly basis except the paper that is reused in some manner. E-waste is the second category of waste that is generated quite frequently at the office establishments. These are generally batteries, printer and fax cartridges. Most of the offices especially banks have proper e-waste policies which govern the collection and disposal of e-waste generated under their facility. Banks have separate storage rooms to store the e-waste generated and are disposed of by private contractors as per their need and quality. Computer batteries which are the most common e-waste at office establishments are given to the dealer in return of new battery.

Biodegradables and plastics are some of the other wastes generated at office establishments. Bio degradable waste mostly comes from kitchen and canteens present in offices and disposables used form the plastic waste. About 63% of the total paper waste produced at offices is reused; rest 37% is given directly to waste bulk dealers. E-waste which another major type of waste produced is either replaced by dealers by new equipments or is given to bulk dealers. Other types of waste like biodegradables and plastic waste are thrown away directly.

Task Ahead:
Keeping in mind the present status of the work in progress this section puts forward the tasks ahead for the coming year. The main work for the coming year will include deriving the findings of the primary survey. Indigenous re-use, recycle and disposal practices in various sources of waste generation will be documented. In the next stage primary survey will be conducted in other land use zones i.e. hospital, industrial, etc. Finally the findings will be compiled in the form of a report.

References

Bartone, C. R., (1991). Key to Success: Private Delivery of Municipal Solid Waste services. Infrastructure Notes: Transportation, Water and Urban development Department. Washington DC, The World Bank.

CDP, (2006).City Development Plan, Bhopal Municipal Corporation, Government of Madhya Pradesh,Bhopal.

Chandra, R., (2003). Solid Waste Management: Need, Innovations and Strategies [A Case Study of Bhopal Municipal Corporation (BMC)] http://kitakyushu.iges.or.jp/docs/mtgs/seminars/theme/swm/presentation/3%20Bhopal%20(Pper).pdf[Accessed Feb 2011]

CPCB, (2000) Management of Municipal Solid Waste. Central Pollution Control Board, Ministry ofEnvironment and Forests, New Delhi, India.www.cpcb.nic.in[Accessed Feb 2011]

CPCB, (2004).Management of Municipal Solid Waste.Central Pollution Control Board, Ministry ofEnvironment and Forests, NewDelhi,India.http://www.cpcb.nic.in/oldwebsite/Municipal%20Solid%20Waste/Waste_generatin_and_Composition.html[Accessed Feb 2011]

Joseph Kurian (Undated).Waste Reduction, Reuse and Recycle Initiatives in India. Available at[http://www.3rkh.net/3rkh/files/INDIA%20-3R%20INITIATIVES%20Kurian.pdf]

Katiyar, R.B., Suresh S., Sharma, A. K. Characterisation of Municipal Solid Waste Generated by the City of Bhopal, India. International Journal of Chem. Tech. Research, 5(2), 623-628 (2013).

Kulshrestha, M. (2011)„ Waste trade market in the city of Bhopal, India: a case study on recycledMSW", Int. J. Environment and Waste Management, Vol. 7, Nos. 3/4,pp.344–355. MOEF,(1986). Ministry of Environment and Forests, The Environment [Protection] Act 1986,Government of India, New Delhi.

MOEF, (1992).Ministry of Environment and Forests, Policy Statement on Abatement of Pollution,Government of India, New Delhi.

MOEF, (2006).National Environmental policy 2006, Ministry of Environment and Forests, Government of India, New Delhi.

MOEF, (2010). Ministry of Environment and Forests, Report to the people on Environment and Forest 2009-2010, Ministry of Environment & Forest, Government of India, New Delhi.

MOL, (1995). Ministry of Law, The National Environment Tribunal Act 1995. 17.6.95. New Delhi,Government of India.

Panate Manoma (2005): "Swedish University Dissertation Essays".

Annexure 1: Household Survey questionnaire:

1. **Name:** _____

Address: _____

_____

Occupation: _____

2. How long have you been in Bhopal? < 5 years ☐ 5-10 years ☐ > 10 years ☐

3. Sex: Male ☐ Female ☐

4. Age: 5-10 ☐ 19-29 ☐ 50-64 ☐
11-18 ☐ 30-49 ☐ 65 plus ☐

5. Yearly Household Income (INR):
<50,000 ☐ 50,000-2,50,000 2,50,000-5,00,000
5,00,000-10,00,000 ☐ ☐ > 10,00,000 ☐ ☐

6. How many people aged 18 and more live in your home?
0 ☐ 1 ☐
2 ☐ 3 or more ☐

7. What kind of home do you live in?
Detached house 1 bhk ☐ 2/3 bhk ☐ 4 or more bhk ☐
Semi-detached house 1 bhk ☐ 2/3 bhk ☐ r more bhk ☐
Flat 1 bhk ☐ 2/3 bhk ☐ 4 or more bhk ☐
Informal (kachha) <100sq.ft. 1 ☐ 00 sq.ft. > 300 t. ☐
Informal <100sq.ft. ☐ 100-300 sq.ft. ☐ > 300 sq.ft ☐
(semi pucca)
Informal (pucca) <100 sq.ft. 100-300 sq.ft. > 300 sq.ft. ☐

8. Ownership Status:
Owned ☐ Rented ☐ Company's accommodatio ☐

9. What are the frequencies of following wastes' generation in your household?

Frequency / Type	Daily	Weekly	Monthly	Occasionally	Never
Clothing / textile					
Metal					
Glass / Ceramics					
Paper					
Plastic					
Kitchen Waste					
Garden Waste					
e-waste					
Appliances					

10. What are the frequencies of following wastes' disposal in your household?

Disposal Frequency / Type	Daily	Weekly	Fortnightly	Monthly	Thrice a year / quarterly	Once a year
Clothing / textile						
Metal						
Glass / Ceramics						
Paper						
Plastic						
Kitchen Waste						
Garden Waste						
e-waste						
Appliances						

11. What are the disposal methods adopted for following types of wastes?

Disposal Method / Type	Throw it	Burn it	Donate for philanthropic activities	Reuse it	Recycle it	Give it to itinerant waste picker	Give it to bulk waste dealer
Clothing / textile							
Metal							
Glass / Ceramics							
Paper							
Plastic							
Kitchen Waste							
Garden Waste							
e-waste							
Appliances							

12. What are the reuse methods adopted for following types of waste?

Type	Reuse method adopted					
Clothing / textile	As kitchen Mop	As kitchen duster	Reuse by domestic helper	As floor mat	As carrying bag	
Metal	As flower pot	Sale to second hand market	For storing food	In sculptures		
Glass / Ceramics	For storing food					
Paper	For packing	Book cover	For drying utensils	For drying vegetables		
Plastic	Carry bags	For packing				
Kitchen Waste	As animal feed	As soil conditioner				
Garden waste	As animal feed	As soil conditioner				
E-waste						
Appliances	Reuse by domestic helpers					

13. What are the sub-types of various types of wastes generated in your house?

Type	Sub-Types					
Clothing / textile						
Metal	Empty cans	Pencil cell / big cell	Plumbing scrap	Old kitchen utensils	Vehicle components	
Glass / Ceramics	Glass jars	In-candescent bulbs / CFL	Glass bottles			
Paper	News paper	magazines	packaging			
Plastic	Non-recyclable (<40 micron size)	Recyclable (>40 micron size)				
Kitchen Waste						

Garden Waste						
e-waste	Cds	floppy disks				
Appliances	Tape recorder	Computer	TV	Micro Wave oven	Refrigerator	

14. Do you generally follow waste segregation in your house? Y / N

15. If yes, how long have you been practicing waste segregation?

<5 years ☐ 5-10 years ☐ 10 years ☐

16. Who had prompted you to start waste segregation?

Self-started ☐ Educated by volunteers of an NGO, specify ☐

Parents ☐ Any other, specify ☐

17. Do you pay for solid waste disposal? Y/N

18. If yes, then expenses Incurred in Solid Waste Collection & Disposal per month? (INR)

<50 ☐ 50-100 ☐ 100-200 ☐ >200 ☐

19. If no, reason for nonpayment?

Solid waste collection is not present ☐ w it ourselves Any ☐ er, specify ☐

20. Will you pay, if solid waste collection is available in your locality? Y / N

Annexure 2: Commercial establishments Survey questionnaire:

Project Title: Advancing Locally Based Green Practices to realize establishment of Sound Material Cycle Society in Asian Cities

Survey Details	
Shop/outlet Name:	
Type of Shop/outlet:	
Survey conducted by:	
Date of Survey:	

Number of Employees	

1. How frequently is the following waste and sub-waste generated in your premises:
2.

SOURCE	GENERATION FREQUENCY				
	(a) Daily	(b) Weekly	(c) Monthly	(d) Occasionally	(e) Never
(1) PAPER					
Office Paper					
Newspaper					
Magazines & glossies					
Tissue Paper					
Other Paper					
Paper Packaging					
Food wrappers (e.g. sandwich wrappers, cake wrappers, crisp wrappers, toffee wrapper, etc)					
Cardboard					
Other					
(2) GLASS					
Pigmented/coloured Glass					
Clear Glass					
Other Glass					
(3) PLASTIC					
Packaging					
Plastic Films					
Plastic Containers/jars/bottles etc.					
Other Plastic					
(4) METAL					
Aluminium Packaging					
Metals Packaging					
Other Metal waste					

SOURCE	GENERATION FREQUENCY				
	a) Daily	b) Weekly	c) Monthly	d) Occasionally	e) Never
(5) BIO-DEGRADABLE WASTE (INCLUDING FOOD ,KITCHEN AND GARDEN WASTE)					
Food waste(leftovers)					
Garden waste					
Kitchen waste					
(6) E-WASTE					
Batteries					
Printer and Fax cartridges					

Office Electrical Equipment, Fluorescent Lighting Tubes						
Others (specify):						
(7) TEXTILE						
Used in cleaning & other purpose						
Others (specify)						

3. Frequency of waste disposal:

	Type of waste	a)daily	b)Weekly	c)Fortnightly	d)Monthly	e)Once in a year	f)Never
1	PAPER						
2	GLASS						
3	PLASTIC						
4	METAL						
5	BIO-DEGRADABLE WASTE						
	I)FOOD WASTE						
	II) KITCHEN						
	III) GARDEN WASTE						
6	E-WASTE						
7	TEXTILE						

4. Frequency of waste collection:

a) Daily	
b) Weekly	
c) Monthly	
d) Other	

5. How many waste collection points are inside your centre/Shop/Outlet: .....
.
6. Do you follow waste segregation? (Y/N): .....

7. Who prompted you to start waste segregation:
a) Self started ☐ b) Awareness program by NGO etc.☐ c) Other, Specify ☐

8. Do you provide staff/ customers with recycling bins/separate bins and are bins clearly labelled (Paper and cardboard, general waste, etc) (Y/N): .....
Specify typology: .....
9. For how long have you been practicing waste segregation?

a) < 5 years☐ b) 5-10 years☐ c) >10 years☐

10.

11. Do you provide staff/ customers with recycling bins/separate bins and are bins clearly labelled (Paper and cardboard, general waste, etc) (Y/N): .....
    Specify typology: .....
12. Who is currently responsible for collecting and disposing of waste/recyclable materials generated in your facility? Check all that apply.

1	In house cleaning/maintenance department	
2	Private contracted service	
3	Government facility/staff	
4	Other: Please specify.....	

13. Methods adopted for waste disposal:

	Type of waste	a) throw	b) Burn	c) reuse	d) recycle	e) give to bulk waste dealer	f) Donate for reuse or recycle activities	e) Donate for charity	(f) Any other
1	PAPER								
2	GLASS								
3	PLASTIC								
4	METAL								
5	BIO-DEGRADABLE WASTE								
	I)FOOD WASTE								
	II) KITCHEN								
	III) GARDEN WASTE								
6	E-WASTE								
7	TEXTILE								

Specify other methods: .....

14. Quantity of waste disposed (no. of containers/bags per day /per month etc.): .....

15. Are there any in –house reuse and recycle practices adopted:

	TYPE OF WASTE	REUSE& REDUCING METHODS ADOPTED						
		(a)	(b)	(c)	(d)	(e)	(f)	(g)
1	PAPER	Make note pads out of print overruns, compu ter printouts, outdated forms and stationery ☐	Reuse wrapping paper to re-wrap. ☐	To line shelves & drawers. ☐	Donating for recycling ☐	Use newspaper, magazines for wrapping ☐	Return excess packa-ging ☐	
2	GLASS/ CERAMIC	Reuse of old crockery by giving it to servants, needy, poor etc. ☐	Reusing by means of refillable form of products	Bring a reusable mug to work. ☐	Donating for recycling	Using reusable crockery/ glass items in place of disposables		
3	PLASTIC	Providing basket, backpack, box or reusable shopping bag instead of plastic bags. ☐	Carry your own water bottle ☐	Reuse water bottles within the office ☐	Use plastic bags to wrap rubbish ☐	provide reusable fabric bags to permanent customers ☐	Give them to charity stores who may use them. ☐	Reuse empty container to store hardware in the shop. ☐

	TYPE OF WASTE	REUSE& REDUCING METHODS ADOPTED						
		(a)	(b)	(c)	(d)	(e)	(f)	(g)
4	METAL	Donating for recycling ☐	Sell to second hand market ☐	Return excess packa-ging ☐	Avoid metal packaging, aluminium foil packaging ☐			
5	BIO-DEGRADABLE WASTE (FOOD WASTE, KITCHEN, GARDEN ☐	Offer leftovers to poor, needy.	Composting/ As garden conditioner. ☐	Feeding to street animals ☐				

	WASTE)							
6	E-WASTE	Donate old computers ☐						
7	TEXTILE	Reused for different stages of cleaning. ☐						

16. Response of the reuse/recycle practices adopted:
    .....
17. Are cleaners & customers aware of waste management and recycling procedures (Y/N): .....
18. Awareness methods adopted: .....
19. Do you purchase/sell environmentally-friendly products/cleaning products (Y/N): .....
20. Are your suppliers currently selected against environmental criteria? (Y/N): .....
21. Do you buy products made from recycled materials or with recyclable or reusable packaging? (Y/N): ..
22. Do you charge your customers for plastic bags? (Y/N): .....
    What are the charges: a) < Rs. 5 ☐ b) Rs. 5-10 ☐ c) > Rs. 10 ☐
23. Response of Customers towards these charges:
    a) Started bringing their own shopping bags instead of purchasing new plastic bags every time. ☐
    b) Encouraged the use of textile bags among customers. ☐
    c) No effect, people readily paying for plastic bags. ☐
24. Do you pay for waste disposal: (Y/N).....?
    If yes, how much do you pay per month: a) < Rs.50 ☐ b) Rs. 50-100 ☐ c) > Rs. 100 ☐

Annexure 3: Office establishments Survey questionnaire:

Project Title: Advancing Locally Based Green Practices to realize establishment of Sound Material Cycle Society in Asian Cities

Survey Details	
Organisation/business/ office Name:	
Type of Organisation/business/ office:	
Survey conducted by:	
Date of Survey:	
Number of Employees	

25. How frequently is the following waste and sub-waste generated in your premises:

SOURCE	GENERATION FREQUENCY				
	(a) Daily	(b) Weekly	(c) Monthly	(d) Occasionally	(e) Never
(1) PAPER					
Office Paper					
Newspaper					
Magazines & glossies					
Tissue Paper					
Other Paper					
Paper Packaging					
Food wrappers (e.g. sandwich wrappers, cake wrappers, crisp wrappers, toffee wrapper, etc)					
Cardboard					
Other					
(2) GLASS					
Pigmented/coloured Glass					
Clear Glass					
Other Glass					
(3) PLASTIC					
Packaging					
Plastic Films					
Plastic Containers/jars/bottles etc.					
Other Plastic					
(4) METAL					
Aluminium Packaging					
Metals Packaging					
Other Metal waste					

SOURCE	GENERATION FREQUENCY				
	f) Daily	g) Weekly	h) Monthly	i) Occasionally	j) Never
(5) BIO-DEGRADABLE WASTE (INCLUDING FOOD ,KITCHEN AND GARDEN WASTE)					
Food waste(leftovers)					
Garden waste					
Kitchen waste					
(6) E-WASTE					
Batteries					
Printer and Fax cartridges					
Office Electrical Equipment, Fluorescent Lighting Tubes					

Others (specify):					
(7) TEXTILE					
Used in cleaning & other purpose					
Others (specify)					

26. Frequency of waste disposal:

	Type of waste	a)daily	b)Weekly	c)Fortnightly	d)Monthly	e)Once in a year	f)Never
1	PAPER						
2	GLASS						
3	PLASTIC						
4	METAL						
5	BIO-DEGRADABLE WASTE						
	I)FOOD WASTE						
	II) KITCHEN						
	III) GARDEN WASTE						
6	E-WASTE						
7	TEXTILE						

27. Frequency of waste collection:

a) Daily	
b) Weekly	
c) Monthly	
d) Other	

28. How many waste collection points are inside your centre/premises: .....

29. Do you follow waste segregation? (Y/N): .....

30. Who prompted you to start waste segregation:
    a) Self started ☐ b) Awareness program by NGO etc. ☐ c) Other, Specify ☐

31. Do you provide staff/ customers with recycling bins/separate bins and are bins clearly labelled (Paper and cardboard, general waste, etc) (Y/N): .....
    Specify typology: .....
32. For how long have you been practicing waste segregation?
    b) < 5 years ☐ b) 5-10 years ☐ c) >10 years ☐

33. Who is currently responsible for collecting and disposing of waste/recyclable materials generated in your facility? Check all that apply.

1	In house cleaning/maintenance department	
2	Private contracted service	
3	Government facility/staff	
5	Other: Please specify.....	

34. Methods adopted for waste disposal:

	Type of waste	f) throw	g) Burn	h) reuse	i) recycle	j) give to bulk waste dealer	f) Donate for reuse or recycle activities	e) Donate for charity
1	PAPER							
2	GLASS							
3	PLASTIC							
4	METAL							
5	BIO-DEGRADABLE WASTE							
	I)FOOD WASTE							
	II) KITCHEN							
	III) GARDEN WASTE							
6	E-WASTE							
7	TEXTILE							

35. Quantity of waste disposed (no. of containers/bags per day /per month etc.): .....

36. Are there any in –house reuse and recycle practices adopted: (tick all that apply)

	TYPE OF WASTE	**REUSE& REDUCING METHODS ADOPTED**

		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1	PAPER	Make note pads out of print overruns, com puter printouts, outdated forms and stationery ☐	Reuse wrapping paper to re-wrap. ☐	To line shelves & drawers. ☐	Donating for recycling ☐	Use newspap er, magazin es for wrapping ☐	Return excess packa-ging ☐	Print and copy on both sides of the paper. ☐	Reuse envelope s for internal mails ☐
2	GLASS/ CERAMIC	Reuse of old crockery by giving it to servants, needy, poor etc. ☐	Reusing by means of refillable form of products ☐	Bring a reusable mug to work. ☐	Donating for recycling	Using reusable crockery/ glass items in place of disposabl es ☐			
3	PLASTIC	Carry your own water bottle ☐	Reuse water bottles within the office ☐	Use plastic bags to wrap rubbish ☐	Using reusable crockery/ steel items in place of disposabl ☐	Reuse empty container to store files, folders, office items etc. ☐			

	TYPE OF WASTE	**REUSE& REDUCING METHODS ADOPTED**							
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
4	METAL	Donating for recycling ☐	Sell to second hand market ☐	Return excess packa-ging ☐	Avoid metal packaging, aluminium foil packaging ☐				
5	BIO-DEGRADABLE WASTE (FOOD WASTE, KITCHEN, GARDEN WASTE)	Offer leftovers to poor, needy. ☐	Composting/ As garden conditioner. ☐	Feeding to street animals ☐					

6	E-WASTE	Reformat computer disks for reuse. ☐	Donate old computers ☐	Donate printer cartridges for recycling. ☐	Use recycled ink cartridges ☐				
7	TEXTILE	Reused for different stages of cleaning. ☐							

37. Response of staff towards the reuse/recycle practices adopted:
    .....
38. Are cleaners/office staffs aware of waste management and recycling procedures (Y/N): .....
39. Awareness methods adopted: .....
40. Do you purchase environmentally-friendly products/cleaning products (Y/N): .....
41. Are your suppliers currently selected against environmental criteria? (Y/N): .....
42. Is your letterhead, envelopes etc made from recycled content paper? (Y/N): .....
43. Do you buy products made from recycled materials or with recyclable or reusable packaging? (Y/N): ..
44. Do you pay for waste disposal: (Y/N).....?

    If yes, how much do you pay per month: a) < Rs.50 ☐ b) Rs. 50-100 ☐ c) > Rs. 100 ☐

    Comments:

    _____

    _____

ANNEX - 4 : International Workshop Report

1st December 2013: Project Core Committee Meeting in Bhopal, India

A project core committee meeting was conducted on 1st of December 2013 in Seminar room of SPA campus at MANIT Bhopal. The meeting was attended by members of the research team. Professor Manmohan Kapshe from SPA Bhopal welcomed the research team and briefed about the project. Dr, Akhilesh Surjan, project leader discussed about the expectations and outcome of the project. Professor Rama Pandey from SPA Bhopal presented the progress status and India component of the project. Team member also discussed about the preparation of the workshop of 2nd December 2013. Photographs taken during the meeting are given below.



2nd December 2013: One Day International Workshop

To bring forward and to discuss the progress of the study 'Advancing Locally Based Green Practices to realize establishment of Sound Material Cycle Society in Asian Cities 'by means of understanding the perspective of various stakeholders and to learn from the experts in the field, two days international workshop on 'SUSTAINABLE CITIES – Generating co-benefits in urban area' was conducted on 2nd and 3rd December, 2013. The seminar was held on the first day, which consisted of two technical sessions and a workshop was held on 3rd December.

This workshop was organized by School of Planning and Architecture, Bhopal, in collaboration with, United Nations University, Institute for sustainability and peace, Tokyo, Japan Tokyo, Japan and Asia Pacific Network for Global Change Research, United Nations University, Institute of advanced studies, Tokyo, Japan and Kyoto University.

The first technical session was on Co-Benefits while the second session was related to Sound Material Cycle Society. The participants included staff, students and faculty of School of Planning & Architecture, Bhopal along with various academicians from prestigious institutes of the country like IIM, Ahmadabad, and Maulana Azad National Institute of Technology, Bhopal etc., officials from different government departments like Town & Country Planning, Bhopal, Bhopal Municipal Corporation etc. and researchers from United Nations University. Policymakers, academicians, experts, professionals, Non-government Organizations, community based Organizations and people from organizations that implement it all were present.

The seminar focussed on the concept of 'Sound Material Cycle Society' and a panel discussion was conducted to get the expert perspective.

The second technical session that was on sound material cycle society (SMC) had two speakers-, Prof. Rama U. Pandey from School of Planning & Architecture, Bhopal and Dr. Akhilesh Surjan form UNU- ISP, Japan and was chaired by Professor Dr. Rachna Khare from SPA, Bhopal. The session was initiated by Dr. Akhilesh Surjan. He discussed the SMC Vision, project outline and some cases from Japanese experience were also presented.

He also spoke about advancing locally based green practices citing examples of practices adopted in Japan. He further elaborated on the research work carried out in Vietnam, Indonesia and India.

Prof. Rama U Pandey from SPA, Bhopal presented the progress of the study in India, she also explained current scenario of solid waste disposal in India highlighting the role of informal sector in disposal, recycling and reuse of waste materials. This was illustrated for household, commercial and office sector, citing cases from city of Bhopal. The existing practices of solid waste management in these sectors were discussed in detail and how these existing practices are contributing to green practices and their role in attaining a sound material cycle society in Indian Context were the highlight of the presentation.

It was followed by participation from the audience. Questions were mainly on the issues in reuse, recycling in terms of efficiency of energy used and efficiency of recycled products. There were also concerns regarding the role of authorities in managing the solid waste in the city and their efficiency in achieving this goal.

The session was concluded with panel discussion on the issues and presentations of the technical sessions. The panel discussion session consisted of four speakers-, Dr. Manmohan Kapshe from SPA Bhopal, Dr. Cristopher N.H. Doll from UNU, IAS, Dr. Jose P D Oliveira from UNU IAS and Dr. Sanjeev Singh from SPA, Bhopal, and was chaired by Dr. Binayak Choudhury from SPA, Bhopal. The panel emphasised on the practical initiatives at particular income levels, resource consumption and achieving balance between desirable and undesirables and the need of a long term vision with techno centric approach based on ecological principles. The workshop was successful in bringing

together people from government organizations and researchers from different parts of the world on the same forum for the discussion.

International Workshop on

Sustainable Cities: Generating Climate Co-benefits in Urban Areas

2nd and 3rd December 2013

Organised by

School of Planning and Architecture, Bhopal

Detailed Programme Schedule: Day - 1

2nd December 2013	VENUE: DARBAR HALL, HOTEL JEHAN NUMA, BHOPAL
09.30 to 10.00 a.m.	REGISTRATION
10.00 to 11.30 a.m.	INAUGURAL SESSION
10.00 to 10.02 a.m.	Seating of Dignitaries on Dais
10.02 to 10.05 a.m.	SPA Anthem
10.05 to 10.10 a.m.	Lighting of Lamp
10.10 to 10.20 a.m.	**Opening Remarks**: Prof. Ajay Khare, Director, SPA, Bhopal, India
10.20 to 10.25 a.m.	**Workshop Introduction**: Prof. Manmohan Kapshe, SPA, Bhopal, India
10.25 to 10.45 a.m.	**Keynote Address**: Prof. Amit Garg, Indian Institute of Management, Ahmedabad, India
10.45 to 10. 50 a.m.	RELEASE OF SPECIAL ISSUE OF JOURNAL OF CLEANER PRODUCTION - CLIMATE CO-BENEFITS IN URBAN ASIA
10.50 to 11.10 a.m.	**Theme Introduction**: Dr. Jose Puppim de Oliveira, UNU-IAS, Japan
11.10 to 11.25 a.m.	**Address by the Chief Guest**: Mr. Anthony J C DeSa, Chief Secretary, Govt. of Madhya Pradesh, India
11.25 to 11.30 a.m.	**Vote of Thanks**: Prof. Binayak Choudhury, SPA, Bhopal, India
11.30 to 11.45 a.m.	TEA BREAK
11.45 to 01.30 p.m.	TECHNICAL SESSION 1: CO-BENEFITS IN URBAN AREAS; Moderator: Prof. Sanjeev Singh, SPA, Bhopal, India
11.45 to 12.05 p.m.	**Waste Management and Co-benefits in Surat**: Mr. Amit Chatterjee, SPA, Bhopal, India
12.05 to 12.25 p.m.	**Co-benefits in Transportation Sector**: Dr. Christopher N. H. Doll, UNU-IAS, Japan
12.25 to 12.45 p.m.	**Bhopal BRTS: Future Challenges**: Mr. Chandramouli Shukla, Additional Commissioner, BMC, Bhopal, India
12.45 to 01.05 p.m.	**Knowledge Gaps and Research Initiatives**: Dr. Mahendra Sethi, UNU-IAS, Japan & NIUA, India
01.05 to 01.30 p.m.	**Discussions & Moderator's Summary**
01.30 to 02.30 p.m.	LUNCH BREAK
02.30 to 03.45 p.m.	TECHNICAL SESSION 2: SOUND MATERIAL CYCLE SOCIETY; Moderator: Prof. Rachna Khare, SPA, Bhopal, India
02.30 to 02.55 p.m.	**Sound Material Cycle: Vision, Project Outline, Cases from Japan**: Dr. Akhilesh Surjan, UNU- ISP, Japan
02.55 to 03.20 p.m.	**Sound Material Cycle: Vision and Project Progress Status in India**: Mrs. Rama Umesh Pandey, SPA, Bhopal, India
03.20 to 03.45 p.m.	**Discussions & Moderator's Summary**
03.45 to 04.00 p.m.	TEA BREAK
04.00 to 05.00 p.m.	PANEL DISCUSSION & CONCLUDING SESSION; Moderator: Prof. Binayak Choudhury, SPA, Bhopal, India
04.00 to 04.40 p.m.	**Theme**: Sustainable future options for cities: Role of co-benefits **Panellists**: Dr. Christopher N. H. Doll, UNU-IAS, Japan Dr. Jose Puppim de Oliveira, UNU-IAS, Japan Prof. Manmohan Kapshe, SPA, Bhopal, India Prof. Sanjeev Singh, SPA, Bhopal, India
04.40 to 04.55 p.m.	**Discussions and Moderator's Summary**
04.55 to 05.00 p.m.	**Vote of Thanks**: Mr. Amit Chatterjee, SPA, Bhopal, India
05.00 to 05.30 p.m.	HIGH TEA

Detailed Programme Schedule: Day - 2

3rd December 2013	VENUE: COMPUTER CENTRE, SCHOOL OF PLANNING AND ARCHITECTURE, BHOPAL
09:30 to 10:00 a.m.	Registration
10.00 to 10.15 a.m.	Opening Remarks from UNU-IAS
10.15 to 01.15 p.m.	Technical Session 3: Training on Co-benefits Assessment Tool
01:15 to 01:30 p.m.	Final Discussion and Closing Remarks

in collaboration with

UNITED NATIONS UNIVERSITY UNU-IAS Institute of Advanced Studies

APN Asia-Pacific Network for Global Change Research

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UNITED NATIONS UNIVERSITY UNU-ISP Institute for Sustainability and Peace

Media Coverage: In 'Naiduniya' , a Hindi Language daily newspaper

'ग्रीन हाउस गैस को लेकर हमें सचेत होने की जरूरत'

स्कूल ऑफ प्लानिंग एंड आर्किटेक्चर की दो दिवसीय इंटरनेशनल कॉन्फ्रेंस शुरू

भोपाल (नप्र)। देश के प्रत्येक नागरिक को, नीति निर्धारकों को ग्रीन हाउस गैसों के दुष्प्रभावों को लेकर सचेत होने की जरूरत है। अगर हम शहरी क्षेत्रों की मूलभूत सुविधाओं के लिए प्राकृतिक संसाधनों का दोहन तय सीमा में करें और वेस्ट मैनेजमेंट की प्रक्रिया को सुदृढ़ बना लें, तो ग्रीन हाउस गैसों के प्रभाव से बचा सकता है। यह बात सोमवार को मुख्य सचिव (मध्यप्रदेश शासन) अंटोनी जेसी डिसा ने कही। वे स्कूल ऑफ प्लानिंग एंड आर्किटेक्चर की ओर से होटल जहांनुमा में आयोजित इंटरनेशनल कॉन्फ्रेंस में बतौर मुख्य अतिथि बोल रहे थे। 'सस्टेनेबल सिटीज : क्लाइमेट को-बेनिफिट्स इन अर्बन एरियाज' विषय पर केन्द्रित इस दो दिवसीय इंटरनेशनल कॉन्फ्रेंस में देश-विदेश से आए विशेषज्ञ हिस्सा ले रहे हैं।

वेस्ट का करना होगा बेस्ट यूज

दो दिवसीय इस कॉन्फ्रेंस के उद्घाटन सत्र में स्कूल ऑफ प्लानिंग एंड आर्किटेक्चर के डायरेक्टर अजय खरे ने अध्यक्षीय उद्बोधन में वर्तमान समय में सस्टेनेबल सिटीज की जरूरत के बारे में बताया। आईआईएम अहमदाबाद के प्रो. अमित गर्ग ने इस अवसर पर ग्लोबल सिनैरियो में वेस्ट की स्थिति को प्रस्तुत किया। उन्होंने कहा कि मुझे लगता है कि वेस्ट दरअसल एक यूजफुल मटेरियल है, जो गलत जगह पहुंच गया है। वेस्ट से हम कई सारी सकारात्मक चीजें बना सकते हैं। हमें दरअसल चीजों का सही इस्तेमाल नहीं आता। जिसे हम वेस्ट कह रहे हैं, वही वेस्ट वर्मी कम्पोस्ट के रूप में हमारे किचन गार्डन में काम आता है। उद्घाटन सत्र में इंटरनेशनल जर्नल के स्पेशल एडीशन 'क्लीनर प्रोडक्शन : क्लाइमेट को-बेनिफिट्स इन अर्बन एशिया' का विमोचन किया गया। यहां आईआईएफएम के निदेशक जीए किन्हल, मैनिट के डायरेक्टर डॉ. अप्पू कुट्टन केके उपस्थित थे।

बीआरटीएस स्मूथ ट्रांसपोर्टेशन के लिए

इंटरनेशनल कॉन्फ्रेंस के टेक्निकल सेशन में भोपाल म्युनिसिपल कॉर्पोरेशन के एडिशनल कमिश्नर चंद्रमौली शुक्ला ने बीआरटीएस भोपाल और इससे जुड़ी भविष्य की समस्याओं पर अपनी बात रखी। इस मौके पर चंद्रमौली शुक्ला ने बीआरटीएस भोपाल पर एक शॉर्ट डॉक्यूमेंट्री पेश की। वहीं माय बस के बारे में उन्होंने कहा कि बीआरटीएस भोपाल की शुरुआत शहर की सड़कों पर बढ़ रहे व्हीकल प्रेशर को काम करने और पब्लिक को स्मूथ ट्रांसपोर्टेशन देने के लिए की गई है। हमारा यही मकसद है कि ज्यादा से ज्यादा लोग बीआरटीएस का यूज करें। शहर के 8 लाख वाहनों में से 80 प्रतिशत बाइक है और करीब 10 प्रतिशत कारें हैं। बीआरटीएस इस समय दुनिया की 96 कंट्रीज में रन कर रहा है। बेशक बहुत ही जल्द भोपाल बीआरटीएस सर्विस भी अपने अच्छे स्वरूप में सामने आएगी। बहुत ही जल्द हम स्मार्ट कार्ड और फेयर गेट्स की सुविधा भी बीआरटीएस के साथ जोड़ने वाले हैं, ताकि भोपाल के लोगों को एक सुकून भरी और किफायती यात्रा हम मुहैया करा सकें। यूनाइटेड नेशंस यूनिवर्सिटी, एपीएन और क्योटो यूनिवर्सिटी के सहयोग से आयोजित इस दो दिवसीय इंटरनेशनल कॉन्फ्रेंस में जापान के डॉ. क्रिस्टोफर एनएच डॉल, डॉ. महेन्द्र सेठी, डॉ. अखिलेश सुरजन और डॉ. जोस फुप्पिम ऑल्वेरिया भी उपस्थित थे।

पब्लिक-सिटी प्लानर्स मिलकर करें काम

हमारे सिटी प्लानर्स पब्लिक के लिए ही सिटी की प्लानिंग करते हैं। ऐसे में अगर हम सिटी के मैनेजमेंट को लेकर किसी तरह की समस्या पाते हैं, तो सिर्फ प्लानर्स को दोष देने की जरूरत नहीं है। मुझे लगता है कि अगर किसी भी शहर की पब्लिक और सिटी प्लानर्स दोनों साथ मिलकर अपनी सिटी को सस्टेनेबल बनाने की कोशिश करेंगे, तो प्रयास का असर ज्यादा जल्दी दिखाई देने लगेगा। सिटी को सस्टेनेबल बनाने के लिए तीन अहम पहलुओं पर सबसे पहले फोकस करने की जरूरत है। जिसमें सिटी की इकोनॉमिक ग्रोथ, सोशल ग्रोथ और एनवॉयरनमेंटल ग्रोथ शामिल है।

– **डॉ. जोस फुप्पिम डे ऑल्वेरिया**, यूनाइटेड नेशंस यूनिवर्सिटी

इंस्टैंट कॉफी की तरह नहीं है समाधान

शहरों की समस्या का समाधान किसी इंस्टैंट कॉफी की तरह संभव नहीं है। सतत विकास की बात हमारी दुनिया में 1972 में आई और तभी से हम विकास के मुद्दे पर काम कर रहे हैं। समस्याएं उस समय आ खड़ी हुई है, जब हमने पहले से तय सीमाओं को तोड़ा और प्राकृतिकरूप से चली आ रही गतिविधियों को बाधित करने की कोशिश की। उत्तराखंड की त्रासदी भी इसी का एक उदाहरण है। लेकिन मेरा विश्वास है कि लंबे समय के छोटे-छोटे बदलावों के कारण जिस तरह आज हम समस्याओं के चरम पर पहुंचे हैं, उसी तरह हम पिछले दौर में लौट भी सकते हैं। प्रयास किए जाएं, तो संभव है कि हम पुराने समय को एक बार फिर से जी सकें।

– **डॉ. अखिलेश सुरजन**, क्योटो यूनिवर्सिटी

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INDONESIA

Aggregate GDP growth in 10 Southeast Asian countries was 7.8% in 2010 (ADB, 2011). According to data, Indonesia has contributed towards potential economic demand for 230 million people. An increase in Indonesia's economic growth last year was driven by strong private consumption, buoyant investment, and robust recovery in export demand.

This condition also has adverse effects, especially on the environment. High economic growth means increasing production and consumption, and also increase of unused products. It can occur in the beginning of production processes or happen in the end of supply chain. This problem has already occurred in Indonesia, which has the fourth largest population in the world according to UN (2004). Citarum River, which is the longest river in West Java, is choked with plastic, loaded with chemicals and human waste. Jakarta Special Province had 6,594.72 tons of waste per day in January 2009 and will have 8,210 tons per day in 2025 (KPS, 2009). Yogyakarta city will have unmanageable amounts of waste in 2014.

Yogyakarta Case Study

Yogyakarta is the third most densely populated city in Indonesia. The macro-economic condition is improving by 4.69%, which is the Regional GDP (RGDP) average growth in 2004-2008, except agriculture and mining sectors. The largest share in contribution towards RGDP was by trade, hotel, and restaurant sector by 25.05% and mining and quarrying sector was the smallest contributor by 0.01% (BPS[1], 2009).

Generally, Yogyakarta's waste consists of six materials which are organic, plastic, paper, metal, glass, textile, and ribbon. The largest composition is of organic material (46.17%), while the smallest is ribbon material (0.2 %) based on a survey conducted in November 2011. The smallest materials contributions are from glass, textile, and ribbon, which are mainly produced by trade, hotel, and restaurant sector, transportation, communication and business services, and manufacturing industry. The largest composition is of organic waste that is mainly produced by the construction and agriculture sector.

Based on Waste Management Act 18/2008, waste management is done by many actors. First, government is a regulator of the waste management system. Second, community is an actor involved in 3R practices. Third, the NGOs evaluate waste policies by the government and also does waste recycling mentoring to community.

Environmental Agency of Yogyakarta Government (*BLH Kota Yogyakarta*)

Yogyakarta has a waste management system integrated in KARMANTUL secretariat. This is a collaborated system of three areas, i.e. Yogyakarta city, Sleman regency, and Bantul regency. Waste management system by Yogyakarta's government is authorized by The Environmental Agency. There are two sub-parts- a section of waste cleaning and section of waste transporting. The schedule of waste transportation is three times per day (morning, afternoon, and evening), 7 days a week (Environmental Agency, 2008). Carrying and Dumping is conducted in two major patterns. The first pattern is individual collection and the other one is communally conducted. About 90% of waste dumped can be transported into the final disposal site. Informally they are helped by the scavengers who help in sorting waste into the temporary disposal sites. They pick-up PET bottles, used box packages, papers, and hard papers to resell to the wholesaler. Incinerator works for 10 hours per day

[1] Central Bureau of Statistics

located in the southern part of Yogyakarta. In the 2008, a recycle facility was built near the incinerator which has $3m^3$ capacities and 1200^oC maximum temperature (Environmental Agency, 2008).

Waste is dumped into two kinds of final disposal sites- the temporary disposal and the final one. A temporary disposal is a place where waste is collected by a person or dump truck before being carried to the final disposal. In addition to designated five places of temporary disposal, there are some illegal temporary disposal sites usually located on the river bank. The final disposal site is about 16 km far in the southeastern part of Yogyakarta city. With 12.5 ha coverage, that place has a capacity of about 2.5 million-3 million m^3 waste. It operated for the first time in 1993, it was estimated that it will have an operating life of 13-15 years. It comprises of a Sanitary landfill separated into 3 zones- dumping, leachate control, drainage and water proof system (Environmental Agency, 2008).

Since 2008, local government has been trying to reduce waste transported into final disposal and promote 3R. As a result, about 1,092 m3/day waste was transfered into the final disposal, and the rest (490,485 m3/day) was managed by the community with 3R practices (BLH, 2009). In 2009, the government supported 3R practices by giving 150 composters in the river plain communities and 90 composters in all 45 sub districts. This consisted of 1,620 *takakura* units and 7,830 units liquid composter (Environmental Agency, 2010).

3R Practices by Communities

Although waste that is stored in the final disposal site (*TPA Piyungan*) has decreased from 91,128 tons in 2008 to 63,918 tons in 2010 (15.9%) (Environmental Agency, 2010), it is still a substantial amount. On the other side, composting by the government only solves the organic waste problem, but not that of non-organic material. Yogyakarta's waste consists of more than 50% of non-organic material, including large share of plastic (26.58%) and paper (17.64%). Paper is easier to handle than the plastic because some companies are buying unused paper. With a pickup mobile, they transport this material from the government, private services, and business unit. Meanwhile, plastic waste is not easy to sell. There are unused PET bottle that can be resold. Another product, e.g. instant noodle packages, sachet, and plastic bag, cannot be resold. Even, the scavengers are not interested in these materials. However, there are many communities practicing 3R. *Migunani* in the Sorosutan sub-district, was one of pilot 3R projects in 2008 which received crusher machines. This community which is a member of *Jaripolah* (Waste-Recycled Community Network) also implemented 3R practices by making handicrafts from plastic material, i.e. wallet, pillow, and handbag, etc.

NGO Practices - *Lestari*

Since 2005, Lestari, a local NGO, has focused on waste reduction activities. Lestari is advising the local government to have a waste reduction regulation, especially for the plastic material. Working together with ESP-US Aid in 2009, it has created a community based recycle network. Because organic and non-organic material is sometimes not always an appropriate terminology, Lestari defined waste categories based on its potential value such as: saleable waste, compostable waste, creative-able waste, dump-able waste. Lestari believes that these characteristics are easier to understand for the community rather than organic-non-organic. In 2011, together with the other communities, Lestari marched and organized a function to remind the government about strong policy on waste reduction. They gave the "*grebeg sampah"* to the Mayor on "waste care day" on February, 21^{st} 2011. They also gave some art-recycled waste performance, such as a waste-recycled costume theater performance and a waste-recycled fashion show.

Problem and issues in Yogyakarta's 3R practices

Despite being the most convenient city in Indonesia, as declared by the 2010 Planning Experts Network of Indonesia's (IAP) survey 2011, Yogyakarta is facing urban development challenges. Increased migration will lead to import more resources and materials from the surrounding areas. Unfortunately, there is no regulation to support waste reduction at the city level. Many facilities do not work, such as the final disposal site and incinerator. In 3R practices, coordination is the main problem. Many *takakura* did not deliver because of poor planning. There is no evaluation of composting programs run by the government. The network of communities is too weak to cover all areas, hence cannot be considered effective. NGOs and Governments have different approaches about waste management and 3R practices. Recycling project needs large capital, and are too expensive to implement at times. Communities are less willing to engage in recycling activities until there is an economic value attached to it. There is only 5.3% of organic material composted to become fertilizer and 14.3% of glass material is recycled. Another problem is the availability of basic information related to SMC practices. There is lack of data about economic category wise consumption and waste production at the city level. The annual waste production report is only a "copy" and "paste" from other reports.

References

ADB, 2010. (http://www.adb.org/documents/books/ado/2010/update/ado2010-update.pdf, downloaded on October 31, 2011)

ADB, 2011. (http://www.adb.org/documents/books/ado/2011/ado2011.pdf, downloaded on October 31, 2011)

Environmental Agency (Badan Lingkungan Hidup Yogyakarta). 2008. Laporan Periodik Per Bulan Terhadap Volume Sampah Harian Tahun 2008. Pemerintah Kota Yogyakarta.

Environmental Agency (Badan Lingkungan Hidup Yogyakarta). 2009. Laporan Periodik Per Bulan Terhadap Volume Sampah Harian Tahun 2009. Pemerintah Kota Yogyakarta.

Environmental Agency (Badan Lingkungan Hidup Yogyakarta). 2010. Laporan Periodik Bulanan Sampah Harian Tahun 2010. Pemerintah Kota Yogyakarta.

Hideto Yoshida, Kazuyuki Shimamura, Hirofumi Aizawa. 2007. 3R strategies for the establishment of an international sound material-cycle society. J Mater Cycles Waste Manage (2007) 9:101–111.

IA . 2011. Indonesia most liveable city index2011. Jakarta. (http://www.iap.or.id/_data/_download/MLCI%202011.pdf, downloaded at September, 10 2011)

Ministry of the Environment. 2003. Fundamental plan for establishing a sound material-cycle society.

Ministry of the Environment, Government of Japan. 2010 .Establishing a sound material-cycle society Milestonse toward a sound material-cycle society through changes in business and life styles.

Ministry of the Environment, Office of Sound Material-cycle Society Waste Management and Recycling Department: Tokyo.

VIETNAM

Vietnam has a surface area of 330.363 km^2 and is the 14^{th} most populated nation in the world with around 90 million people in 2011 (GSO). Vietnam's economic reforms have resulted in an average annual economic growth of 7.5% during the last decade. The country's rapid economic growth also brings about unprecedented environmental challenges, particularly for burgeoning urban and industrial areas, which already experienced serious health and environmental impacts (VEM 2004, Mitchell 2006). In the coming years, it is forecasted that the urbanization rate in Vietnam will continue to grow. It is estimated that by 2015, population in urban areas is 35 million people which accounts for 38% of total country population and by 2025 it will be 52 million people which accounts for 50% of total country population (JICA 2010).

Solid waste is a growing problem for Vietnam. The country is producing more than 27 million tons of waste each year, and this amount is expected to grow rapidly over the next decade (MoNRE 2010). Urban areas, which contain only 24% of the population of the country, generate more than 50% of the country's municipal waste. By 2010, municipal waste generation is expected to increase by over 60%. In addition, the expansion of urbanization in combination with industrial growth and the modernization of medical services lead to a significant increase in industrial waste and hazardous medical waste generation. If not managed well, the toxic and hazardous waste pose significant threats to public health and the environment (VEM 2004, JICA 2010).

In response, the country has made great efforts to develop a sound legal framework for environmental protection and solid waste management, especially in major cities. The institutional framework at national level includes MoNRE and MoC assigned as the main party in charge of management of municipal solid waste, line ministries such as MoPI and MoF as directly involved in waste management activities, URENCOs as service providers for municipal waste management at the local level. Led by MoNRE, regulatory agencies at both national and local levels supervise and monitor the management of solid waste from industries, hospitals, solid waste operators, and individuals. Over the last decade, several policies and strategies on solid waste management have been issued which shown good signs of government's commitment on improving solid waste management, especially with regard to a considerable increase in investment. This included landfill construction, hazardous waste management, capacity in managing and socializing solid waste services, at-source separation and composting, and cleaner production (VEM 2004, Mitchell 2006, JICA 2010). However, the current solid waste management in Vietnam remains some of weaknesses and needs to be addressed in a proper way.

In addition, green based practices related to 3Rs (reduce, reuse and recycle), such as separation at source, cleaner production, and green consumption have been introduced and implemented in several cities and towns over the last decade, but these practices have not been widely adopted. In order to promote the 3 R practices in Vietnam, requiring more efforts from government, industries, hospitals, treatment companies and individuals.

Research objectives

The overall objective of the study is to investigate the current status of urban solid waste management and locally based green practices/3 R practices in Vietnam. The specific objectives are to:

- Understand community's existing consumption and recycling practices and social struggle to keep pace with the rapid economic growth (which is fuelling environmental degradation and increasing volumes of material waste) in Vietnamese cities;
- Review of the waste recycling at household, neighborhood, city/province and national level;
- Identify urban policies which influence rapid economic growth and alter city's material flows and corroborate to ascertain links with environmental degradation;
- Analyze major factors responsible for the formation of social wasteful practices as well as negligence of cyclicity of materials in key sectors.
- Departments of Health (DoH), waste collection, transport and treatment have not been received sufficient attention, particularly separation at source, both normal and hazardous medical wastes (see MoNRE, 2010).

Scope of the study

The scope of this study is limited to the current situation on solid waste management in Vietnam, including waste generation, waste handling (reuse and recycling, collection, treatment and disposal), and solid waste management problems and issues. The term solid waste used in this study covers municipal garbage, industrial waste, medical/ health care waste and some cultivation waste. It does not include sewage sludge, construction and demolition waste, and mining residues.

The study also reviews green based practices in Vietnam. Since green based practice is a new concept in Vietnam, this study focuses on 3R (reduce, reuse and recycle models) practices including waste separation at source, cleaner production, and green consumption in Vietnam.

Methodology

This study was prepared using documentation research methods. Secondary data, information literature, and previous studies used for this review study were gathered from national and local authorities, academic and research institutes, related projects and websites. There are a number of constraints and challenges in undertaking this review study. First, green based_practice is a new concept in Vietnam thus limited availability of research reports concerned with. Second, so far only a few studies concerned 3R practices have been done in Vietnam. Third, there may also be case studies of 3R practices in Vietnam that we have omitted – whether unknowingly or consciously.

Current situation on urban solid waste management in Vietnam

Waste generation and components

According the National Report on the Environment in Vietnam (MoNRE, 2010), Vietnam produces over 27.8 million tons of waste in 2008 from various sources. More than 45% (12.8 million tons/yr) is from municipal sources, including households, restaurants, markets, and businesses. More than 9 million tons (32%) of waste is from rural areas, making it the second most significant source. Industries generate over 4.7 million tons of waste (17%) each year, making it the second most significant source. Handicraft villages generate over 1 million tons of waste (3.5%) each year. About 179,000 tons/yr (1%) of Vietnam's waste is considered healthcare waste (see Table 1).

Looking at the amount of waste generated by per person, in 2008 each person generates 1.45 kg/person/day in urban areas and 0.4 kg/person/day in rural areas.

- **Table 1. Quantity of waste generation in 2003 and 2008**

Type of waste	Unit	In 2003	In 2008
Municipal waste	Ton/year	6.400.000	12.802.000
Industrial waste	Ton/year	2.638.400	4.786.000
Medical waste	Ton/year	21.500	179.000
Agricultural waste	Ton/year	6.400.000	9.078.000
Craft village waste	Ton/year	774.000	1.023.000
TOTAL	Ton/year	15.459.900	27.868.000
Average amount per person in urban area	Kg/person/day	0.8	1.45
Average amount per person in rural area	Kg/person/day	0.3	0.4

Sources: National Report on the Environment in Vietnam (MoNRE, 2010)

During the period from 2003 to 2008, the amount of solid waste generated in Vietnam has been increasing steadily with about 150-200%, municipal waste increases more than 200%, industrial waste increases 181%, see Table 1 (MoNRE 2010).

Waste amount in Vietnam is predicted to increase by over 43.6 million tons per year by 2015. Particularly, municipal waste and industrial waste will be drastically increased in the next 10 to 15 years (Table 2).

- **Table 2. Waste amount forecast in Vietnam**

(Unit: million ton)

Year/ Type	Municipal waste	Industrial waste	Medical waste	Waste from rural waste	Waste from craft village	Total
2015	22.2	9.6	0.2	9.8	1.8	43.6
2020	35.2	20.8	0.3	8.8	2.5	67.6
2025	51.7	27.8	0.3	7.6	3.6	91.0

Source: National Strategy on Integrated SWM up to 2025, vision toward 2050

Solid waste (SW) in urban areas of Vietnam can be grouped broadly into 4 categories: municipal waste, industrial waste, medical waste and e-waste.

1. Municipal solid waste:

Municipal solid waste comprised of residential, commercial and market wastes. Cities in Vietnam are major generators of municipal waste. Urban areas generate 35.100 tons/day and rural areas generate 24.900 tons/day. On average, each urban dweller in Vietnam produces over 1.45 kilogram of waste each day, which is more than three times compared to a resident in rural areas. Results from a study on waste generation in urban areas show a regularly increasing trend in producing waste over time, on average 10-16% per year (MoNRE 2010).

2. Industrial waste:

Industrial waste includes hazardous waste from the processing activities of factories and other manufacturing units; sewage from municipal sewer systems.

In Vietnam, industries generate 13.100 tons/day; industrial waste comprises about 17% of waste but varies depending on the size of the province/city and its degree of industrialization. For example, in big cities (e.g., Ho Chi Minh, Ha Noi, Da Nang, Hai Phong...) and big provinces (like Binh Duong, Dong Nai, Ba Ria - Vung Tau...) have more industrial parks and manufacturing industries than other cities/provinces in the country, it is not surprising that these cities/provinces is the majority contributor to industrial waste in Vietnam.

3. Medical waste:

Medical waste generation in Vietnam is about 179,000 tons/yr (about 1% of total waste). In 2003, total amount of waste generation from healthcare stations in the whole country is about 300 tons/day, of which 40-50 tons is hazardous medical waste and need to be treated. In 2008, total amount of medical waste produces more than 490 tons/day, in which 60-70 tons/day is hazardous one and need to be treated (MoNRE 2010).

4. E-waste:

E-waste is a popular, informal name for electronic products nearing the end of their "useful life." Computers, televisions, VCRs, stereos, copiers, and fax machines are common electronic products. Many of these products can be reused, refurbished, or recycled (CalRecycle website).

It is worthy of noting that e-waste is currently not mentioned in the Government's documents in Vietnam. For example, according to the Vietnam Government's Decree No. 59/2007/ND-CP, dated on April 9, 2007 on management system in Vietnam, solid waste is divided into three types: municipal solid waste, industrial waste and medical waste.

Due to the rapid integration of the global economy, e-waste becomes one of the rising issue in Vietnam. However, until now, e-waste generation rate in Vietnam is still low because electrical and electronic equipment (EEE) are mostly reused. Further, EEE in Vietnam is mostly discarded by selling to the collectors for dismantlement. There are different collection systems for e-waste in Vietnam operated by collectors, transporters. Big generators usually transfer e-waste to licensed transporter and treatment facilities. Household and small generators who do not register usually transfer waste to unlicensed collectors and transporters (Yen, 2010).

Waste Collection

Waste collection is carried out in each city by Public Urban Environment Company (URENCO, this may have different names in different city or province), which is responsible for street sweeping and collection of municipal waste, and in most cases also industrial and medical waste.

According to national statistics, on average, waste collection rate in urban areas is about 65% (in 2003) and 72% (in 2004), and increases up to 80-82% in 2008 (MoNRE, 2010). There is often a lack of service coverage in temporary housing areas and city outskirts, which are typically occupied by low income people. Self - disposal is common in these areas. Recently, community - based groups and private companies have been encouraged to work with local URENCO in the framework of public - private partnership (PPP), which help fill the gaps in municipal waste collection services (Liem 2007).

Most hazardous medical and industrial waste is mixed with general waste at collection. There is limited available data regarding collection and disposal practices at medical and industrial facilities. The majority of these facilities have contracts with local URENCOs for the collection of their waste. Even if hazardous waste is separated from general medical waste at the hospital wards and industries, it is commonly re-mixed with common waste prior to collection by URENCOs. Medical facilities that operate incinerators treat their hazardous waste on-site, and the treated waste and incinerator ash are later collected with other (VEM2004).

The collection of industrial waste is now received much attention from big companies and industrial parks, but this was not received the concern of small companies. However, in recent years, in line with socialization policy on the collection, transport, and treatment, the collection of industrial waste has been improved fairly well (MoNRE, 2010).

Majority of medical waste generated from healthcare stations under administration of the Ministry of Health (MoH) is collected and transported to centralized areas of disposal for burning by incinerators. Regarding local healthcare stations managed by Provincial Departments of Health (DoH), waste collection, transport and treatment have not been received sufficient attention, particularly separation at source, both normal and hazardous medical wastes (see MoNRE, 2010).

Waste treatment and disposal

According to VEM (2004), forty-nine out of 439 national "environmental hotspots" deemed by MoNRE to pose high environmental and human risks are poorly operated landfills and open dumps. Prime Minister's Decision No. 64 requires these sites to be treated by 2007, but lack of funding. While efforts have been made to improve municipal waste management, information on the treatment of hazardous waste is lacking, and there is an urgent need for better management.

Technology of waste treatment is out of date; treatment facilities are small in size and scattered following administrative boundaries so that their management is not efficiency, low effectiveness in use. Open and controlled dumps are dominant forms of waste disposal in the country with an average one landfill per city (for Hanoi & HCMC, each city has 4-5 landfills/dumping sites). Only 12 out of 61 cities and provincial capitals have engineered or sanitary landfills. Of the 91 landfills across the country, only 17 are sanitary landfills. The development of waste treatment and disposal systems, which includes landfills, is a government priority, but due to the lack of financial resources the government is constructing most sanitary landfills with ODA funding (VEM 2004).

Self-disposal is common in areas with no collection and disposal services. Households that do not have access to collection and disposal services use their own means of waste disposal. This often results in waste being dumped in nearby rivers or lakes, or discarded at sites near homes. Other methods of self-disposal include burning or burying waste. These methods cause serious environmental damage and may risk to human health.

Many landfills and dump sites are posing environmental threats to local populations. Poorly operated landfills and dump sites cause a multitude of environmental problems for surrounding communities, including contamination of ground and surface water by untreated leachate, emissions of airborne pollutants, and the spread of odors, flies, mosquitoes, rodents, dust, and noise (VEM 2004).

Treatment of industrial hazardous waste from industrial zones industrial parks is recently receiving more attention. There are plans for development of centralized facilities in big cities/provinces in Vietnam. For example, the Le Minh Xuan industrial zone in HCMC, industrial zones in Dong Nai province, a treatment complex for industrial waste as part of the Nam Son landfill in Hanoi city. Most industrial hazardous waste from large industries is either treated onsite by simple furnaces or industrial boilers, or by specialized private enterprises, which recycle part of the waste and use locally made and cheap burning technology at low temperature. As a result, the risk of posing further environmental impacts from air emissions and ash is high. For small and minimum enterprises (SME), there are a few options for proper treatment of industrial hazardous waste. The lack of combined treatment facilities has led industries, especially SMEs, to practice a variety of unsafe methods of treatment and disposal, including co-disposal with municipal waste, storage onsite, or sale to recyclers (VEM, 2004).

Incineration capacity for hazardous medical waste has increased but is not being fully utilized. Vietnam has built 43 modern medical waste incinerators since 1997, bringing its total capacity for incineration of hazardous medical wastes up by roughly 50% by 2002. Unfortunately, existing incineration infrastructure is underused, and poorly treated. Most of the international and local investments on incineration have focused on equipment, while hospitals are left to finance the operating costs of incineration from their existing budgets. Since most hospitals do not have sufficient financial resources to operate incinerators, hazardous medical waste is often not properly treated, and is disposed mixed with general medical waste. In contrast, in recent years, some new incineration facilities were built in big cities which helped to increase the treatment rate for medical waste in these cities. For example, the new Cau Dien incinerator in Hanoi, which is centralized and properly operated, helps bring up the rate of hazardous medical waste treatment in the capital from 33% in 2003 to more than 90% in 2004 (VEM, 2004).

Reuse and recycling

Reuse and recycling is a popular practice in many households in Vietnam. People reuse items that would otherwise become wastes, either within the home by giving the items away, or by selling them in second-hand markets and repair shops. Households routinely select recyclable wastes such as metals (iron, copper, lead, aluminum…) and paper (carton, old books…) and sell them to collectors. Other wastes (vegetables, fruits, clothes…) are collected and mostly land filled, some are used for composting. Reusable and recyclable wastes are also being separated by waste pickers, and then sold to the recycling business (Ferguson, 1998).

There is limited information on the amount of waste recycled and reused in Vietnam. However, it is said that about 20% of the municipal waste in Hanoi is recycled. The majority of the recyclable and reusable waste in Vietnam is collected by informal sectors. The trading of recyclable materials generates sufficient income for informal sectors in urban areas. More than 80% of non-hazardous industrial waste from selected industries is recyclable. It is said that industrial waste recycling is widespread in Vietnam but little information on the amount of industrial waste recycling is available (JICA, 2001; VEM, 2004).

Composting and recovery

Composting is a useful form of recycling of organic waste to produce a clean soil conditioner, and could help to increase the recovery rate of recyclable materials. Composting could contribute to a more efficient municipal solid waste system. However, composting is not widespread in Vietnam for a number of reasons such as inadequate attention to the biological process requirements; poor feed stock and poor quality of the fertilizers; and poor marketing experiences.

Composting and recovery of landfill gas can reduce air pollution, helping address global warming. Landfill gas can be collected and used as a fuel for electricity generation or industrial processes. Composting can also reduce landfill gas emissions by removing organic matters that would otherwise degrade under landfill conditions. The reductions in greenhouse gas emissions from these activities are eligible to receive "carbon credits" under the Clean Development Mechanism of the United Nations Framework Convention on Climate Change. These credits can be sold in international markets, resulting in revenues for landfill operators.

Waste management issues in Vietnam

Policy and legislation

The basic legal framework for environmental protection in Vietnam is the Law on Environmental Protection (LEP), which was approved by the National Assembly in December 1993 and validated in January 1994. The LEP was enacted to serve a long-term and sustainable development of the nation and to aim at "preserving a healthy, clean and beautiful environment, improving the environment, ensuring ecological balance, preventing adverse impacts created by man and nature on the environment, exploitation and utilization of natural resources in a rational manner".

Over the past decade, commendable efforts have been made to develop a sound policy and legal framework for environmental protection, particularly management and disposal of waste streams, specifically the Strategy for the management of solid waste in Vietnam cities and industrial parks (1999), the National Strategy for environmental protection (2003), the Government's Decree no. 59 on solid waste management (2007), and the National Strategy for integrated solid waste management until 2025, vision toward 2050 (2009).

The Strategy for the management of solid waste in Vietnamese cities and industrial parks (Decision No. 152/1999/QĐ-TTg dated July 10, 1999). This is the first strategy in Vietnam outlines actions to be taken by local governments until the year 2020 to implement a comprehensive approach to waste management. The strategy focuses on infrastructure development in urban areas and industrial zones. Key features include: legal reform, increased awareness and training, increased privatization and cost recovery, and use of appropriate and modern technologies and their application in Vietnam. The lead agency is MoC and the collaborating agencies include MoNRE, MoSTE, MoPI, MoF, MoI, MoH, and other related ministries.

The National Strategy for environmental protection (Decision No. 256/2003/QĐ-TTg dated December 2, 2003). The strategy addresses overall environmental protection in the country until 2020. The main focus of the strategy is environmental management and capacity building. Key features include promotion of economic approaches to environmental protection, legal and policy reform, promotion of public and civil society involvement, capacity building targeted at local and

national agencies, policy research, and pollution control. The lead agency is MoNRE and the collaborating agencies are MoST, local authorities which polluted units located on.

The Government's Decree no. 59 on solid waste management (Decree No. 59/2007/NĐ-CP dated April 9, 2007). The decree focuses on the regulation on the solid waste management activities, the right and duty of the person related to solid waste management. The decree applies to all Vietnamese organizations, households, individuals and international organizations and individuals that have activities in the territory of Vietnam. The Decree stipulates unequivocally that solid waste must be segregated at source, and that source-separated materials have to be reused and recycled. The Decree requires that no type of domestic solid waste is exempted or excluded from it. The Decree calls for monitoring and implementation on. The lead agency is MoNRE and the collaborating agencies include MoC, and other related ministries.

The National Strategy for solid waste management until 2025, vision toward 2050 (Decision No: 2149/QD-TTg dated December 17, 2009). The Strategy sets the target for the handling of solid waste management; such as municipal waste, industrial waste, medical waste, in the target year of 2015, 2020 and 2025. It is expected by 2050 that all kinds of solid wastes will be collected, reused, recycled and treated completely by advanced technologies which are environmentally friendly, suitable to each locality and limiting the landfilling waste to the minimal level. MoC and MoNRE are in charge for policy making on SWM and/or 3R (Reduce, Reuse, Recycle), and implementation of SWM is in charge for people's committees at the local governments. The supportive and collaborating agencies are MoPI, MoF, MoIT, MoH, MARD and other related ministries. In addition, in order to achieve the target of the Strategy on integrated SWM, action program composed of 10 programs is attached in the Strategy.

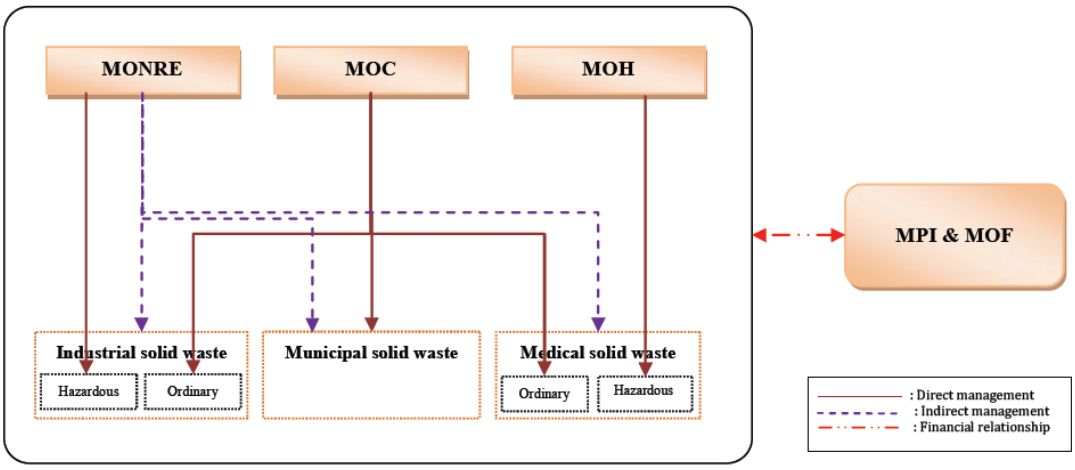
It is generally acknowledged that these targets are very ambitious, and meeting them would require greater investment from the government, the private sector, and international donors.

Institutional framework

At national level, the main ministry responsible for the environment in Vietnam is the Ministry of Natural Resources and Environment (MoNRE).

Regarding municipal solid waste, Ministry of Construction (MoC) is assigned to be the main party in charge of management of municipal solid waste. Line ministries such as Ministry of Planning and Investment (MPI) and Ministry of Finance (MoF) are also directly involved in waste management activities. The structure of relationship among government agencies on solid waste management in Vietnam is prescribed in Figure 1.

- **Figure 1: Institutional Framework on SWM in Vietnam**



Source: JICA, 2010

Below are functions and roles of each government agency.

- Ministry of Natural Resources and Environment (MoNRE): MoNRE is a central agency in charge of environmental management and protection in Vietnam. Its role in waste management is to issue guidelines, regulations, and standards on waste management in coordination with other ministries, compile annual and long-term waste management plans, formulate policies and strategies, plan and allocate budgets for research and development relating to waste treatment projects and appraise and approve environmental impact assessment (EIA).

- Ministry of Health (MoH): MoH involves in medical waste. Its responsibilities in terms of waste management are basically assessing the impacts of solid waste on human health, inspecting and supervising hospital waste treatment activities.

- Ministry of Construction (MoC): MoC is a central ministry with the highest authority in municipal solid waste management and landfill sitting. Its responsibilities and jurisdiction in solid waste management is to formulate policy and legislation, planning and construction of SWM facilities, develop and manage plans for the construction of waste-related infrastructures nationally and provincially.

- Ministry of Planning and Investment (MPI): In term of waste management, MPI in combination with Ministry of Finance (MoF) consider and provide funding and financial sources for other ministries, government agencies, and localities to implement waste management plans based on their annual and long-term waste management plans. In addition, MPI and MoF are also involved in provision of economic incentives to facilitate waste management activities in the country.

- Ministry of Finance (MOF): Regarding waste management, MoF together with MPI, the main task is to allocate budgets for waste management activities. Specifically, MoF focuses more on financial and pricing issues.

At local level, Provincial People Committee (PCC) is responsible for state administration. In terms of waste management, the PCC's responsibilities are:

- To implement state management regulations on environmental protection in its local level. Direct its functional agencies in organizing, coordinating with the functional agencies of the central level in working out annual and long-term plans for waste management, and taking measures to help its local well perform its tasks for environmental hygiene.
- To make approval of waste treatment projects in its local area based on demographic, socioeconomic, and industrial conditions of each locality.
- To mobilize investment capital from various sources for the construction of landfills and work out mechanisms to encourage non-governmental organizations to take part in waste management activities.
- To direct the provincial DoC and/or DoNRE in carrying out waste treatment projects in terms of design, construction, monitoring, EIA, etc., according to the country's environmental and construction standards.
- To direct the provincial URENCO in organizing waste collection, transport, and treatment activities and make approval of waste collection and treatment fees based on recommendations of provincial DoF.

Line provincial departments directly involves in waste management activities are:

- Department of Natural Resources and Environment (DoNRE): DoNRE is an agency, operating under the influences of both parties: PPC in terms of administrative and political relations and MoNRE in terms of collaboration, support, and technical guidance. DoNRE plays an important role in waste management with respect to monitoring environmental quality, managing and implementing waste management policies and regulations issued by MoNRE and PPC, appraising EIAs for waste treatment projects, and coordinating with DoC in considering and choosing candidate landfill sites, all of which are then proposed to PPC for approval of the most appropriate site.
- Department of Construction (DoC): like DoNRE, DoC operates under influences of both PPC and MoC. Its responsibilities in municipal solid waste management and landfill sitting are: supporting PPC in making decisions on waste treatment facility projects, and reporting and proposing appropriate landfill sites to PPC for approval in coordination with DoNRE.
- Urban Environment Company (URENCO): URENCO may have different name in different city or province depending on its role and functions. It is a state-own company that is in charge of solid waste collection, transport, and treatment in the province or city.

Major issues in solid waste management

The main issues in solid waste management in Vietnam include lack of reliable solid waste data, poor enforcement of environmental regulations, weak legal framework, poor coordination among agencies, lack of equipment and capital, lack of public awareness on separation and recycling. These issues will be elaborated below.

- *Lack of reliable solid waste data*

Enterprises are requested to register for hazardous industrial waste generation and submit annual reports regarding types and amount of hazardous industrial waste generation. However, many enterprises do not register officially; some treatment companies do not register as well. Therefore much data of hazardous industrial waste is not gathered to DONRE. In addition, some DONREs are not able to compile the data accurately. Currently, there is no way to get data of non-hazardous industrial waste. Most of the non-hazardous industrial waste is mixed and disposed of with municipal solid waste at landfill in many cities/province. Therefore, it is difficult to clarify a flow of industrial waste treatment (VEm 2004, JICA 2010). This means that solid waste data in Vietnam is low reliable. To enable an effective waste management planning in Vietnam it requires a more reliable solid waste data.

- *Poor enforcement of environmental regulations*

One of the main challenges to solid waste management is the poor enforcement of environmental regulations. In other word, the regulations are not effectively enforced when put in operation. This is often attributed to a lack of resources as well as a lack of institutional capability to implement policy framework. The regulation of waste management operators, industries, and hospitals promulgated by MoNRE and other line agencies and authorities, including MoH, MoI, and Industrial Zone Management Board (IZMB) which are suffered from major gaps in enforcement and insufficient supervision of waste management practices, largely due to limited human resources, unclear mandates, fragmented and overlapping roles of various government agencies, and limited interagency coordination (VEM, 2004; Mitchell, 2004; 2006).

- *Lack of clarity of regulatory responsibilities among government agencies*

In Vietnam, MoNRE, through the provincial DoNREs, is responsible for monitoring, supervision and inspection of environmental pollution from a factory or industrial zone, in collaboration with MoI and the IZMB. It is not clear about the role of each organization in supervision, monitoring and punishment. A vague division of responsibility also exists between MoNRE and MoH for monitoring and inspection of environmental pollution from hospitals. The lack of clarity of roles of the agencies, along with limited interagency coordination, has led to gaps in enforcement and a lack of supervision of waste management practices (VEM, 2004; JICA, 2010).

- *Lack of capacity and human resources for monitoring and regulation*

A lack of human resources and weak capacity of government's agencies (such as MoNRE and DoNRE) leads to an insufficient and ineffective solid waste management. According to VEM (2004), with the limited number of staff for environmental inspections, MoNRE can only inspect just over 0.5% of the nearly 600,000 factories and hospitals in the country. Staffs that are in charge of solid waste management do not have proper knowledge of solid waste management and treatment. This lack of human resources for inspection is compounded by the fact that the inspections do not normally emphasize major waste-related environmental problems, such as open dumping of hazardous waste and poorly operated incinerators or landfills. In addition, in many urban areas, there is no systematic monitoring of solid waste management, such as waste generation, collection, and composition (VEM, 2004; JICA, 2010).

- Lack of capability for hazardous waste treatment

There is a lack of facilities and responsible entities to treat and dispose of many types of hazardous waste. This gap has led factories to dispose of hazardous waste in unsafe ways, either by mixing it with non-hazardous waste, storing it on site, or dumping it indiscriminately. Hospitals undertake the responsibility for separation, collection and storage of hazardous medical waste. However, the task of medical waste management is often shared. For treatment and disposal, they typically either operate their own incinerator or treatment system, or have arrangements with URENCOs for disposal (VEM, 2004).

- Lack of awareness of segregation and recycling

It is often observed that informal sectors are very active in waste reuse and recycle in Vietnam; this provides a good basic for increasing rates of reuse and recycling (VEM 2004, Thao 2010). Several pilot projects and programs on waste separation at source have been introduced and implemented in different cities in Vietnam but results are limited. For example, in HCMC since 1998, many districts have implemented pilot projects and program funded by non-government organizations. In 2004, the city implemented a project on waste separation at source in six districts. However, until the end of 2010, only one implemented waste separation activities, other district had not started yet (Vietbao 2011). Reasons explaining why the project is not successful include lack of money, lack of equipment, and lack of public awareness on waste separation and recycle.

According to JICA (2010), treatment companies (URENCOs), enterprises and households have not taken much care about separating and recycling solid waste. In each province, URENCO is in charge of collection and treatment of municipal solid waste, and covers a broad range of collection of non-hazardous waste. URENCO also partly collects and treats hazardous waste. These wastes should be collected separately, but in many cities some of these wastes are mixed during collection stage. Enterprises have not paid much attention to segregate municipal solid waste, hazardous waste, non-hazardous waste and recyclables.

Therefore, there is a need to promote practices on waste separation and recycle. This can be done through economic and other incentives, especially for private sectors to participate in source separation, recycling operations, and composting facilities (VEM 2004, JICA 2010, Thao 2010).

- Lack of research and development for solid waste management

Research and development (activities for solid waste management are mostly funded by the government through research institutes of related government's agencies such as MoNRE and MoC. The primary focus has been placed on planning and technologies for collection, transportation, and treatment of hazardous waste. However, the research and development implementation is limited due to the lack of practical applicability, financial investment, and government policy support (VEM, 2004). There is also a limitation on collaboration with international research institutes in conducting researches related to solid waste management in Vietnam.

- Civil society plays a limited role in waste management

Civil society in Vietnam, including communities, NGOs, and other associations, plays an important role in solid waste management. In the recent years, some cities and provinces have promoted

community programs focused on waste collection, transportation, and treatment, through which community groups, cooperatives, and private enterprises are in charge of waste collection activities (e.g., see detailed projects on waste separation at source implemented in Vietnamese cities in the next section).

Socialization programs transfer responsibility for waste management to local community groups and are becoming more popular throughout Vietnam. For example, the Hanoi People's Committee authorized a socialization program for waste collection in the city in the 1990s. Local community groups may have responsibility for hiring waste collectors, purchasing collection equipment, collecting fees, and overall management of the collection system. Some models have been adopted in different cities and towns in Vietnam, with varying levels of government funding and community management. It is often observed that one of the main factors contributed to the success of community based model on solid waste management is the participation of members of Vietnam Women's Union (Richardson 2003, VEM 2004, Thuy 2005, Nguyen 2005, Thanh 2008).

According to VEM (2004), community groups and private sectors currently play a limited role in solid waste management systems in Vietnam. Therefore there is a need to strengthen the role of civil society in waste management. The Vietnamese government has developed a number of policies and programs to promote public education, public participation and awareness raising, these programs has helped improve waste collection and other services such as street sweeping.

- *Lack of financing for operations threatens the sustainability of investments*

Investments in waste management have increased rapidly in Vietnam, from VND 195 billion in 1998 to nearly VND 1,100 billion in 2003, and are expected to continue in the next decade. However, the sustainability of these investments is questionable under current conditions, since there is limited spending on operation and maintenance of solid waste collection and disposal systems (0.18% of GNP in 2003). Revenues from solid waste fees cover only 58% of costs for operating and maintaining solid waste management systems. In response, central and local governments have provided large subsidies for solid waste management systems, but the resources are not sufficient. In some cities, improved cost recovery can be achieved through more effective fee collection. In other cities, it may be necessary to increase fees, a measure that has met with resistance in many localities. Improving the financial sustainability for the solid waste management system could also involve private sectors' participation and getting the polluter pay's approach (VEM 2004; JICA 2010).

Practices on 3R in Vietnam

This section reviews a number of practices related to 3Rs (reduce, reuse and recycle) in Vietnam, including waste separation at source, cleaner production, and green consumption.

Waste separation at source in Vietnamese cities

There are a number of pilot programs and project on waste separation at source that have been introduced and implemented in different cities and provinces such as in Hanoi, HCMC, Da Nang city, Quang Nam and Long An provinces. This section summarizes some of these programs.

In Hanoi

There are several programs on waste separation at source in Hanoi. For example, Hanoi URENCO has carried out some experiments on waste separation at source. The first one was done in Kim Lien Ward (Dong Da District) in February 2001 and the second one was in Phan Chu Trinh Ward (Hoan Kiem District) in September 2003. There are some other programs and projects on waste separation at source in Hanoi such as program by Gia Lam Urban Sanitation Enterprise in Gia Lam district, and a pilot project in Trau Quy Ward (Gia Lam District) carried out by Hanoi Agricultural University.

a) Program in Kim Lien Ward

A pilot program of waste separation at households in Kim Lien Ward in 1999 can be considered as the first experiment that URENCO Hanoi carried out on waste segregation at source. Limited information about this program is available because the program only lasted within three months in operation. Reason for this successful program was lacked of financial support and complexity in waste separation (Thuy 2005). For example, in this pilot program, residents were asked to separate waste into four types (plastic, paper, organic and other waste), which was complicated for them to follow. In addition, after collecting separated wastes, Hanoi URENCO had no clear plans or means for treating those types of separated wastes, which discouraged local households to continue separating their wastes.

b) Program in Gia Lam District

Gia Lam Urban Sanitation Enterprise is responsible for an at-source compostable waste separation program in Gia Lam district, Hanoi. This program is carried out in three communities: (i) Sai Dong community (started in June 2001); (ii) Duc Giang community (started in June 2002); and (iii) Yen Vien community (started in April 2003). According to Thuy (2005), proportion of households in participated in the program is not the same among three communities. For example, Sai Dong has highest proportion of households participated in the program with 96.8%, while Duc Giang and Yen Vien have 73.3% and 75.5% of households participated in the waste reparation program, respectively.

Households participated in the program were requested to store compostable and non-compostable waste in red and blue waste bins, respectively. These bins were distributed free of charge by the Gia Lam Urban Sanitation Enterprise from the beginning of the program. Every day, two waste collectors push two hand-carts to collect waste door-to- door, then the collectors take them to waste transfer places for disposal. In early in the evening (at about 7 pm), two compactor trucks take all the waste from the transfer places to the dumping site and the composting plant at Kieu Ky.

The program in Gia Lam district on waste separation at source can be considered successful as many households were willing to participate in the program (more than 73% of households) and the residents were able to separate waste effectively (the purity of the separated compostable waste was about 95% (Thuy 2005).

c) Program in Phan Chu Trinh Ward

In September 2003, Hanoi URENCO started a program of waste separation at households in Phanchutrinh Precint. The project has produced satisfactory results; therefore it was extended in the whole Hoan Kiem District after 2005 (Claudio 2004).

Phan Chu Trinh Precint has 1719 households (about 8000 people). The Ward includes eight residential blocks, six schools, 120 offices and enterprises, two markets, and a park. The Ward generated about 11 tones of waste per day, of which 40% is compostable waste. The quantities of waste collected were largely varied depending on the time of the year, for example, the amount is higher in January when residents consumed more food for celebrating the Lunar New Year holidays (URENCO Hanoi, 2003). URENCO encouraged residents to participate in the program through numerous community meetings and distributed information leaflets. The company also had contracts with the local households as a legal document to indicate that they agree to participate in the project. Every month, households were freely given plastic bags with two different colors, black for non-compostable waste and white for compostable waste.

Waste bags are collected, loaded on waste trucks. Compostable waste is then transported by compactor trucks to the Cau Dien composting plant for composting purpose. Non-compostable waste was carried to the Nam Son landfill site for being buried.

The waste separation program in Phan Chu Trinh Precint can be considered successful since the purity of the separated compostable waste is over 85%. However, the proportion of waste separation between compostable waste and non-compostable one is fairly low (1/4) (URENCO Hanoi, 2003), this means that only 20% of compostable waste was collected in this Ward. As a result, the amount of waste reduced from waste streams going to the landfill through this program is not significant, and the amount of composting products in the output stream is slightly small (Thuy 2005).

d) Pilot project in Trau Quy Ward

The pilot project in Trau Quy Ward was organized by the Hanoi Agricultural University started in 2002. The project was first carried out in three community groups nearby the University in Trau Quy Ward, Gia Lam District, Hanoi. The main purpose of the project is to encourage residents in the Ward to separate organic waste at the household level for composting. The project provided an educational program in these three community groups; posters were distributed and students went to each household to explain the organic waste separation program. Each household in the project site was provided with a waste bin to keep their organic waste. Then, waste collectors picked up the organic waste and transferred to a pilot composting place in Hanoi Agricultural University (Thuy 2005).

e) 3R Initiative Project in Hanoi

In November 2006, Hanoi conducted 3R Initiative Project with funding by JICA organization. The project has been implemented in 4 pilot precincts in Hanoi, including Phan Chu Trinh, Nguyen Du, Thanh Cong and Lang Ha. After 3 years of implementation, 18,000 households at the 4 pilot precincts joined the project. Up to September 2009, the project attracted more than 250 volunteers joined 3R Club, and implemented many propaganda activities in order to raise residents' awareness of 3R, such as 3R cinema, smile check contests, environmental education at schools, ect. The activities aimed at combining the collection workers - residents - compost plant and farmer who use compost. In the pilot precincts, the amount of kitchen waste from households reduced averagely from 31,2 - 45,1%, gained the aim of reducing 30% of amount of inorganic waste which should be dumped in landfill sites. The number of residents who know about 3R and source separation at the pilot wards

is about 85 to 97%. During the project time, 25,000 tons of organic waste was collected and about 10,000 tons of compost was processed at Cau Dien Compost Plant (3R-HN 2009).

In Ho Chi Minh City (HCMC)

There is a number of projects, programs on waste separation at source implemented in HCMC, including Pilot project in Sub-ward no. 3 (Ward 12, district 5); Pilot project in Sub-ward 18 (Ward 3, District 11);

a) Pilot project in Sub-ward no. 3, Ward 12, District 5

This project, known as "sorting waste at source", was started in June 1997 and lasted for two years. This can be considered as the first residential at-source waste separation project in Vietnam. It took place in Sub-ward 3, Ward 12, District 5, HCMC. In the second year, the project expanded to the rest of ward 12 based on experiences obtained from the first year. The partners of the project were Environmental Development Action (ENDA) Vietnam, Environment Committee (ENCO) of HCMC, and the People Committee of Ward 12, District 5. The project aimed to (i) experiment on possibilities of sorting waste at source through verbal and visual communication activities and to (ii) develop awareness and responsibility among households on waste management and the environmental impacts of solid waste separation at source. It provided households waste bins for storing easy-decomposed waste. The project also provided educational programs with activities such as distribution of leaflets; flyers and posters, provision of information on type of waste that can be separated and how to separate them properly. The project only lasted for two years due to the lack of financial support (Thuy 2005).

A survey conducted by Bang et al., (1999) (cited in Thuy 2005) on at-source waste separation in 8 community groups in May 1999 with 7 to 40 households in each community group. The result shows that the proportion of separated easy-decomposed waste was fairly high (86.2% on average). Therefore, if the easy-decomposed waste generated in this area had been composted, the waste stream going to the landfill would have been reduced significantly.

b) Pilot project in Sub-ward 18, Ward 3, District 11

This pilot project began in 2003 and was expected to last for two years. It received financial support from the Asia Foundation and the United States - Asia Environmental Protection (US-AEP) which both cooperate with US-AID. The partners involved in this project are: (i) The Institute of Environment and Resources; (ii) the Water and Environmental Technology Institute; and (iii) the People Committee of district 11. This project focused on encouraging a reduction in waste discharged into the Tan Hoa - Lo Gom channel. The project also aimed to increase awareness of the local residents for environment protection. About 35 households living in the sub-ward were involved in this project. The project consisted of the activities including organization of community workshops to inform residents about the project, distribution of leaflets to residents to show them how to separate waste, and provision of waste bins and a small scale to each household. Residents were asked to separate waste and then measure and record the quantities of compostable and non-compostable waste they generated every day. Results of a survey conducted from May 12th to June 12th 2004 show that the average daily quantities of compostable and non-compostable waste were 1.77 kg/household/day and 0.38 kg/household/day, respectively. Compostable waste, therefore,

makes up 82.4% of the total household waste generated (Institute of Environment and Resources 2003) (cited in Thuy 2005).

c) Pilot project on waste separation at source in 6 districts

In 2004, the People Committee of HCMC decided to implement a pilot project on waste separation at source in 6 districts including District 1, 4, 5, 6, and Cu Chi District. However, until the end of 2010, only District 6 implemented waste separation activities, other district had not started yet (Vietbao 2011).

The pilot project on waste separation at source in District 6 was officially conducted in February 2006. In District 6, 9 out of 14 wards were conducted waste separation at households. The pilot project carried out activities including provision of propaganda about at-source waste separation program; guidelines on waste separation between organic and non-organic waste, allocation of plastic bags and bins for participated households, schools and government units in the project site.

In 2009, District 6 completed the pilot project, according to Mr Tran Van Danh, Director of the Public Service Company of District 6 (the company was in charge of implementing the pilot project), results of the project were under expectation as a large proportion of households was not participated in the project, some waste collectors collected already separated wastes at households but put them in the same place (Vietbao 2011). Result from a primary report conducted after three months of piloting shown that about 45% of households participated in the project and separated waste correctly, the remain of 55% of household was not separated or separated incorrectly (Vietbao 2007). According to a result of a survey conducted in Ward 8, District 6, about 44-75% of households participated in this pilot project (Thanh 2008).

In Hoi An city, Quangnam province

In May 2001, a pilot project on waste separation at source was implemented in Minh An Ward with an expectation of expansion to the whole Hoi An city. The project was conducted by Hoi An Public Construction Company with financial support from the provincial government. The project aimed to investigate the residents' attitude and the feasibility of such a program. The pilot project lasted until the end of 2001. Since the pilot project in Minh An Ward was not successful, thus the intension of expansion the project to the entire of Hoi An city was not implemented (Nguyen 2005).

Results of the pilot project in Minh An ward shows that 70% of total residents in community no. 4 separated their wastes while only about 40% of residents in communities no. 1, 2, and 3 separated their waste at home. This difference was due to leaders in community no. 4 were willing to participated while leaders in communities no. 1, 2, and 3 did not encourage their residents to participate in the project. Main reasons explaining the failure of the pilot project in Minh An ward included inadequate promotion of the project, unclear guidance for using treatment chemicals, lack of facilities for compostable waste collection and transportation, lack of place for waste disposal (both types of waste were dumping at the same Cam Ha landfill), and some weaknesses in management of the project (e.g., lack of penalty for households that did not separated waste) (Nguyen 2005).

In Da Nang city

In 2007, a pilot project of waste separation at source was implemented in Nam Duong Ward, Hai Chau District, Da Nang City. In the project site, each household was received two bins with two different colors for separating compostable and non-compostable waste. After five months of operation, the project has created a good habit for local people in waste separation at home. However, due to lack of facilities in waste collection, transport and disposal for waste separation, the pilot project had to stop in 2007. This pilot project has received positive participation of local residents; the project had also positive impacts on community's awareness and behavior for environment protection (Thiennhien.net 2007; Da Nang URENCO, undated).

In Long An province

In March 2007, under the financial support of European Union (EU), Long An province implemented a pilot project waste separation at source and waste treatment for recovering contaminated environment at Loi Binh Nhon landfill. The project provided plastic bags and two-color bins for separating compastable (organic waste) and non-compostable wastes to households, schools, government units, and service enterprises. The project also conducted survey for evaluating level of pollution at Loi Binh Nhon landfill and collected compostable waste for agricultural purpose (Binh 2007).

Cleaner production

Practices of cleaner production in Vietnam

UNEP defines cleaner production (CP) as "the continuous application of an integrated preventive environmental strategy applied to processes, products, and services in order to increase efficiency and reduce risks to humans and the environment".

Other concepts similar to CP are: waste minimization, pollution prevention, and green productivity.

Being aware of the importance and urgent needs for cleaner production in industry in Vietnam, the Government of Vietnam has supported CP, both politically and financially.

In 1998 the Vietnam National Cleaner Production Centre (VNCPC) was established within the framework of the project VIE/96/063, signed by the Ministry of Education and Training (MoET) and the United Nations Industrial Development Organization (UNIDO). Funding for the centre activities is provided by the Swiss Government through the State Secretariat for Economic Affairs (SECO). The Centre aimed to act as a national focal point for cleaner production, and to play a catalytic and coordinating role in promoting CP in Viet Nam.

In Ho Chi Minh city, with the financial support from Swedish International Development Agency (SIDA) and technical assistance from UNIDO, the City had accessed to CP since 1996 through implementing a project entitled “Minimization of industrial pollution in HCMC". The City's government has directed to develop the industrial and SME production pollution minimization program and the financial mechanism to support the enterprises in broad application of CP via financial funds such as "Industrial pollution minimization fund", which was established in 1999 by the People's Committee of HCMC (Decision no. 5289/QĐ-UB-KT, dated 14/9/1999) with an initial fund of one million USD. In 2001, the People's Committee of HCMC established another financial fund named "Revolving fund" as a part of sub-project on "Industrial pollution control and

institutional capacity strengthening" of the Project on "Environment improvement in HCMC" with a budget of US$ 2.5 million funded by ADB. These two funds are under the management of HCMC Finance and Investment State-owned Company (HFIC).

Since CP is relative new concept in Vietnam, many demonstration programs have been developed and financed. This section reviews some PC demonstration projects with available information.

During 1999 and 2000 the VNCPC conducted a cleaner production demonstration program with the participation of 13 companies. The objectives of the in-plant demonstration program were to show how the concept of cleaner production works in Viet Nam, to get practical results, and to provide opportunities for hands-on training for trainees in a cleaner production training course. The demonstration program has covered the sectors of pulp & paper, textile, food & beverage, and metal processing/finishing. Out of the 13 companies, 9 were state owned, 3 were private and 1 was an equitized company. Result of the demonstration program shown that many company managers were planning to expand the cleaner production activities to other parts of their production. Eleven of companies have agreed to pay fee for the VNCPC follow-up activities in 2001 (Hummelmose 2008).

In HCMC, in combination with UNIDO and SIDA, HCMC - DoSTE conducted a program on demonstration of CP and its benefits in selected industrial sectors. Six companied participated in this demonstration program. The aim of this program was to show that preventative approaches to environmental problems through reducing the consumption of resources, minimizing waste at source, improving management practices and introducing efficient clean technologies can significantly improve environmental and economic performance. According to HCMC- DoSTE, after the program was implemented, the demonstration results shown that the individual demonstration companies and their neighboring areas experienced significant environmental improvement (e.g., up to 66% reduction in wastewater discharges, up to 70% reduction in air emissions, up to 27% reduction in solid waste generation). In addition, a total of 45% of measures implemented across the six demonstration companies had medium to high improvements on environmental performance (HCMC- DoSTE, undated).

Despite the promotion of CP by government, academia and research institutions in the past few years, only a small number of Vietnamese industries have adopted it. For example, in November 2004, HCMC- DoSTE organized a workshop on CP in industry to meet a need of minimization of industrial pollution in the city. Result shown that less than 1 percent in 30.000 enterprises in HCMC applied CP (Laodong, 2004). Reasons explaining why CP implementation has not been widely adopted by industry in Vietnam include poor enforcement of environmental regulations, lack of cooperation between government agencies, lack of awareness, limited CP information, lack of desire from industry managers to implement CP, lack of capital to finance CP projects (UNEP 2002, Mitchell 2006).

CP-related strategies

CP-related national strategies have been prepared in last ten years such as "National Strategy on Environmental Protection", "National Action Plan of Cleaner Production (2001-2005)", and "Cleaner production Strategy in Industry to 2020".

National Environmental Protection Strategy

The National Environmental Protection Strategy (NEPS), covering the period 2001–2010 was developed by the Ministry of Science, Technology and Environment (MoSTE) with the participation of a large group of scientists, government managers working in various fields, as well as contributions of international organizations and funding agencies such as World Bank, UNDP, SIDA, etc. This strategy lacked cross-sectoral support and integration with economic and social policies. As a result, the strategy typically lacked realistic implementation plans.

National Action Plan of Cleaner Production

In December 2000, the MoSTE together with the National Environment Agency (NEA) prepared a draft "National Action Plan of Cleaner Production 2001 – 2005". The VNCPC had been contributing to the elaboration of this action plan. This action plan is a comprehensive and well-prepared document, the implementation of which would certainly advance CP in Vietnam. One weakness of the action plan is that no strategy for the financing of the various proposed actions is elaborated. However, many of the recommendations of the plan have not been implemented and numerous environmental regulations have effectively been ignored (Mitchell 2004).

Cleaner Production Strategy in Industry to 2020

In 2009, the Government of Vietnam issued a Strategy for Cleaner Production in Industry of Vietnam to 2020 (Decision no. 1419/QD-TTg, dated on 07th September 2009).

The target of the strategy to 2020 is to make 90% of industrial production facilities aware of the benefits that CP in industry brings in. It is projected that by 2020, 50% of industrial production facilities will apply CP methods and reduce energy and material consumption by 8-13%. 9% of medium and large-sized companies are expected to have specialized departments in charge of cleaner production. 90% of Industry and Trade Departments are expected to have cleaner production-specialized officials who are capable to provide instructions in this field. The strategy is based on the approach of disseminating the CP concept to 63 provinces and cities nationwide via communications and media mass, technical assistance, CP networking and financing mechanism which are to promote the industrial production facilities to participate in CP application (CP Strategy for Vietnam 2009).

From August 2010 to February 2011, the Cleaner Production in Industry Component has undertaken a national baseline survey of CP implementation against the objectives of the Strategy on Cleaner Production in Industry. The survey was taken place at 63 Departments of Industry and Trade (DOITs) and 9012 industrial production units of Vietnam. Results show that 2.509 enterprises were aware of CP, equivalent to 28% of industrial production units across the country. Level of awareness varies from being propagandized about CP and not fully aware of the double benefits of CP economically and environmentally, to applying CP and meeting the Strategy's objective. CP has been applied at 1.031 enterprises, equivalent to 11% of industrial production units nationwide. Among those, 309 enterprises get the reduction of 5-8% of fuel and material consumption, equivalent to 3% of the surveyed enterprises. To the time surveyed, 12 DoITs were capable of providing guidance and advice on CP application, 50 DoITs had staff that capably disseminate and give training on CP; and 1 DoIT was unable to identify the CP capability (CPI 2011).

CP in industry has brought back encouraging results with over 300 enterprises to apply CP, waste audits, thousands of officials and consultants of cleaner production have been training. Up to now, Vietnam has around 1,300 enterprises in 63 provinces and cities in the whole country apply CP solution (Industrial Review 2011).

Green consumption

The term “green consumption” covers a full range of activities in both production and consumption fields, including green products, the recycling of materials, the efficient use of energy, the protection of the environment, and the preservation of species (China.org.cn).

In Vietnam, several activities have been done to promote green consumption (GC) by authorities, newspapers, business community such as launching GC campaigns, rewarding green awards to enterprises.

In HCMC, in 2010, the Sai Gon Giai Phong Newspaper and the supermarket chain Saigon Co-op, and supported by the HCMC's DoIT and DoNRE organized GC campaign project. The project aims to promote the consumption of green products and products of green businesses among Vietnamese consumers, and especially among customers of the supermarket outlets throughout Vietnam. The project was first started in Ho Chi Minh City, but later it was spread out to Hanoi and other large cities in Vietnam (Green Consumption Campaign Project).

The first GC campaign was launched in mid 2010 with the theme "Use green product to protect your health" which received great response from business community. Saigon Co-op integrated activities of green consumer product week into its biggest sale promotion month of the year in 46 supermarkets and 12 Co-op food stores nationwide. Other production companies, shopping centers, and supper markets (such as Kim Nhat Packing Company, Sai Gon Paper Company, An Phong Investment Company, Big C, MaxiMark supermarket system, Parkson Shopping Center, Lotte Shopping Center) also actively engaged in the environmentally-friendly bag use month campaign. The campaign even expanded to traditional markets such as Tan Dinh market, Ben Thanh, Ba Chieu and Hoa Hung with an increasing number of green product consumers in these markets (VEN 2011).

The second GC campaign, launched in 2011, is aim to change the habit of consumers towards more environmentally-friendly direction and implement green consumer stimulus through supermarkets and shopping centers. Numerous communication promotion activities about green consumer products are implemented such as talk shows on green consumer, music performance, flyers about green products distributed in universities, high schools, residential areas, offices, buildings and supper markets. The organizers also hold many other activities including a contest for students named “Future Green Customers among university students”, “Children and Environment week”, “Vietnamese goods ambassadors with green consumption” and “Riding bicycles for the campaign”. In addition, in the campaign’s framework, Saigon Co.op carried out a promotion program with the offer of bags for multi-time use, coupons for green products and discounts on vegetables and free family’s meal vouchers (VEN 2011, QDNDNews 2011).

The "Green Enterprise Awards" program, launched in November 2006, is an initiative of HCMC's People Committee and is being co-organized by the Sai Gon Giai Phong Newspaper, DoNRE in collaboration with other agencies of HCMC. The program is to encourage industrial companies to

care for the environment and honor enterprises observing the law on environmental protection. The Awards are yearly given to selected companies. Criteria of the Awards focus on waste treatment standard, raising public awareness about environmental issues, research on advanced technology application, and successful recycle waste products (SGGPNews 2006; 2007; 2010).

Continuing the activities carried in the first year of the project, several additional tasks and activities were carried out by the Hue College of Economics (HCE) research team and Dr. Tran Van Giai Phong.

1) Conduction of secondary data collection
2) Review of literature
3) Organize consultation workshop
4) Organize focus group discussions (FDGs)
5) Conduct key informant interviews (KIIs)
6) Writing reports

Below we elaborate the activities in details.

1) Conduction of secondary data collection

During this phase, documentary research method and secondary data collection were used to gather secondary data and published information related to the study. Secondary data, information literature, and previous studies used for this step were gathered from national and local authorities, academic and research institutes, related projects and websites. We have bought the GIS database of the waste collection location and updated the statistical record of the solid waste management of the city.

2) Review of literature

During this study, a senior researcher was hired to conduct the following activities:

- Review the literature and programs related to waste generation, collection and disposing in Vietnam.
- Review municipal solid waste management systems in Vietnam and in Hue.
- Review of 3Rs practices in Vietnamese cities.
- Develop the analytical framework for the case study in Hue city.

3) Organization of consultation workshop

On the 10th June 2013, we organized the consultation workshop at the HCE campus. The consultation workshop's participants are policy makers coming from government offices, representatives from local management offices, experts working in the related fields; representatives from different sources of waste generations, etc. in order to gather opinions and ideas about locally green based practices in Hue city. Table 1 reports the consultation workshop program.

Table 1. Consultation workshop program, at HCE campus

Time	Activities	People in charge
8h00-8h30	Registration	Ms. Bao Chau, Mr Minh Tri Part-time researchers, HCE
8h30-9h00	Opening speech	Dr. Nguyen Van Phat, Rector, HCE

9h00-9h30	Introduction of the project	Dr. Phong Tran Project manager, HCE
9h30-10h00	Urban waste management in Vietnam	Dr. Tran Huu Tuan Researcher, HCE
10h00-10h30	Tea-break	All
10h30-11h00	Waste management in Hue city	Le Vinh Thang, HEPCO
11h00-11h30	Environmental issues in Hue city	Nguyen Manh Dai Lan, DONRE
11h30-12h00	Solid waste management system in Hue city	Tran Thi Hanh, Hue city
12h00-14h00	Lunch	All
14h00-15h30	Discussion on methodology	Dr. Bui Duc Tinh
15h30-16h00	Break	
16h00-17h00	Group presentation	Dr. Tran Huu Tuan
17h00-17h30	Closing speech	Dr. Phong Tran

There are 25 participants participated the consultation workshop, name of participants and their organizations are reported in Appended 1.

The following information was shared and discussed during the consultation workshop:

- Update the status of urban solid waste management system in Vietnam and in Hue city.
- Review of the generation, collection, transportation and disposing of waste in Vietnam and in Hue city.
- Review of practices related to 3Rs in Vietnamese cities.
- Sharing opinions about issues of waste generation, reuse, recycle and disposing: advantages, difficulties and barriers that government agencies, companies, schools, hospitals, and households have in waste generation, reuse, recycle and disposing.
- Suggestions and recommendations on how to improve the management system in Hue city.

4) Focus Group Discussion (FGD)

We organized one FGD on 25 June 2013 with participants are representatives from different stakeholders to participate. The purpose of the FGD is to gather in details the information of waste collection, transport and disposing in Hue city. Participants of this FGD are reported in Appended 2.

Table 2. Focus Group Discussion program, at HCE campus

Time	Activities	People in charge
8h00-8h30	Registration	Dr. Bui Duc Tinh, researcher, HCE
8h30-9h00	Introduction the purpose of the FGD	Dr. Tran Phong, Project manager, HCE
9h00-10h30	3 groups divided to discuss on three separated topics	Facilitated by Dr. Tuan, Dr. Phong and Dr. Tinh
10h30-11h00	Tea-break	All
11h00-11h50	Present from each group	Dr. Tinh
11h50-12h00	Concluding remark	Dr. Phong

5) Key Informant interviews (KIIs)

There are 45 key informants were invited for interviews coming from provincial and city authorities, experts working in the area of solid waste collection, transportation and disposing. Key informants from different sources of waste generation including households, commercial and office establishments, industrial park, hospitals, construction works… are also invited for interviews. Conducting Key Informant interviews by face to face techniques allows collecting qualitative information related to four stages including (1) generation of waste, (2) reuse of waste, (3) recycling of waste, and (4) disposing of waste. Taking notes and tape-recorders were used to capture information.

In addition, we conduct eighteen (18) in-depth interviews with households who have green based practices such as households have models for composting bio-fertilizers from biodegradable waste, households who doing works related to reduce, reuse and recycle of waste such as street pickers, scavengers, junk buyers, scrap purchasing establishments...

6) Organize technical meeting

During the visit of Dr. Akhilesh Surjan (UNU) to Hue, we organized the technical meeting on the 7th December, 2013 at HCE campus. The program, participants and activities of the meeting is shown in Table 3.

Table 3: Technical meeting program

Time	Activities	People in charge
8h00-8h30	Registration	Dr. Bui Duc Tinh, researcher, HCE
8h30-9h00	Opening speech and Introduction of the project	Dr. Tran Phong, Project manager, HCE
9h00-10h30	Present key findings of the research project	Dr. Tran Huu Tuan, Researcher, HCE
10h30-11h00	Tea-break	All
11h00-12h00	Questions and answers	All
12h00-14h00	Lunch	All
14h00-17h00	Technical team meeting with Dr. Surjan	Dr. Akhilesh Surjan, Dr. Phong Tran, Dr. Tinh Bui, and Dr. Tran Huu Tuan

The participants of the technical meeting are reported in Appendix 3.

6) Organize thematic meetings

During 8th – 10th December, 2013, we were also organizing three thematic meetings as reported in Table 4.

Table 4: Thematic meetings

No.	Meetings	Location	Date
1	Meeting with the Management Board of Department of Natural Resources and Environment	Hue city	8/12/13

2	Meeting with the Management Board of Hue Environment Company	Hue city	9/12/13
3	Meeting with the leaders of Hue College of Economics (HCE)	HCE campus	10/12/13

The objectives of these thematic meetings are:

- The objective of the first meeting (Meeting with the Management Board of Department of Natural Resources and Environment) is to share the findings and to explore the potential events to share the key findings with other departments through DONRE channel.

- The objective of the second meeting (Meeting with the Management Board of Hue Environment Company) is to explore the solid waste management structure and share the experiences of solid waste management from Japan by Dr. Surjan.

- The objective of the third meeting (meeting with leaders of HCE) is to investigate the possibility for future research collaboration

Participants of these meetings are reported in Appendix 4.

8) Organize field visits

In addition to the thematic meetings mentioned above, we also organized a number of field visits as reported in Table 5.

Table 5: Field visits

No.	Field visits	Location	Date
1	Field visit Phu Hau solid waste collection site	Phu Hau ward	8/12/13
2	Field visit to informal solid waste collection site in Thuy Phuong	Huong Thuy town	9/12/13

The purpose of these field visits is to help researchers to understand the practical solid waste management system.

9) Writing report

Based on data and information collected, HCE team wrote up Research report for submission to UNU. See attached file.

APPENDED 1. PARTICIPANTS OF THE CONSULTATION WORKSHOP

No.	Name of participants	Name of organizations
1	Phong Tran	Hue College of Economics
2	Tran Huu Tuan	Hue College of Economics
3	Bui Duc Tinh	Hue College of Economics
4	Nguyen Manh Dai Lan,	Department of Natural Resource & Environment
5	Le Vinh Thang	Hue Urban Environmental & Public Works Company
6	Nguyen Quang Phuc	Department of Agriculture and rural development
7	Tran My Minh Thanh	Thuan Hoa primary school
8	Nguyen Thanh Hai	Hue Hospital University of medicine
9	Ho Thi Bich Ngoc	Hue Central hospital
10	Nguyen Huu Tuyen	Department of Environment protection

11	Duong Thi Tuyen	Department of Planning and investment
12	Tran Huynh Bao Chau	Faculty of Economics & development studies, HCE
13	Mai Chiem Tuyen	Faculty of Economics & development studies, HCE
14	Tran Quang Khai	Slaughter house
15	Ton Nu Hai Au	Scrap purchasing business
16	Le Anh Quy	Tan Long Phu repair workshop
17	Tran Minh Tri	House trading company
18	Tran Quy Cap	TTH Women association
19	Phan Thi Nu	Youth union of TTH
20	Ho Tu linh	Youth union of TTH
21	Nguyen Duc Kien	Nordic assistance for Vietnam
22	Bui Dung The	Hue Urban environment & public work company
23	Bui Duy Minh	College of Agriculture & Forestry
24	Tran Dai Thang	Dong Ba market
25	Chau Thai Dung	Phu Xuan Bookstore

Appended 2. Name and organization of participants

No.	Name of participants	Name of organizations
1	Hoang Van Duc	Hue Environmental and Public Work Company
2	Nguyen Thien	Truck Transportation team, HEPCO
3	Phan Van Xung	Street sweeping team, HEPCO
4	Pham Van Sau	Management board of Dong ba market
5	Truong Thi Thuy	Bookstore of Phu Xuan
6	Tran Thi Lanh	Big C supermarket
7	Tran Van Gioi	Coop mark supermarket
8	Nguyen Bich	Truck Transportation team, HEPCO
9	Le Van Dung	Lac Viet bookstore
10	Nguyen Ngoc Truong	Scrap purchasing house
11	Nguyen Thi Cam	Big C supermarket
12	Le Anh Tu	Bookstore of Phu Xuan
13	Nguyen Thanh Kien	Tan Long Phu repairing workshop
14	Le Thi Mai	People committee of Tay Loc ward
15	Tran Nguyen Thu Ha	People committee of Thuan Loc ward

Appendix 3: Participants of technical meeting

No.	Name of participants	Name of organizations
1	Tran Huu Tuan	Part-time researcher, Hue College of Economics (HCE)
2	Bui Duc Tinh	Part-time researcher, HCE
3	Nguyen Trung	Faculty member, HCE
4	Le Van An	Faculty member, HCE
5	Tran Van Hoa	Vice-Rector, HCE
6	Mai Van Xuan	Dean, Faculty of Economics & development study, HCE
7	Tran Phong	Project Investigator, HCE
8	Nguyen Quoc Tuan	Thuan Loc Ward
9	Tran Thi Tham	Dong Ba market manager
10	Tran Quoc Tuan	Provincial Department of Science & technology
11	Tran Trung Kien	Representative of Thuy Xuan ward
12	Nguyen Thanh	Member of People committee, Tay Loc ward

13	Tran Van Khanh	Hue Urban Environment & Public work Company
14	Hoang Ngoc Hung	Member of Dept. of Natural resource & Environment
15	Phan Duy Uyen	TTH House Trading company
16	Phan Minh	Hospital of Hue University of Medicine
17	Hoang Thi Hong	Thuan Hoa Healthcare station
18	Le Kim Tuyen	Provincial Department of Health
19	Phan Ngoc	Faculty of Business, HCE
20	Hoang Thi Loi	Faculty of Economics, HCE

Appendix 4: Participants of thematic meetings

No.	Name of participants	Name of organizations
1. Meeting with the Management Board of Department of Natural Resources and Environment		
1	Tran Huu Tuan	Part-time researcher, Hue College of Economics (HCE)
2	Bui Duc Tinh	Part-time researcher, HCE
3	Phong Tran	Project leader, HCE
4	Akhilesh Surjan	UNU
5	Pham Thi Lanh	Staff, Department of Environment protection, DoNRE
6	Tran Binh Minh	Director, DoNRE
7	Nguyn Van Nam	Head, Department of Development Economics, DoNRE
8	Tran Tien	Office of Environment management, DoNRE
9	Hoang Quan	Staff, DoNRE
10	Duong Yen Ngoc	Staff, Department of Environment protection, DoNRE
2. Meeting with Management Board of Hue Environment Company		
1	Tran Huu Tuan	Part-time researcher, Hue College of Economics (HCE)
2	Phong Tran	Researcher, HCE
3	Akhilesh Surjan	UNU
4	Bui Duc Tinh	Part-time researcher, HCE
5	Pham Van Mach	Director of HEPCO
6	Hoang thi Thuy	Head of labor union, HEPCO
7	Hoang Van Nam	Head of technology office, HEPCO
8	Pham Thi Liet	Head of administrative office, HEPCO
9	Nguyen Ngoc Dung	Staff of management board, TSNCP
3. Meeting with the leaders of HCE		
1	Tran Huu Tuan	Part-time researcher, Hue College of Economics (HCE)
2	Bui Duc Tinh	Part-time researcher, HCE
3	Phong Tran	Project leader, HCE
4	Akhilesh Surjan	UNU
5	Tran Van Hoa	Vice-Rector, HCE
6	Mai Van Xuan	Dean, Faculty of Economics & development study, HCE

References

- Bang, AT. et.al. (1999). Pilot project on waste separation at source. Unpublished report of the second year of the project, ENDA Vietnam. June 1999.
- Binh, Thanh (2007). Long An thí điểm "Dự án phân loại rác tại nguồn" (Long An's pilot project on waste separation at source). Paper available at: http://www.monre.gov.vn/v35/default.aspx?tabid=428&cateID=24&id=24168&code=B67MN24168 (accessed August 17, 2011).

- Claudio, Corazon PB. (2004). Waste Separation at Source in Hanoi City. Paper available at http://3rkh.net/3rkh/?q=node/841
- Cleaner Production Component (CPI, 2011). National CP Implementation Review. Sponsored by CPI of Vietnam Denmark Development Cooperation in Environment Program. Paper available at: http://www.sxsh.vn/en-US/Home/Environment-5/2011/National-CP-Implementation-Review-880.aspx (accessed August 20, 2011).
- CP Strategy for Vietnam (2009). Strategy for Cleaner Production in Industry of Vietnam to 2020. the strategy was developed by the Ministry of Industry and Trade and endorsed by the Prime Minister at the Decision no. 1419/QD-TTg, dated 07th September 2009.
- Ferguson, C. (1998). The Household Reuse Economy in Hanoi, Vietnam: A Conceptual Model. University of Toronto.
- GSO (2011). General Statistics Organization
- HCMC- DoSTE (1999). Reduction of industrial pollution in Ho Chi Minh city: Cleaner production case studies food procesing, pulp & paper and textile processing sectors. Project TF/VIE/97/001. HCMC - DoSTE, Ho Chi Minh City, September 1999.
- HCMC- DoSTE, (undated). Reduction of Industrial Pollution in Ho Chi Minh City (HCMC Cleaner Production Project). Paper available at http://kitakyushu.iges.or.jp/docs/network_meetings/kin1/Presentations/Session%20I/Ho%20Chi%20Minh.doc (accessed July 7, 2011).
- HWS Report (undated), Healthcare Waste Status (HWS) Report Vietnam, Paper available at: http://www.3rkh.net/3rkh/files/16_3RKH_TWGSHW1_SR_Vietnam.pdf. (accessed August 7, 2011).
- Hummelmose, B. (2008). Promising CP demonstration projects in Vietnam. Paper available at http://sdsap.org/data/cp-vietnam.pdf (accessed July 10, 2011).
- Institute of Environment and Resources (2003). Promote the recovery water quality of Tan Hoa – Lo Gom channel in Hochiminh City. Memorandum. March 2003.
- Industrial review (2011). Building a green production and sustainable consumption. Industrial review of Vietnam. June 23, 2011. Paper available at: http://www.tapchicongnghiep.vn/News/channel/1/News/145/15450/Chitiet.html (accessed July 12, 2011).
- JICA (2001) The Study on Sanitation Improvement Plan for Haiphong City in the Socialist Republic of Vietnam.
- JICA 2010. The Study on Urban Environmental Management in Vietnam. Study Report on Solid Waste Management in Vietnam December 2010. Volume 06
- Liem, PS. (2007). Handling of solid waste in Vietnam. Paper presented at the 4th Civil Engineering Conference in the Asian Region held by the Asian Civil Engineering Coordinating Council (ACECC) in Taipei 26-28 June, 2007.
- Mitchell, Carrie L. (2006). Beyond barriers: examining root causes behind commonly cited Cleaner Production barriers in Vietnam, Journal of Cleaner Production, Volume 14, Issue 18, 2006, Pages 1576-1585
- MoNRE (2010), National report on Environment in Vietnam, 2010 (Bao cao Moi truong Quoc gia nam 2010). Ministry of Natural Resources and Environment (MONRE). Hanoi 2010.
- Nguyen, TTT. (2005). Audit and Separation of Compostable Solid Wastes at Households in Danang, Vietnam. University of Toronto. pp.103
- QDNDNews (2011). HCMC launches a green consumption month. June 8, 2011. Paper available at http://www.qdnd.vn/qdndsite/en-us/75/72/182/156/189/147900/Default.aspx (accessed July 20, 2011).
- Richardson, D. (2003). Community-Based Solid Waste Management Systems in Hanoi, Vietnam. University of Toronto. 103 pp

- SGGPNews (2006). Green Enterprise Award" Program Starts. Sai Gon Giai Phong Newspapers, November 01, 2006. Available at http://www.saigon-gpdaily.com.vn/National/2006/11/52441/ (accessed August 7, 2011).
- SGGPNews (2007). Green Enterprise Awards Wrap up. Sai Gon Giai Phong Newspapers, Febuary 01, 2007. Paper available at http://www.sggpnews.org.vn/Hochiminhcity/2007/2/54477/ (accessed July 5, 2011).
- SGGPNews (2010). City launches Green Consumption Campaign, Sai Gon Giai Phong Newspaper (SGGP), September 12, 2010. Available at http://www.saigon-gpdaily.com.vn/Hochiminhcity/2010/9/85517/ (accessed August 17, 2011).
- Thanh, T. (2008). Thực hiện thí điểm phân loại rác từ nguồn ở Tp HCM: Bỏ 5 tỉ đồng để biết thế nào là phân loại rác (Piloting waste separation at source in HCMC: Spent 5 billion VND just to know how to separate). Published on Nguoi Lao dong newspaper, April 2008, available at http://nld.com.vn/220106p1002c1207/bo-5-ti-dong-de-biet-the-nao-la-phan-loai-rac.htm (accessed 25 July 2011)
- Thao Nguyen (2010). Solid Waste Management in Vietnam. An Industrial Ecology Study. School of International and Public Affairs, Columbia University. July 2010.
- Thiennhien.net (2007). Phân loại rác tại nguồn – Thành công bước đầu tại Đà Nẵng (waste separation at source - a preliminary success in Danang city). July 2007. available at http://www.thiennhien.net/2007/06/16/phan-loai-rac-tai-nguon-thanh-cong-buoc-dau-tai-da-nang/ (accessed August 10, 2011).
- 3R-HN (2009). Final seminar of 3R-HN project and impressive figures. 3R initiative project in Hanoi. Paper available at http://3r-hn.vn/?option=mod_news&sel=detail&cid=10&view=198&id_lang=2 (accessed on July 24, 2011).
- UNEP (2002). Cleaner Production assessment in industries. United Nations Environment Programme (UNDP). Available online at: http://www.uneptie.org/pc//cp/understanding_cp/cp_industries.htm; 2002. (accessed August 5, 2011).
- URENCO Hanoi (2003). The content of conducting pilot project of waste separation at households in Phanchutrinh ward. So Giao Thong cong chinh Ha Noi- URENCO
- URENCO Da Nang (undated). Chương trình phân loại rác tại nguồn (Program on waste separation at source). Da Nang Urban Environment Company (URECO). Paper available at http://www.moitruongdothidanang.com.vn/duan.aspx?act=view&id=1 (accessed August 10, 2011).
- VEM (2004). Vietnam Environment Monitor 2004. World Bank, MoNRE and CIDA. Vietbao (2011). Phân loại rác tại nguồn ở TP.HCM: 7 năm "giẫm chân tại chỗ (Waste separation at source in HCMC: 7 years with out progress). Paper available at http://vietbao.vn/Xa-hoi/Phan-loai-rac-tai-nguon-o-TPHCM-7-nam-giam-chan-tai-cho/1735239189/125/ (accessed August 1, 2011).
- Vietbao (2007). Nguoi dan TP HCM hoc cach phan loai rac (residents of HCMC learn how to separate waste). June 2007. Paper available at http://vietbao.vn/Xa-hoi/Nguoi-dan-TP-HCM-hoc-cach-phan-loai-rac/11011871/157/ (accessed July 25, 2011)
- Yen, NT. (2010), Introduction on E-waste management in Vietnam. Paper available at http://gec.jp/gec/jp/Activities/ietc/fy2010/e-waste/ew_1-10.pdf (accessed July 5, 2011).
- VEN (2011). Promoting Green Consumption, Vietnam Economic News (VEN), May 2011, available at http://ven.vn/promoting-green-consumption_t77c233n21566tn.aspx (accessed August 25, 2011).

JAPAN

The project team documented examples of Best Practices of SMCS from various places in Japan. The team explored various aspects of SMCS, by developing an understanding of traditional Japanese

practices of 3R like the Mottainai and the policy and legal framework which supports the establishment of a Sound Material Cycle Society. The team gained an insight into the flourishing second hand markets and recycle shops and examples like the Shibuya Umbrella Campaign wherein dumped umbrellas are collected and then lent to people, and the Shinjuku Eco-Jiman Project in which customers receive points and benefit if they exhibit eco-friendly behavior when they shop. The Biomass Nippon Strategy was explored in detail. In a Biomass Town, there is a wise and practical use of biomass, and effective conversion of biomass into energy. In the Yokohama city G30 campaign, by simply segregating and recycling, the amount of waste was reduced by almost half. Atsugi city, which can be considered a model city for SMCS, conducted activities like Kitchen Recycle Project, Rooftop farm project etc.

Another interesting example is the Eco-life promotion project which provides points to people who cooperate in efforts such as reduction of plastic grocery bags, bringing their own chopsticks, promotion of simple packaging, sale by measure and bringing their own bags. There was also an attempt at understanding the 3R efforts in the Tokyo Metropolitan Government office, and the activities in the 23 wards of Tokyo municipalities. Interesting examples like making biodiesel fuel from waste cooking oil in Higashi Kurume city, introducing reusable cups in offices, reducing packaging by purchasing refills and a system of rewards for encouraging 3R activities were also noted. Some of these cases have been mentioned in the appendix in detail.

Furthermore, through extensive literature review, the team developed a detailed understanding of how the Sound Material Cycle Society is linked with 3R, Resource Circulating Society and above all a Sustainable society. Various facets of the Fundamental Law for Establishing a Sound Material Cycle Society were explored, along with gaining clarity on definitions and concepts like Material Flow analysis, locally based green practices, SMCS and similar concepts like Life Cycle Management (UNEP), Circular Economy in China, Sustainable waste management in U.K, sustainable consumption and production (EU), Integrated Solid Waste Management. A concept note developed on Sound Material Cycle Society is attached to the appendix. The project team explored ways by which SMCS can be established in Asian Cities and at the national and regional scale, along with the possible challenges.

6. Self evaluation of work performed to date:

<Be as detailed and frank as possible and include, too, project targets not met and reasons why>

In the second year of the project, research team actively build on the progress made during the first year of the project. Research team was able to document case studies that illustrate the formation of a Sound Material Cycle Society in case countries. In addition, a clear understanding of all relevant concepts and terminologies associated with SMCS was established, and ways in which SMCS can be established at the regional level were explored.

At the conclusion of the first year, it was decided that the study shall focus on the methods of segregating and regulating the waste disposal and the prevalent reuse and recycle practices along with possible practices that would help in reducing the waste. In doing so it was discussed that contribution of formal as well as informal processes shall be documented.

In India, first task taken was to understand community's existing consumption and recycling practices and social struggle to keep pace with the rapid economic growth in India. This task was accomplished by documenting the existing consumption and recycling practices in India, observations and data were primarily from the secondary sources. While the first stage talks about the waste at household level, the second stage is about waste generated from commercial and office establishments. The observations here are based on both primary and secondary sources which

include the existing literature on Waste Management practices in India, government reports and other data bases.

For understanding the existing waste management practices at commercial and office establishments' primary survey was conducted among selected commercial and office centres within the city. This was aimed at understanding the contextual issues for the selected case study city of Bhopal. The perceptions on the issues and concerns regarding 3R's (Reduce, Reuse, Recycle) have been investigated in particular. An attempt has also been made to explore the perceptions among various stakeholders about the issues related to 3R's.

A review of the 3R practices at various levels has also been investigated. This detailed review through various surveys was carried out and the existing practices that are prevailing were documented. In order to understand the community's existing consumption and recycling practices a preliminary survey was conducted. Each of the modes of recycling associated with commercial and office establishments was documented here and an attempt was made to explore all the modes through which various stakeholders are involved in the waste recycling.

In Vietnam, most of the project objectives have been met- including documentation of existing green practices, as well as collection of background information about waste management in country, province and city level. A number of key informant surveys, stakeholder discussion and group discussion helped to further deepen our understanding on community and government centric perspectives on 3R and material flows.

In Indonesia, an attempt has been made to collect secondary data on economic production and consumption at the city level, however, data was available only till 2008. With regard to data on the general overview of Yogyakarta's waste management, it has been difficult to find data. It was also found that there are no specific urban policies that talk about material flow. Indonesian project counterpart has received a large research project therefore will not be continuing in the project. Tehrefore, another potential collaborator has been roped in from Bandung-city. During the final year of the project, research will build on progress made in first two years and detailed case-study will focus on Bandung-city.

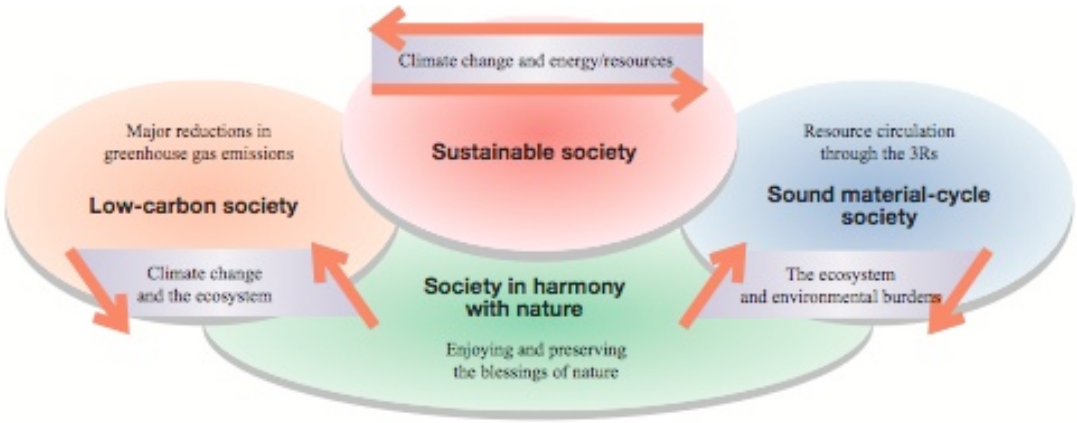
7. Appendix

APPENDIX 1 : Sound Material Cycle Society – A Concept Note

Introduction: "Overconsumption and inefficient production systems in the last decades have caused pollution, environmental degradation and the depletion of scarce resources in both developed and developing countries." (Tohru Morioka 1). Within this context, world leaders converged at the United Nations Conference on Environment and Development, also known as the Rio Summit, to address issues related to production patterns, renewable energy, water scarcity, and climate change (Okazawa 125). One product of this conference was the notion of a "sustainable society." According to Kazuyoshi Okazawa, a sustainable society "can be generally defined as a society where the following objectives are achieved: poverty eradication, sustainable consumption and production, protection of natural resources, protection of the environment, economic and social development, and protection and promotion of human health (125).

In Japan, the movement towards achieving a sustainable society has consisted of three different efforts: the creation of a sound-material cycle society (SMCS), a low-carbon society, and a society in harmony with nature. This approach is graphically depicted in figure 1.

FIGURE 1

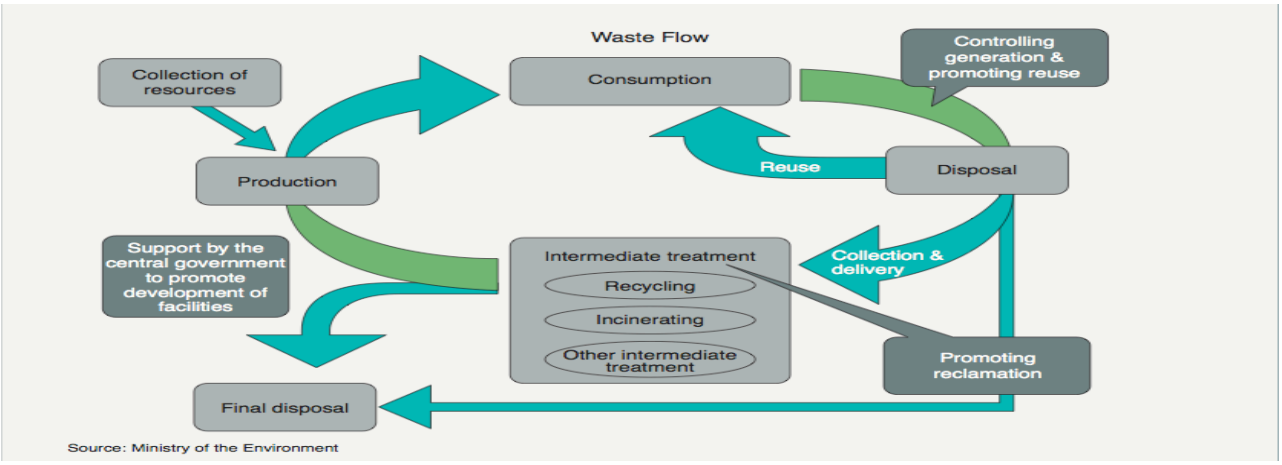


As Vice-Minister of the Environment Masayoshi Namiki relates, Japan was faced with severe waste issues: improper waste management by open incineration, illegal waste dumping and improper storage of PCB (polychlorinated biphenyls) waste etc. (4). The conception of a Sound Material-Cycle Society was a product of the need for a proper waste management plan.

This essay will focus specifically on the creation of a Sound Material-Cycle Society, as it is understood in Japan. First, the concepts and definitions involved in a SMCS will be laid out. Then an explanation will be given regarding how the framework for a SMCS is established. Next, the role locally-based green efforts play in the functioning of a SMCS will be discussed. Lastly, SMCS is compared against similar international efforts to assess the strengths and weaknesses of SMCS. In this manner, the concept of a Sound Material-Cycle Society will be solidified, as well as its role in a sustainable society.

Definitions and Concepts: As defined by the "Fundamental Law for Establishing a Sound Material-Cycle Society", a SMCS is "a society where the consumption of natural resources is minimized and the environmental load is reduced as much as possible, by restraining products, etc. from becoming wastes, etc., promoting appropriate recycling of products, etc. when they have become recyclable resources, and securing appropriate disposal of the recyclable resources not recycled, which means the disposal as wastes as defined in the Article 2, paragraph 1, of the Waste Management and Public Cleansing Law (1). An illustration of a SMCS is given in figure 2.

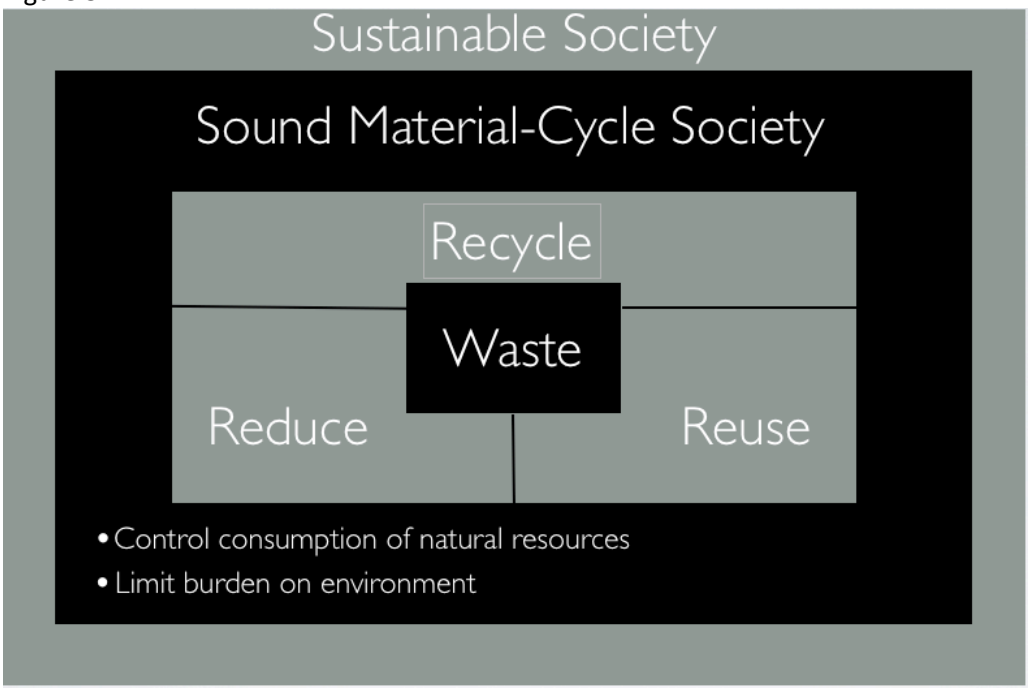
Figure 2



Within the "Fundamental Law for Establishing a Sound Material-Cycle Society," the following definitions are given:

In figure 3 below, another way of picturing a sound material-cycle society is illustrated:

Figure 3



Waste - The articles once used or collected or scrapped not used (excluding those currently in use), or the articles obtained secondarily in the course of manufacturing, processing, repairing or sales of products, supply of energy, civil engineering and building works, production of agricultural and livestock products, and other human activities

Recyclable Resources - Those useful among wastes, etc.

Recycling - Means reuse, regenration, and heat recover.

Reuse - Refers to the following actions:

(1) To use recyclable resources as products as they are (including the use of them after repair)
(2) To use the whole or part of recyclble resources as component or part of products.

Regeneration - The use of the whole or part of recyclable resources as raw materials

Heat Recovery - To use for obtaining heat the things which are the whole or part of recyclable resources and which are available for combustion or have such a possibility

Environmental Load - Means any adverse effects on the environment generated by human

Establishment of a Sound Material-Cycle Society

Ten years after the implementation of the Fundamental Law for Establishing a Sound Material-Cycle Society, the Japanese Ministry of Environment (MOE) published a report titled "Establishing a Sound Material-Cycle Society" to mark the anniversary of the event. In the report, the Ministry of Environment provides a comprehensive list of measure undertaken to establish a Sound Material-Cycle Society, which can be broken down into four steps.

1. Material Flow of Country

In order to establish a Sound Material-Cycle Society, it is important to understand the amount of resources being collected, consumed, and dumped in a society. Knowing where, what, and how much waste is generated is essential to gain a clear picture of the cause of waste generation, and to devise methods for the promotion of the efficient use of material input into society (MOE 1). Also, without a quantitative understanding of the amount of waste being generated, it is impossible to set goals and measure the progress of efforts to minimize waste. Thus, the first step in creating a SMCS is to understand the material flow in a society.

2. Implement Legal Systems for the Establishment of a Sound Material-Cycle Society

With the intention of revising the mass-consumption, mass-production lifestyle of the Japanese people, the Japanese Government enacted the "Fundamental Law for Establishing a Sound Material-Cycle Society," which became enforced in 2001 (MOE 58). The law provides the groundwork for a society where the consumption of natural resources is minimized and the strain man-made activities have on the environment is reduced. To do this, the law states the following:

(1) Objects subject to this law should be understood as "wastes, etc." in an integrated manner regardless of whether they are valuable or of no value and products should be prevented from becoming wastes, etc.,
(2) the usefulness of generated wastes, etc. should be paid attention to and wastes, etc. should be re-recognized as "recyclable resources" for them to thereby be subject to cyclical use (reuse, recycling, and heat recovery),
(3) wastes that are not capable of cyclical use should be appropriately disposed. With these processes, this law aims to realize "a sound material-cycle society", that is "a society where the consumption of natural resources can be reduced and as much of the environmental load as possible can be decreased" (MOE 58)

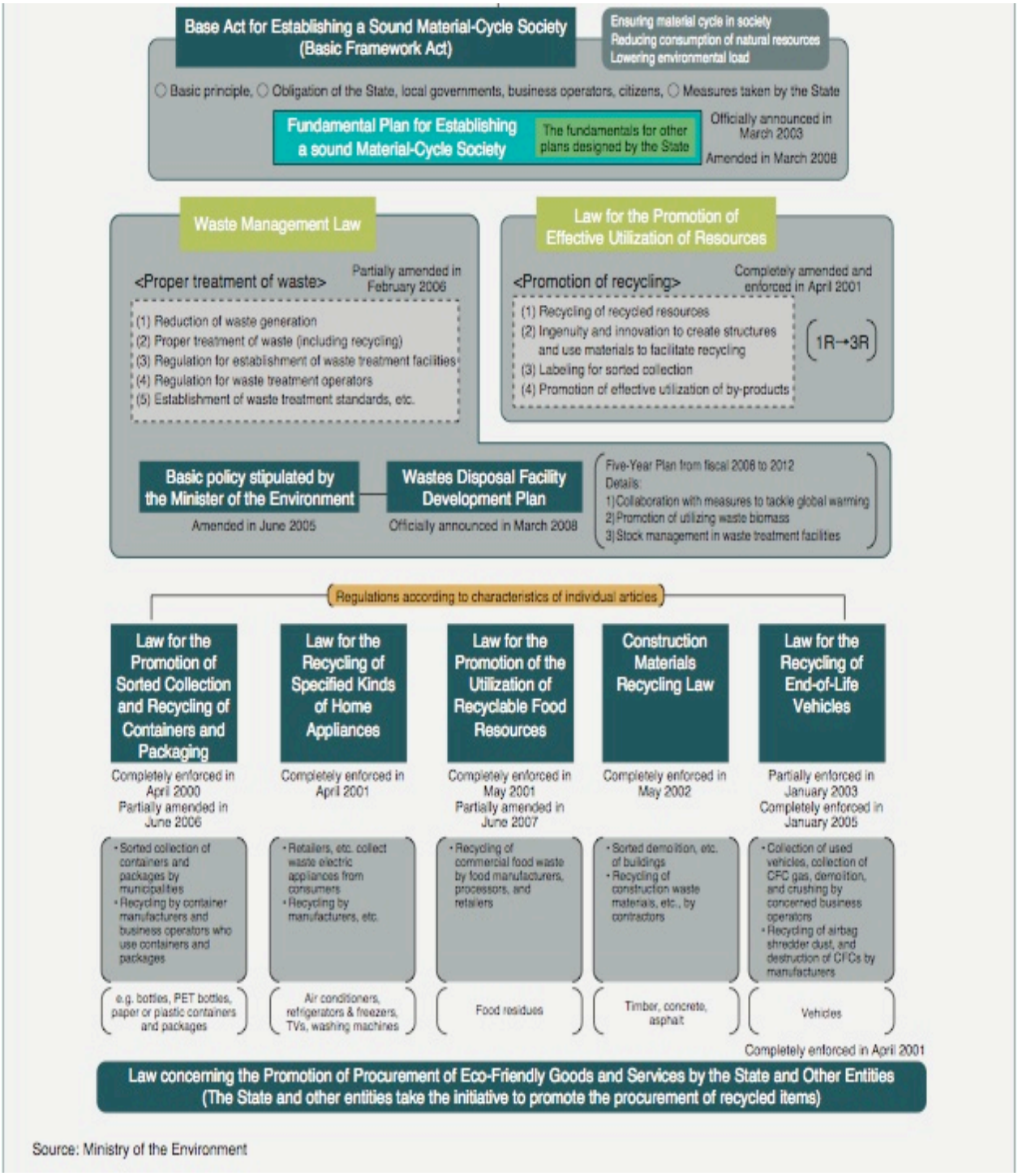
Within this law, two concepts are stressed:

(1) A waste generator must bear the primary responsibility for the reduction of environmental load caused by its disposal of wastes
(2) Extended producer responsibility, which is the idea that a producer bears responsibility (physical or financial) for the reuse, recycling, and disposal of the products it produced even after the products were used and then disposed of (MOE 58)

Additionally, a fundamental law for the implementation of a sound material-cycle society should have a fundamental plan for the establishment of such a society. The fundamental plan contained in the law is a necessary step in that it: is a central device for comprehensively and systematically implementing policies related to the establishment of a sound material-cycle society, and it provides the image of what a sound material-cycle society should be like sets numerical targets for the

establishment of a sound material-cycle society, and shows the direction of actions taken by the national government and other actors (MOE 58)

Such a system of policy measures for creating a sound material-cycle society is illustrated in figure 4.



Source: Ministry of the Environment

3. Infrastructure Development

The final step in the creation of a sound material-cycle society is the installation of infrastructure. In the 2010 report "Establishing a Sound Material-Cycle Society" by the Ministry of Environment, eight areas are shown whereby Japan moved to create a Sound Material-Cycle Society. These are:

(a) Financial measures - Part of the government budget is allocated to the development of a Sound Material-Cycle Society

(b) Promotion of the Sound Material-Cycle Society business - Eco-friendly goods have been promoted. Additionally, a goodness evaluation system for the treatment of industrial waste has been distributed
(c) Utilization of economic instruments - Various policy instruments, such as regulatory and economic approaches, have been implemented
(d) Promotion of education and learning, enhancement of public relations activities, support for civil activities, and human resources development - Public efforts, along with the support of civil groups, business operators, and local governments have worked on novel measures to achieve a SMCS
(e) Implementation of research and promotion of science and technology - Money has been given to research pertaining to 3r technology
(f) Facilities - Monetary support has been allotted to improve certain recycling-related facilities
(g) Preventive measures against and measures to block the spread of illegal dumping, etc. and measures against remained cases - National and prefectural governments have implemented measures toward the eradication of illegal dumping
(h) Other governmental efforts - Efforts include government's zero emission plan and promotion of urban redevelopment project

Locally-based Green Practices

Although the sound material-cycle society concept consists of a number of national policies, "the [Japanese] government also promotes local and regional action plans for establishing an environmentally sound material-cycle society" (Morioka 6). Furthermore, the actualization of a sound material-cycle society can also be realized based on the local regions where its principals are being applied to. Material cycles do not have to be uniform. "It is important to establish cycles on a scale that is optimal for the characteristics of each region ... "SMC blocks" is based on the idea that resources that can be circulated within a given area will be circulated within that area as far as possible while, for practical reasons, other resources will need to be circulated in wider areas" (MOE 12).

Sound material-cycle society realizes the importance of adapting to the local region where it is being applied. At the same time, locally-based green practices of a specific region impact the successfulness and characteristics of a sound material-cycle society. Locally-based green practices can be understood in this context as any bottom-up strategy that takes place in a community and incorporates local values, attitudes, and world views in designing strategies that enhance the effectiveness of a sound material-cycle society. A few examples of locally based-green practices are listed below.

Shibuya Umbrella Campaign

One example of a locally based-green practice is the Shibuya Umbrella campaign, started in 2007, and organized by SOL (Symbol of Life) an organization of college students. According to Tsuginosuke:

A hundred and thirty million umbrellas are consumed annually in Japan ... and ninety percent of the umbrellas are disposed after being used only one. [The] Shibuya Umbrella campaign collects dumped umbrellas, and lends them at cooperating stores, mainly cafes and bookstores. Celebrities in Japan also support this campaign by designing original umbrellas, and calling people to construct an environmentally friendly society. (3)

Atsugi City Kitchen Recycle Project

Atsugi City planned and carried out a project to manage kitchen waste in 2005. In collaboration with Atsugi Garden City Building Inc. they installed eco-stations to dehydrate and dry garbage. Tokyo University of Agriculture's Laboratory of Crop Production helped out on the project, producing compost from the garbage. Tsuginosuke details the precise plan (9):

1. When kitchen garbage is brought in by consumers, they will be given eco-money, which can be used at local shopping districts.
2. The collected garbage was then dehydrated and dried at eco-stations, and converted into compost at Tokyo University of Agriculture's Labaratory of Crop Production.
3. Compost, decomposed and fermented at a high level, created at the university will be provided to local farms, and its products will be sold at a specified shopping district.
4. Consumers will be able to purchase the vegetable at the specified shopping district using eco-money.

SMCS in an international context

"In April 2008 at the Conference on Resource Efficiency co-organized by the OECD and UN Environment Programme in Paris ... the participants affirmed the importance of sharing the best practices on national initiatives and continuing efforts to improve resource efficiency" (Moriguchi 180). Chairs of the conference concluded that different concepts had convergent approaches. These national initiatives included:

- Sound Material-Cycle Society (Japan)
- Circular Economy (China)
- Sustainable Waste Management (UK)
- Sustainable Consumption and Production (EU)
- Life-Cycle Management (UNEP)
- Integrated Solid Waste Management (UNEP)

Below is a brief synopsis of each program followed by a chart contrasting the initiatives:

Circular Economy

Similar to what happened in Japan, rapid growth in China has resulted in severe environmental degradation and resource overconsumption. A circular economy (CE) is meant to address these problems. "The CE is a mode of economic development based on the circulation of resources: CE aims at sustainable growth by means of rational use of energy and resources and ecological preservation" (Yabar 93). Within the circular economy, three levels are stressed.

- At the individual firm level, managers see higher efficiency through the three Rs
- The second level is to reuse and recycle resources within industiral parks and clustered or chained industries, so that resources will circulate fully in the local production system
- The third level is to integrate different production and consumption systems in a region so the resources circulate among industries and urban systems. This level requires

development of municipal or regional by-product collection, storage, processing, and distribution systems. (Indigo 3).

"Efforts at all three levels include development of resource recovery and cleaner production enterprises and public facilities to support realization of the CE." However, unlike a SMCS, a CE is accomplished only through top-down approaches.

Sustainable Waste Management

Sustainable waste management is a concept conceived by the government of the UK. At its core is the idea that goods and products are all natural resources, and that we must conserve natural resources, prevent the unnecessary emissions of GHG and protect public health and ecosystems through proper waste management (Local Government 1). Sustainable waste management is based on the following hierarchy:

1. Reduce or prevent waste arising - waste minimization initiatives to help businesses and households reduce the amount of waste that they create
2. Reuse waste - reuse waste and thus avoid energy consuming reprocessing
3. Recycle - reprocess waste for further use
4. Energy recovery - generating energy from waste using a variety of technologies
5. Disposal - put waste in landfill sites

The sustainable waste management plan is to be enacted by local authorities and has as its primary object the minimization of waste that can not be reduced, reused, or recycled.

Sustainable Consumption and Production

Motivated by the same concerns - the effect consumption and production patterns have on the environment etc. - as Japan and China, the EU in 2008 proposed an action plan for sustainable consumption and production. "At the core of this plan is a dynamic framework to improve the energy and environmental performance of markets and foster their uptake by consumers" (EUR Lex 2). This plan carries the intention of making the EU nations more sustainable without burdening either producers or consumers. Encompassed with the sustainable consumption and production action plan are the following:

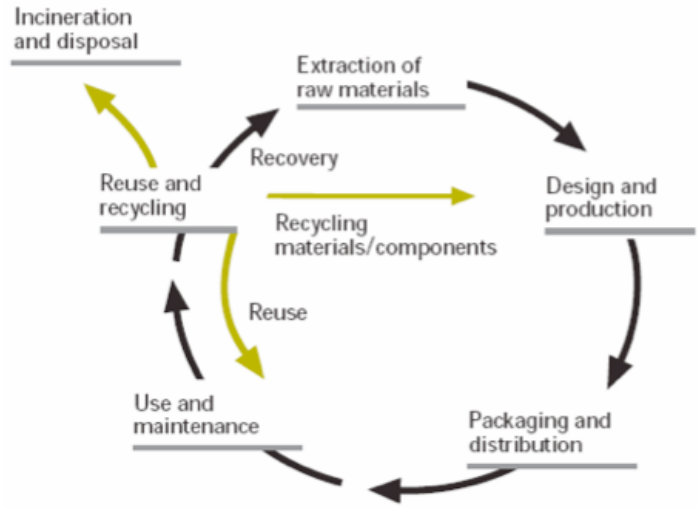
- Ecodesign requirements for more products
- Reinforced energy and environmental labeling
- Incentives and public procurement for highly performing products
- Green public procurement practices
- Consistent product data and methodologies
- Work with retailers and consumers
- Supporting resource efficiency, eco-innovation and enhancing the environmental potential of industry
- Promoting sustainable production and consumption internationally

The EU's sustainable consumption and production plan goals are to improve the environmental performance of products through their life cycle, stimulate the demand for products which are less burdensome to the environment, and to teach consumers to make smarter decisions.

Life-Cycle Management

Life-Cycle Management is an idea advanced by the United Nations Environmental Program (UNEP) that encourages producers to expand their focus from production site and manufacturing processes "to include the environmental, social, and economic impact of a product over its entire life cycle" (Remmen, et al., 9). In this manner, a products resource use and emissions can be reduced and its lifecycle performance enhanced. The UNEP stresses that there are three things to bear in mind when building a successful LCF program: any organization can implement a LCM program, the program should be enacted at all levels of a company's organization, and a company must go beyond its boundaries to enact life-cycle thinking (Remmen, et al., 15). Figure 5 provides an illustration of Life-Cycle Management.

Figure 5

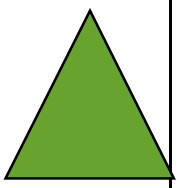
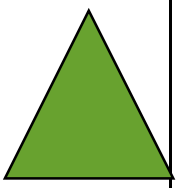
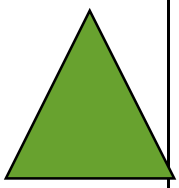
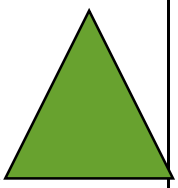
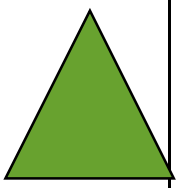
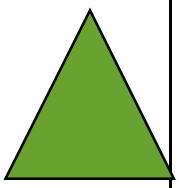
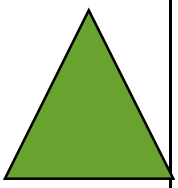
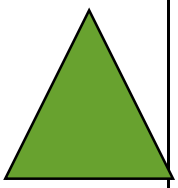
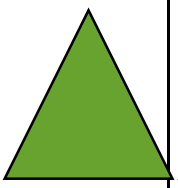
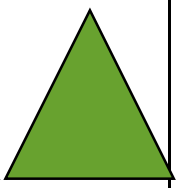
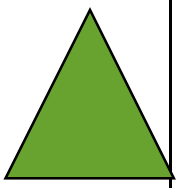
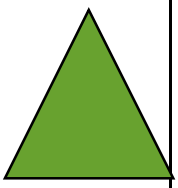
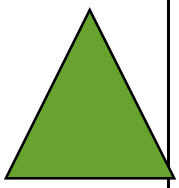
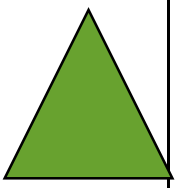
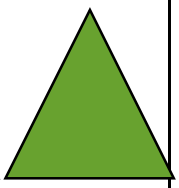
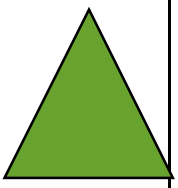
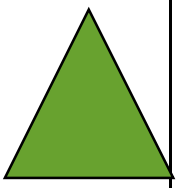
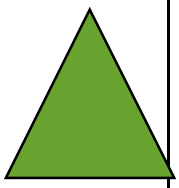
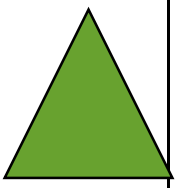
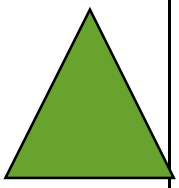
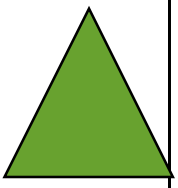
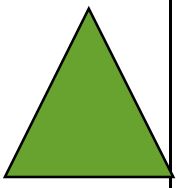
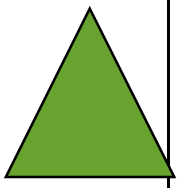
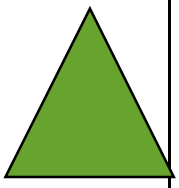
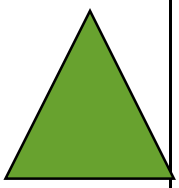
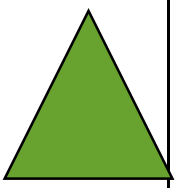
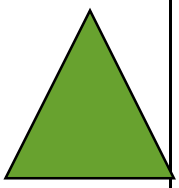
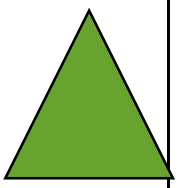


Integrated Solid Waste Management

As the world's population grows, so has the amount of human-generated waste. In Asia alone, the amount of municipal solid waste is expected to increase by more than 150 percent by the year 2030 (Chandak 12). Furthermore, solid waste poses a threat not just to human health, but to the environment as well. In response to the growing concern over how to handle waste, the United Nations Environment Program proposed the term Integrated Solid Waste Management (ISWM). ISWM "refers to the strategic approach to sustainable management of solid wastes covering all sources and all aspects, covering generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner with an emphasis on maximizing resource use efficiency" (Chandak 15).

According to Chandak, implementing an Integrated Solid Waste Management requires five steps (23).

- Baseline data on waste generation and characterization and quantification with future trends
- A list of targets to be achieved through the ISWM system
- A plan with details of the Management System covering policies, technologies and voluntary (awareness raising, self regulations) measures
- Implementation aspects such as time schedules, costs, institutional requirements etc.
- Monitoring and feedback mechanism

	Sound Material-Cycle Society	Circular Economy	Sustainable Waste Management	Sustainable Consumption and Production	Life-Cycle Management	Integrated Solid Waste Management
Consumers reduce resource use						
Producers reduce resource use						
Reuse of goods and materials						
Recycling of materials and components						
Heat Recovery						
Extended Producer Responsibility						
Encouragement of smarter consumption habits						

Conclusion

Due to the amount of waste generated in Japanese society, lack of landfill space, and concern over the depletion of natural resources, the Japanese government enacted a fundamental law for creating a sound material-cycle society. Throughout all sectors a sound material-cycle society seeks to minimize the extraction of resources, "from resource extraction through production, distribution, consumption and disposal, through a range of measures such as reduction of waste generation and use of the 3rs (reduce, reuse, and recycling), thereby minimizing environmental loads" (MOE 3).

Minimizing the consumption of natural resources and reducing the environmental load, the two main pillars of a sound material-cycle society, can help to reverse the global trend of overconsumption and overproduction. Through such action, huge strides can be taken towards a healthier material cycle and the development of a sustainable society.

References

- Chandak, Surya P. Integrated Solid Waste Management: Why, What and How? United Nations Environment Programme. Web. Sept. 2011.
- "China's Circular Economy Initiative." Welcome to Indigo Development. Web. 21 Sept. 2011. <http://indigodev.com/Circular1.html>.
- "EUR-Lex - 52008DC0397 - EN." EUR-Lex — Access to European Union Law — Choose Your Language. Web. 21 Sept. 2011. <http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52008DC0397:EN:NOT>.
- Japan. Ministry of Environment. 2010 Establishing a Sound Material-Cycle Society: Milestone toward a Sound Material-cycle Society through Changes in Business and Life Cycles. 2010.
- Japan. Ministry of Environment. Fundamental Plan for Establishing a Sound Material-Cycle Society. March 2008.
- Japan. Ministry of Environment. Fundamental Law for Establishing a Sound Material-Cycle Society. June 2, 2000.
- Morioka, Tohru, Kazuhito Haruki, and Helmut Yabar, eds. Transition to a Resource circulating Society: Strategies and Initiatives in Asia. Osaka: Osaka UP, 2007.
- Morioka, Tohru, Keisuke Hanaki, and Yūichi Moriguchi. Establishing a Resource-circulating Society in Asia: Challenges and Opportunities. Tokyo: United Nations UP, 2011.
- Namiki, Masayoshi. "Promotion of Sound Material-Cycle Society in Japan and 3r Initiative." Apr. 2008. Lecture.
- Remmen, Arne, Allan A. Jensen, and Jeppe Frydendal. Life Cycle Management: a Business Guide to Sustainability. Nairobi, Kenya: United Nations Environment Programme, 2007.
- Takeuchi, Kazuhiko. "Rebuilding the Relationship between People and Nature: The SATOYAMA Initiative." The Second International Conference On Sustainability Science in Asia. Hanoi. 2 Mar. 2011. Lecture.
- Tsuginosuke, Omori. The Construction of a Sound Material-Cycle Society at a Regional Level with Atsugi as a Model City. Diss. Tokyo University of Agriculture.
- "What Is Sustainable Waste Management." Local Government. May 2010. Web. Sept. 2011. <http://www.idea.gov.uk/idk/core/page.do?pageId=9594604

APPENDIX 2: Some SMCS Case Studies from Japan

1) Biomass Nippon Strategy- A Domestic Measure by the Japanese Government

What is Biomass?

- Biomass is defined as "a reusable, life-originating organic resource with the exception of fossil resources". Biomass is a resource that can be continuously regenerated as long as life and solar energy exists.
- Biomass can be utilized in the following three ways: utilizing energy into fuel, converting materials into fertilizers and food for domestic animals including fishes, and producing lignified plastic from the material.

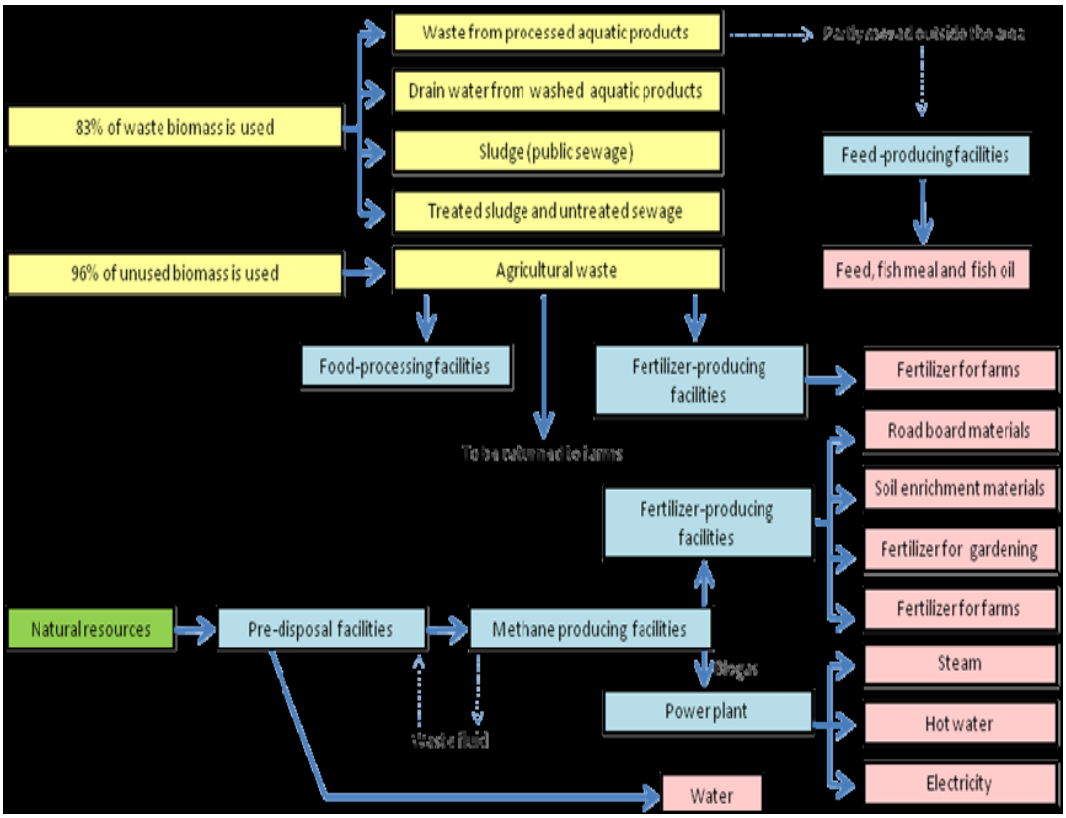
Biomass Nippon Strategy aims to promote biomass utilization for the following -

- to prevent global warming, for the construction of a sound material-cycle society
- to train a new strategic industry with competitiveness
- for use in rural areas that depend on agriculture, forestry, and fisheries as its income.

What is the Biomass Town Plan?

Since the year 2004, local governments have been working as a part of the Biomass Nippon Strategy, with the purpose of constructing a *Biomass Town*. The plan aims to utilize either more than ninety percent, after carbon conversion, of wasted biomass, or more than forty percent of unutilized biomass. Biomass is derived from life, and therefore has the characteristic of existing "in small numbers but widely", which results in the need for an effective conversion of materials into energy at the local level. The role of a *Biomass Town* is to construct the system that translates these plans to real life.

A *Biomass Town*, with Miura City, Kanagawa, as an example



Definition of A *Biomass Town*

A town where there is a wise and practical use of biomass, either now or in the near future.

Steps to achieve the Goal

- Persons and parties concerned must gather before the authorization of a *Biomass Town*. Persons and parties concerned, in this case, refer to administrations, local and public organizations, educational institutions, private enterprises, and citizens of the area.
- The second step is to calculate the amount of biomass in the area, collect information about advanced industries and technology, propose a *Biomass Town* plan that is unique to the area, and submit the plan to the district's agricultural administration and prefectural authorities.
- After this, the plan can be examined by The Conference for the promotion of Biomass Nippon Strategy, and will be declared a *Biomass Town* if the plan is in accordance with the standards.
- New environmental business models, such as financially-considered continual local system models that fit into local conditions, are envisioned in the plans, along with creation of employment opportunities for the construction of new facilities for biomass utilization.
- Local areas, related governments, and municipalities around the nation will benefit by sharing and exchanging information related to *Biomass Towns*. The government planned to recognize three hundred municipalities around the nation by year 2010. Till June 2009, Miura City is the only city in Kanagawa that is recognized by the Ministry of Agriculture, Forestry and Fisheries.

2) A measure by Atsugi City ～Mission 35

Introduction

In Atsugi City, only 15% of the garbage was converted into resources in the year 2006, and the amount of garbage per person per day was 1108 grams. These numbers ranked at the 18th place out of 19 cities in Kanagawa. In order to improve the rank, the city had planned to promote a measure, known as *Mission 35*, from October 19, 2009. Districts of Morinosato, Tamagawa, and Nanasawa were selected as model districts, and Mission 35 has been progressing since October 2008. Consequently, the collection rate of resources almost doubled, with a rate of 187% compared to that of 2008. The percentage of garbage converted into resources was not mentioned.

Steps taken:

The model districts of Atsugi City improved the system in the following ways:

1. The collection dates of combustible garbage were reduced, and the collection dates of resources were increased.
2. Plastics, which were sorted as combustible garbage, was converted into resources.
3. Combustible garbage and resources were collected from the same points.

Results

A survey was conducted in the model districts in order to find an explanation for the rise in the collection rates of resources. A survey was conducted among 1200 citizens living in the area, with age over 20, and were selected randomly. The survey was conducted between the 6th and the 28th of February, 2009, and the collection rate was 46.1%. The results of the survey are as follows:

1. 77.6% answered that the increase of collection dates of resources made it easier to sort resources.

2. 83.4% answered that they dumped plastic every week, and 68.9% answered that the amount of combustible garbage decreased, since plastic was now sorted as resources.

3. 47.9% answered that the unification of garbage disposal points made it easier for them to dump resources, and 36.0% answered that the disposal points were already unified from the past.

4. 80.1% answered that they were looking for "the distribution of easy-to-understand leaflet", following the beginning of Mission 35, in order toreduce the confusion that could arise from the changes of garbage disposal points.

5. Atsugi City aims to decrease the amount of garbage by more than 30%, and to convert 35%or more garbage into resources in order to construct a sound material-cycle society. The citizens were asked to select any three actions that they thought were important for the city to initiate from now onwards, the results are shown in the chart below.

Action	Votes	Percentage
Promotion of a new system to reduce garbage and convert them into resources	274	49.5%
Addition of new items to convert into resources	81	14.6%
Promotion of the 3Rs	288	52.1%
Promotion to spread kitchen garbage processors	168	30.4%
Promotion of shopping at environmentally friendly stores	56	10.1%
Education in awareness to sort garbage and resources	329	59.5%
Public relations, including posters	121	21.9%
Others	30	5.4%
Unanswered	8	1.4%
Total	1355	244.9%

The results from this survey, showed that public education in awareness to sort garbage and resources lead to the reduction in the amount of garbage.

2.a) A second measure by Atsugi City ～Kitchen Recycle Project～

Atsugi City, in the past, was only taking measures for commercial activation. Since 2001, however, the reaction of customers became negative against measures for commercial activation. Atsugi City aimed for an urban husbandry that is compatible with both commercial activation and environmental conservation, launched ecological projects, and gained awards.

Year	Content	Award
2001	Installation of collectors for cans and bottles	
2003	Installation of solar and velocity-powered hybrid streetlamps	Kanagawa Environmental Award
2005	Launching of Kitchen Recycle Project	Ministry of Environment's public participation business

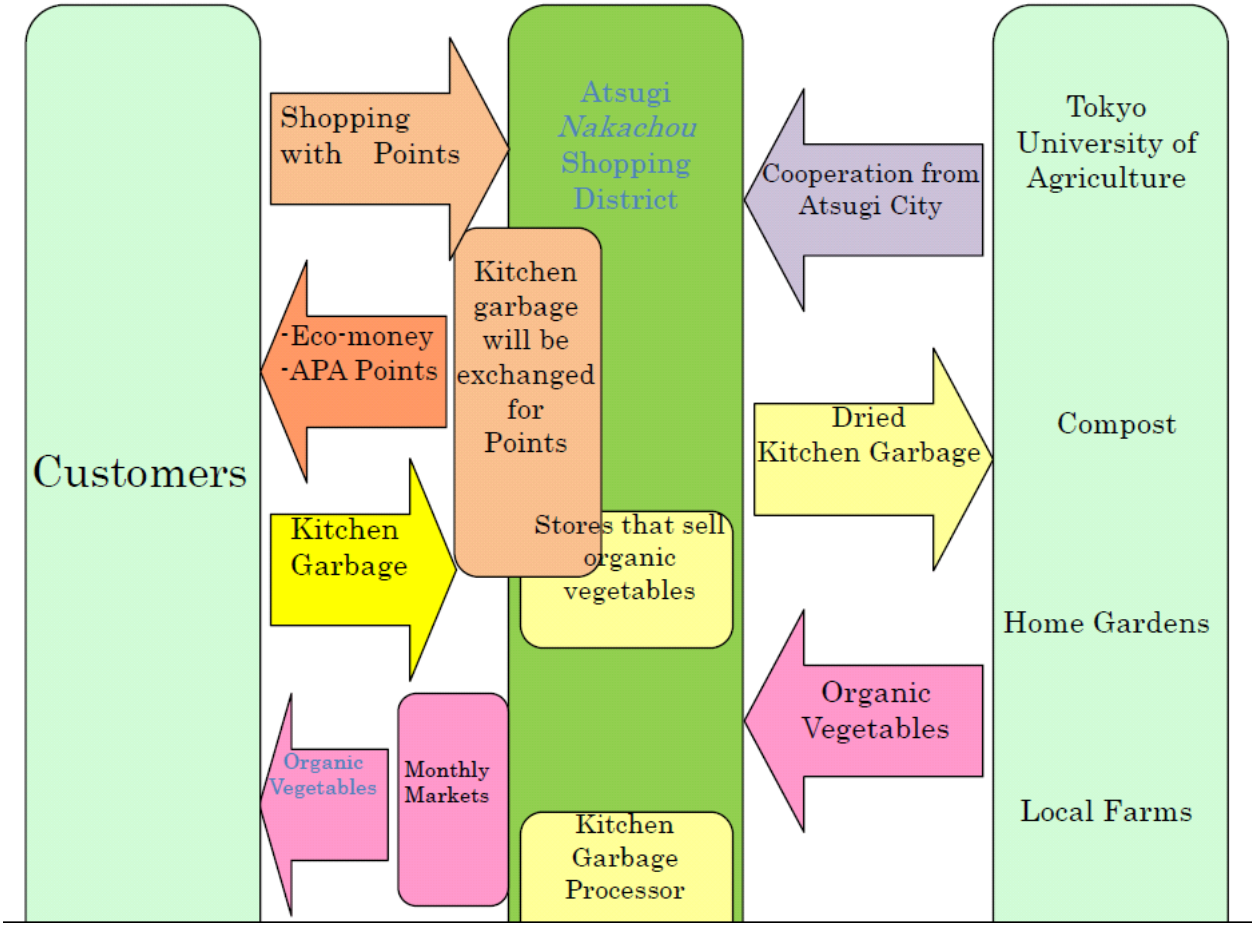


Chart 6: The contents of the Kitchen Recycle Project, from Atsugi *Nakachou* Shopping District's website.

Steps taken

- Six hundred citizens brought kitchen garbage monthly, and 1.3 tons of kitchen garbage was collected. This was also promoted with the help of the media, including television

and newspaper, leading to a promotion of the shopping district, and numerous observation offers were made from across the nation.

- Atsugi City planned and invested in the Kitchen Recycle Project. *Eco-stations*, which dehydrate and dry garbage, were installed by ATSUGI GARDEN CITY BUIL. Inc., and Tokyo University of Agriculture's Laboratory of Crop Production managed the project and produced compost from the collected garbage. The precise plan of the project is given below.

1. When kitchen garbage is brought in by consumers, they will be given *eco-money*, which can be used at local shopping districts. The exchange rate is one yen for every hundred grams of garbage.

2. The collected garbage was then dehydrated and dried at *eco-stations*, and converted into compost at Tokyo University of Agriculture's Laboratory of Crop Production.

3. Compost, decomposed and fermented at a high level, produced at the university will be provided to local farms, and its products will be sold at *Nakachou* Shopping District.

4. Consumers will be able to purchase the vegetables at *Nakachou* Shopping District using *eco-money*.

The Kitchen Recycle Project constructed a sound material-cycle model of farm products and *eco-money*. Students from Tokyo University of Agriculture also participated in this project, and took part in creating compost. The project, sadly, is not presently functioning, due to the odors from *eco-stations* and the damage to the facilities due to unpredicted alien substances in kitchen garbage. Tokyo University of Agriculture's Laboratory of Crop Production is thinking about installing *eco-stations* at local primary schools, but concrete measures are yet to be taken.

2.b) A measure by Atsugi ISF ～*MYLORD Hon-Atsugi* Rooftop Farm Project～

Introduction

Considering the measures taken by local governments described above, Atsugi ISF came to the conclusion that the solutions to environmental problems are effective at local levels. It is important to recognize the problem, and for local citizens, enterprises, universities, and administrations to work together for the solution. Continuous urban husbandry can be achieved by making "the solution to environmental problems" and "the activation of local economy" compatible with each other. Giving due consideration to these thoughts, *MYLORD Hon-Atsugi* Rooftop Farm Project was started in May 2009, in collaboration with Tokyo University of Agriculture, Atsugi City's Department of Commerce Prosperity, and MYLORD Hon-Atsugi Inc , lead by Atsugi ISF.

Goals of the Project

1. To create a foundation for city offices, enterprises, and universities to work together in future projects to construct a sound material-cycle society.

2. To secure a sound material-cycle system for feces and urine produced from domestic animals kept at Tokyo University of Agriculture, and to utilize Moso Bamboo (*Phyllostachys heterocycla*) that grow naturally at countryside landscapes within the Atsugi City.

3. To develop urban hospitality through "local production for local consumption", by asking local restaurants to make use of the products.

4. To educate the next generation to take over the projects for local activation, by conducting food education programmes, mainly targeting primary school students, at the rooftop farm.

Steps :

1. Fifteen garden planters were brought into the rooftop farm from Tokyo University of Agriculture. Various plants are being grown at the farm; brinjal, tomato, gumbo, beefsteak plant, celery, parsley, bitter gourd, and basil are just to name a few. Brinjal, tomato, gumbo, and various herbs are being harvested as of September 2009. Of these, brinjal and gumbo can be harvested almost daily.
2. Vegetation that was originally planted at the rooftop were trimmed and improved, and a farm with more than fifteen species of plants is being developed. The farm has various species of plants, with only a few roots of each species.
3. Flowering plants, such as Japanese morning glory, globe amaranth, and sunflower, are being planted in addition to vegetables, and the flowers were blooming, as of September 2009.

Projects that are based on the rooftop farms are planned, at this moment, as follows:

- Flower beds, made out of moso bamboo
- A food education programme, including harvesting experience and a seminar for "local production for local consumption" will be conducted for primary school students
- A wall surface gardening project

4. Atsugi City is putting in effort for the construction of a sound material-cycle society, owing to *Mission 35*. Atsugi City's Department of Commerce Prosperity is developing the *Atsugi Prosperity Adventure Project*, in cooperation with the five universities located in the city. This project aims to activate local economy using creative ideas from students.
5. Tokyo University of Agriculture, along with several members of Atsugi ISF, are participating in this project, and the university has a close relationship with the city. Odakyu Electric Railway Co. Ltd., the parent company of MYLORD Hon-Atsugi Inc. , declares that the enterprise will "contribute to the development of local societies and the enrichment of people's lives through its business" as part of its corporate social responsibility. MYLORD Hon-Atsugi Inc. therefore positively cooperated with the project.

The roles of each organization are as follows:

- Tokyo University of Agriculture: management of the rooftop farm and planning of events
- Atsugi City: investment into projects, public relations within the city

- Odakyu Electric Railway Co. Ltd.: provide rooftop of *MYLORD Hon-Atsugi*, cooperative management of projects with department stores, public relations outside the city

Shinjuku Eco Jiman Point: Shinjuku Ward

Shinjuku Eco Jiman Point is a three-R effort indicative of Shinjuku. This effort is an advocate of the Shinjuku Ward Three-R Promotion Council that was established in April 2008 by ward residents, businesses and the ward itself. If consumers get receipts or stamped cards from retail stores showing that they declined shopping bags or practiced some other eco-friendly behavior when shopping, they can gather these and bring them to events organized by the ward or environmental groups as proof of their environmentally-friendly consumer behavior. This allows them to enjoy privileges other than those offered at the stores themselves.

The event organizers come up with various ways to use the receipts and stamps, such as giving out prizes and holding point contests. Through such efforts, Shinjuku ward aims to encourage consumers to be eco-friendly through things like refuse shopping bags and promote raised awareness throughout the ward regarding general environmental and waste-related issues. Since its inception in 2008 through March 31st 2009, the system has been used in several events, recording 356 participants and 5,288 points (times of usage).

Flow for the Shinjuku Eco Jiman Point system

Decline shopping bags (plastic or paper) when shopping.

⇩

Store the receipt or other proof that the bag was declined, if received. Proof of refusing or other eco-friendly activity can be in the form of printed receipt, stamped card, etc.
* Information on stores offering such proof is periodically posted on the Shinjuku Ward homepage.

⇩

Bring your proof to environmental events to make use of them. Possible uses include special gifts, preferential rights for attractions, raffle tickets, and ranking contests.
* Participating events are periodically posted on the Shinjuku Ward homepage.
** Pieces of proof can only be used once per piece. They will be marked as used and returned.

⇩

Large numbers of consumers declining shopping bags will help promote reduced CO_2, preservation of petroleum resources, and reduction in waste.

Image of Shinjuku Eco Jiman Point registration card

Source: Shinjuku Ward

References

- MOEJ, 2010. Establishing a Sound Material Cycle Society- Milestone Towards a Sound Material Cycle Society through changes in Business and Lifestyle [online].Tokyo: Office of Sound Material-cycle Society Waste Management and Recycling Department. Available at http://www.env.go.jp/en/recycle/smcs/a-rep/2010gs_full.pdf [Accessed 20 November 2010]
- Tsuginosuke, Omori. The Construction of a Sound Material-Cycle Society at a Regional Level with Atsugi as a Model City. [online] Diss. Tokyo University of Agriculture. Available at http://www.nodai.ac.jp/cip/iss/english/9th_iss/fullpaper/2-2-3%20atsugiISF.pdf [Accessed 20 November 2011]

APPENDIX 3

Photographs from 3 R practices in Indonesia- Segregation of waste, Compost, and Handbags made with Recycled materials:

Waste Management in Indonesia

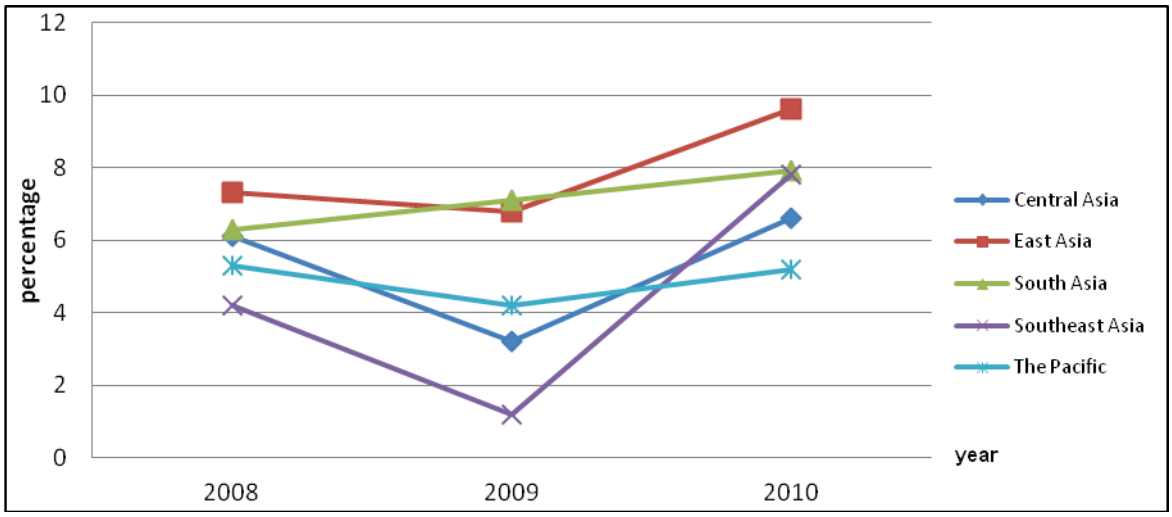
A) Transportation of Waste by Government Authorities, B) Scavenging

C)Waste at Temporary Disposal Site, D) Waste Transportaion by Community

Waste Survey

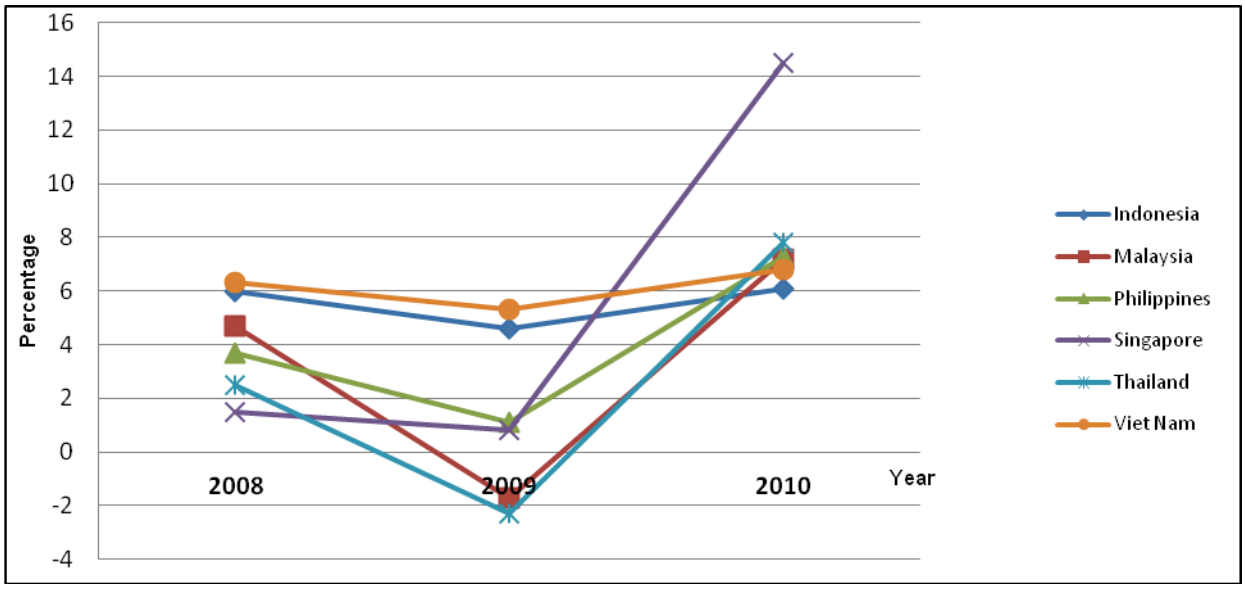
APPENDIX 5 – FIGURES AND TABLES FOR INDONESIA

Figure 1 Growth rate of GDP (% per year) 2008-2010 in the Developing Asia Countries



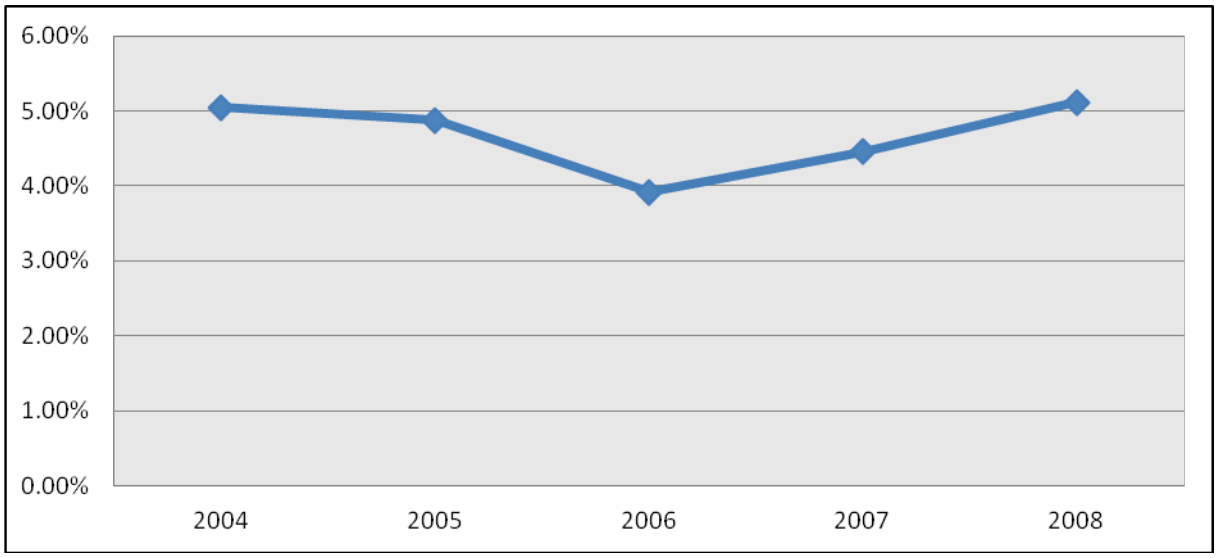
(Source: ADB, 2011, modified)

Figure 2 Growth rate of GDP (% per year) 2008-2010 in the South Asia Region



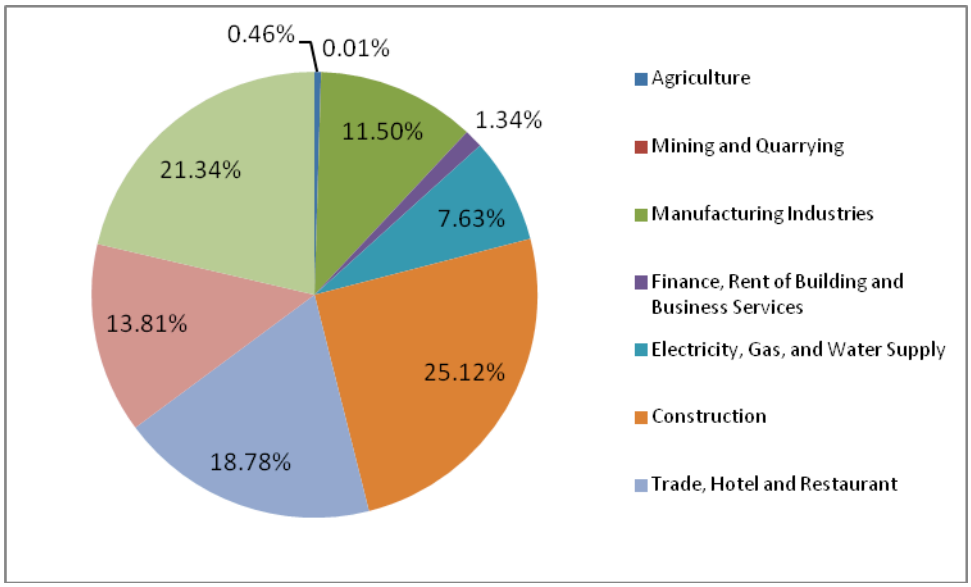
(Source: ADB, 2011, modified)

Figure 4 – RGDP Growth in 2004-2008 in Yogyakarta City (Constant Price of 2000)



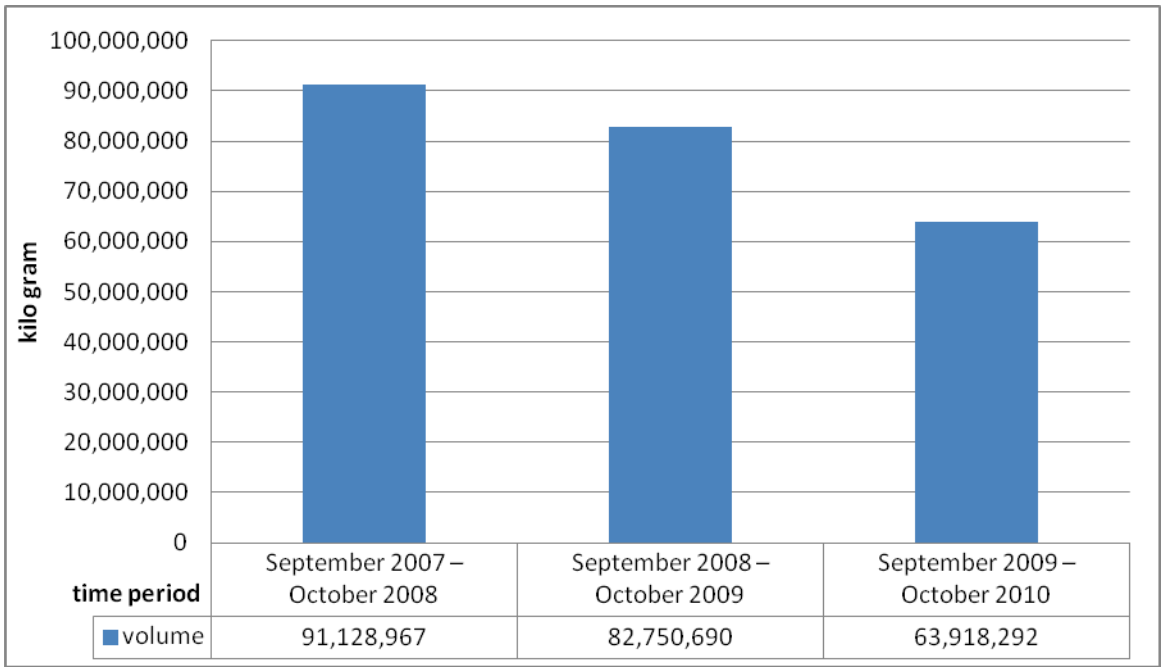
(Source: BPS, 2009)

Figure 5 Average RGDP Sector Contribution 2004-2008 in Yogyakarta City (constant price of 2000)



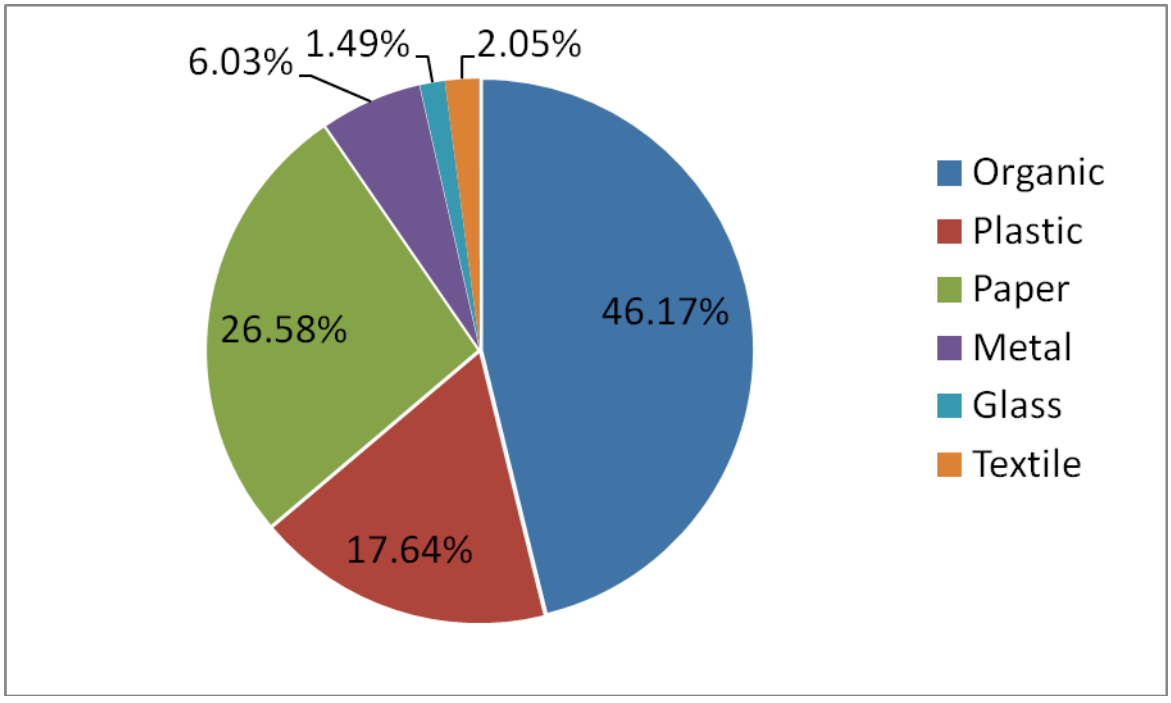
(Source: Statistic Central Bureau, 2009)

Figure 6 Waste Volume of Yogyakarta City 2008-2010 (kg)



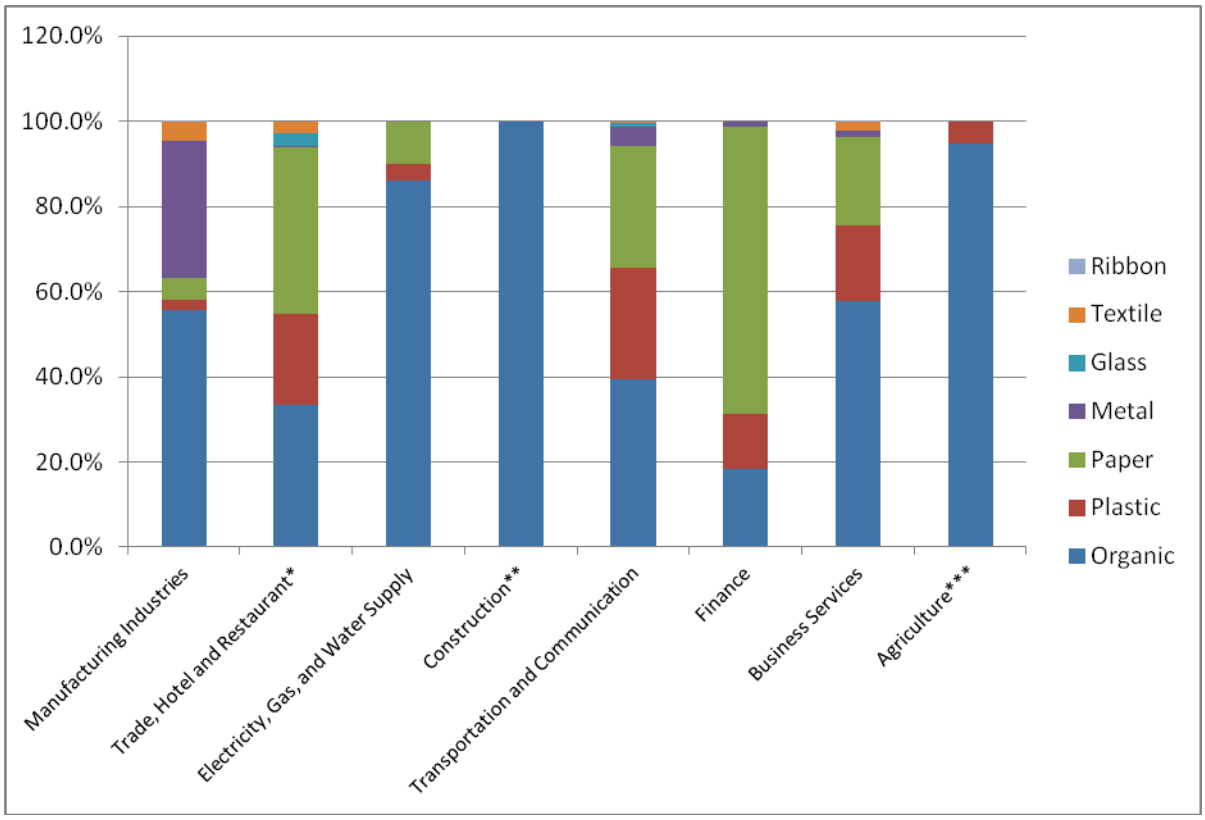
Source: Enivironmental Agency, 2011

Figure 7 Waste Composition of Yogyakarta City (percentage)



Source: Primary data

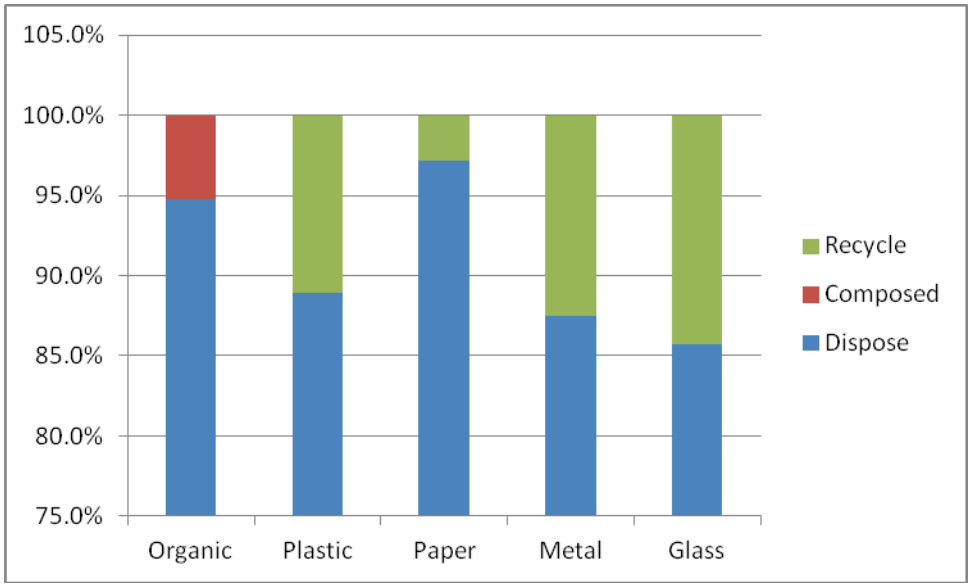
Figure 8 Waste composition of Yogyakarta City by RGDP Sector (percentage)



* Multinational Company not included; ** i.e. wood, scrap, rock, brick; *** estimated by production capacity

Source: Primary data

Figure 9 Waste Treatment of Yogyakarta City (percentage)



Source: Primary data

Table 1 Facility of Waste Cleaning by Government

Facility	Number
Tricycle	13 units
Bicycle	24 units
Pedicab	74 units
Recycle bin	500 units
Sub-Office	7 places
Incenerator	1 unit

(Source: Environmental Agency, 2009)

Table 2 Facility of waste transporting by government

Facility	Number	Facility	Number
Dump truck	33 units	Vulkaniser machine	2 units
Armroll truck	10 units	Transfer depo	13 unit
Bachoe loader	1 unit	Container socket	16 units
Carrying pick-up	2 units	Temporary Disposal	34 units
Operational pick-up	1 unit	Temporary Disposal 1m3	75 units
Motor cycle	2 units	Sub-Office	8 places
Container-motor cycle	27 units		

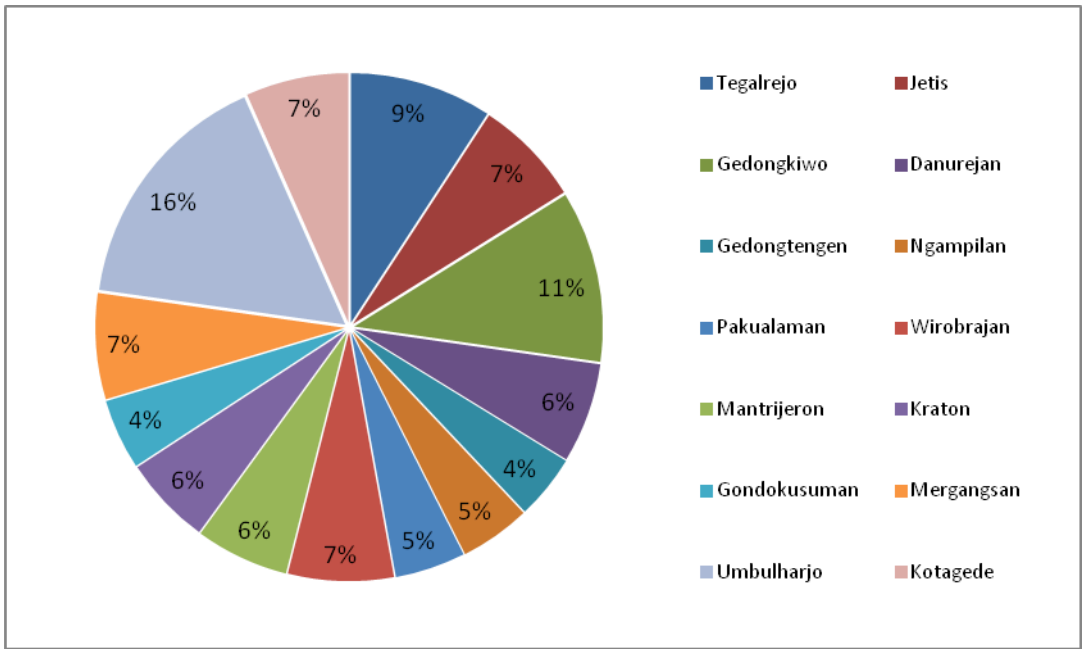
(Source: Environmental Agency, 2009)

Table 3 Facility of Piyungan Final Disposal Site (*TPA Pyungan*)

Facility	Number
Bull dozer	4 units
Whell loader	1 unit
Exavator	1 unit
Loader Truck	1 unit
Tank Truck	1 unit

(Source: Environmental Agency, 2009)

Figure 10 Composter Distribution 2009-2011 per District (percentage)



(Source: Environmental Agency, 2011)