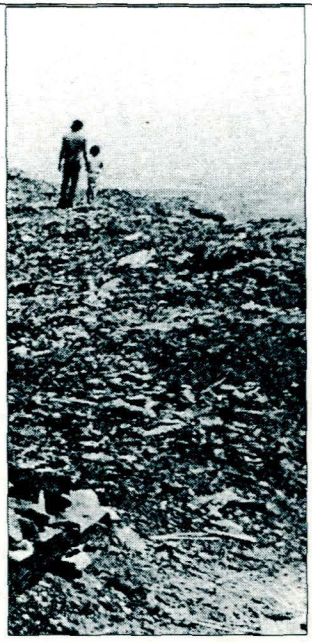
RESOURCE RECOVERY IN SOLID WASTE MANAGEMENT:

Strategies, Initiatives, Policy Issues



MA. LOURDES G. REBULLIDA

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FOREWORD

As we begin the Third Millenium, urbanites in the country are perplexed and puzzled. The reason: incineration and landfill will no longer be allowed henceforth. Congress decreed so. What will replace these two tested and most popular methods of waste disposal practiced all over the world? Have we reached a dead-end in solving our waste management problems? Or are there other options available to us?

Professor Maria Lourdes G. Rebullida's state-of-the art study on Resource Recovery in Solid Waste Management explores the range of options available to our worried urbanites. Her first and most drastic proposal is to discard the traditional view that waste no longer has value and therefore must be disposed of. Rather, she argues that waste must be viewed as a resource — through recycling and reuse. The traditional view emphasizes the last function in waste management — disposal — and is otherwise known as the "dilute and disperse" approach. On the other hand, the two major alternatives, both being propagated under the rubric of "sustainable development," are "clean technology" — "non-waste" or "low-waste" technology — and "zero-waste management." The latter is described by its adherents as an "ecological method of handling wastes." The common target of these two resource recovery approaches is waste minimization through source reduction, resource recovery and treatment. Indeed the zero-waste management school specifically seeks elimination or avoiding burning or incineration and open dumping.

Prof. Rebullida, through the "policy analysis" approach, had provided a fresh and definitely more encompassing view of waste management. Previous studies on this subject concentrated on the so-called six functional elements of waste management, i.e., from waste generation to storage, to collection, to transfer and transport or processing and recovery to final disposal. Under this perspective, it is assumed that there already exists consensus on the goals or objectives of waste management. Hence, the implementors' or administrators' principal task is to achieve the most efficient management of the program. But as Prof. Rebullida demonstrates, no clear cut national policy exists. There are more differences than agreements among the principal stakeholders, while an active informal sector thrives in the waste management system, among others. More importantly, waste management cannot be dissociated from urbanization and industrial-

ization, and therefore, must logically be a part and component of any community development and planning.

Prof. Rebullida's challenge to everyone is timely. Let us view waste as a resource thereby converting the problem to solution.

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Chapter 1

Introduction

Critical Conditions in Solid Waste Management

Mention solid waste management and it invariably evokes unsightly garbage dumps, the stench of trash and concern over dangers to health and environment.

One's practical concern can spring from experiences in daily life — at home, in the community, or place of work — whenever garbage is dumped indiscriminately and remains uncollected, or when there is no proper place to throw it away. Complaints are expressed now and then, but to whom and where can one turn to? It is like raising a "lonely voice in the wilderness." Most people have become apathetic or accustomed to the situation, unmindful of the trash scattered around them.

Eventually the garbage clogs the sidewalks, the streets, *esteros*, canals and drainage systems, causing floods and traffic. Garbage dumps pose dangers to health because these places breed mosquitoes, rats, roaches and other pests. Only then is the gravity of the situation acknowledged.

Media coverage of Smokey Mountain, the dumpsite in Tondo now closed by government, stirred public anxiety about the plight of families residing in the area. The sight of children and their parents scavenging in that mountain of garbage for a living elicited sympathy as well as distress. The defects and negative consequences of the conventional system of waste collection and disposal using dumpsites, landfills and incinerators have become critical concerns. Various nongovernment organizations have pointed out the dangers of improper waste disposal to the land, air, water, people and the environment.

Enough evidence confirms the negative impacts arising from this conventional or traditional system of waste management.

News of disasters raised the public's consciousness on the effects of hazardous wastes. The dangers posed by the export of dangerous wastes by developed countries to developing countries, or simply by the transit

of such wastes from country to country, has stimulated widespread criticism and protests. Governments now enter into agreements among themselves to prevent global repercussions of national behavior toward wastes.

The volume of wastes generated and bound for final disposal indicates how much resources are being used and thrown away. In the long run the resources from the environment may no longer sustain continued economic-industrial development. Moreover, the adverse impact on public health may be irreversible.

Concerns over environmental degradation and depletion of natural resources resulting from increased urbanization and industrialization, as well as improper disposal and non-use of wastes, have given impetus to the development of alternative schemes. Emerging ideas point to the possibilities of waste minimization by reducing volume and increasing recovery or reuse, thus avoiding rapid loss of environmental resources. Wastes properly collected and disposed of present no health hazards nor danger to the environment. In this sense, waste management systems promote environmental conservation and human development (upliftment of the health and quality of life of the people).

Wastes are generated at centers of human activity. These are then collected and disposed of by the local governments. Altogether, changing attitudes and behavior styles have contributed to the rising volume of wastes.

What has been done to stem the tide? It is common to lay the responsibility on the government as waste collection and disposal has been traditionally part of its menu of services. It is also expected to regulate the behavior of individuals, industries and businesses. The thing is that people complain but not very many want to act. Some think that the matter should be left to the technical experts and politicians. Others believe that the situation is not yet serious because the problem has not reached their backyards. People in poor and low-income communities are accused of indiscriminately discarding waste, or putting themselves at risk by scavenging. Industries and businesses pollute the air, water and land. They are responsible for handling their wastes properly. The government is expected to set the standards and monitor compliance.

As current practices, technologies and systems of waste management have become obsolete, the call is, "Something has to be done!" The betterment

of the future lies in doing something now, in looking for alternatives and initiating action that captures and energizes public consciousness. An apt statement recently often quoted says, "Waste is a resource that has not yet found its rightful place for use."

Considering the concern over the critical situation of waste management, this study presents an overview of current trends, state-of-the-art disposal technology and issues on solid waste management. It seeks to clarify the various ways of identifying and defining solid wastes. It explains the magnitude of the problem, the prospects of waste resource recovery for sustainable development and the need to call for nationwide public attention. These problems and issues are discussed within the context of urbanization and industrialization.

Various groups have taken action in the past 20 years to deal with the rising problems of waste management. This study describes their efforts, their areas of agreement and their differences.

This study attempts to bring out an overall picture of the issues that must be addressed by policymaking, program and institutional interventions for sustained action and effective results. It highlights the following areas of concern:

1. choice of technology and system of waste management;
2. science and technology research, feasibility and pilot study on alternative, affordable and appropriate technologies;
3. policymaking-legislation at national, city and municipal levels;
4. financing schemes for solid waste management systems, programs and projects;
5. public and private partnerships and social participation;
6. market and product development for reused wastes;
7. program and project development, organization and management, institutional arrangements; and
8. values formation, behavior and lifestyle changes.

The author made use of available literature and materials on the subject and undertook roundtable discussions, consultation meetings, interviews and

discussions with various persons in government, nongovernment organizations and academe who are involved in solid waste management programs, projects and research. She visited the sites of selected projects such as the transfer station in Las Piñas, Rizal, the sanitary landfill in Carmona, Cavite, community-based ecological waste management projects and composting projects in Sta. Maria, Bulacan and Fort Bonifacio.

The following experiences also provided data and insights: volunteer participation in designing and conducting the perception survey for a market waste management program; participant observation in training, organizing of core members and conducting community diagnosis for a pilot community-based ecological solid waste management; organizing a network of research and extension units to work on ecological waste management; convening a conference workshop; and organizing a series of roundtable discussions on ecological solid waste management.

A limited exploratory survey in Metro Manila addressed the following objectives:

- to identify the projects and the people and organizations engaged in alternative technologies for solid wastes;
- to determine the efforts undertaken by government, private and nongovernment organizations — their approach, line of activities, implementing schemes-strategies and results; and
- to present the lessons learned in initiating and sustaining alternative technologies.

Interviewed were representatives or officers of NGOs and community associations. Brochures, handouts and news clippings were also utilized.

This study is funded by the University of the Philippines Center for Integrative and Development Studies (UP CIDS) that recently convened the program desk for Solid Waste Management. This expresses the institutional response of the university to the rising concern for solid waste management. Through research and public service, the UP CIDS aims to contribute to policy formulation and the development of programs and projects to improve the services of the government and mobilize people's action for their own welfare.

Call for Nationwide Attention

Three main concerns call for nationwide attention on solid waste management and waste resource recovery. One is the magnitude of the problem of waste generation, collection and disposal. The second pertains to the prospects of recovering resources from waste discarded by its original or previous user. This view treats waste as a resource. By using alternate technologies and systems, recycling and reuse can be possible. The third concern raises the imperative for lifestyle changes — in values, attitudes and critical behaviors.

Problems with Traditional Solid Waste Management

The United Nations Commission on Human Settlements (Habitat) has cited rapid urbanization and growth of industry and services as key features of demographic and economic development in most developing countries (UNCHS Promotion of Waste Recycling and Reuse in Developing Countries, Manila, January 1993, pp. 1-8). The increased population in the cities and the rise of more businesses and industries have produced a greater volume of wastes.

Where poor and low-income groups have settled as squatters with no amenities such as water, toilets and space, all sorts of wastes can be found wantonly discarded in canals, *esteros* and streets. These have resulted in seriously degraded urban environments and health problems.

The next problem is the government's lack of funds. Government cannot cope with the increasing volume of waste. What is more, communities have now protested against open dumpsites, landfills and incinerators, regarding these as threats to the environment. Furthermore, open dumpsites and landfills pollute the air and cause respiratory problems for people who live near them. In the long run, groundwater can be contaminated and become unsafe for drinking and washing. Hazardous and toxic wastes may also be mixed with other types of wastes in the dumpsites. By now, existing dumpsites have started to overflow or reach their maximum capacity. When other dumpsites are considered, the people in those localities protest. Sanitary landfills for waste disposal cannot be set up in sites not suitable or acceptable to the public.

A related problem is that of scavenging by poor people as most graphically shown in Metro Manila's "Smokey Mountain." A study on their health shows the prevalence of respiratory problems, especially among children who suffer from stunted growth, malnourishment and parasitism. The round-

the-clock smoke, the presence of hazardous and toxic wastes, the flies and the stench are just some of the hazards confronting the scavengers and their families (Torres, 1994).

The problem can be summed up thus: increasing volume of solid wastes, lack of disposal sites, ineffective age-old system of disposal by open dumping and landfills and environmental degradation and dangers to health.

Prospects of Waste Resource Recovery and Sustainable Development

Alternative remedies are being tried in many parts of the world. This trend is compelled by a number of factors.

First, the informal system of scavenging and trade of retrieved wastes has resulted in the recovery and the reuse of certain wastes. Someone's waste has become another's resource. Various reports on the waste management systems in the municipalities and cities of Metro Manila (World Bank Study, 1992), Cebu (Ballescas, 1995), Olongapo and Bacolod (Peralta and Valencia, 1992), Batangas and Baguio (EMB, 1995) and even in other Asian countries (Cointreau, 1984) show that this informal system has provided income and livelihood for the poor. Itinerant scavengers would sort garbage into containers as they moved from place to place. Others concentrate at the dumpsite to retrieve still reusable items. They clean and process the materials for their own needs, or sell these directly to users or to small buy-and-sell entrepreneurs. The recovery and reuse of discarded paper, bottles, scrap metal and other wastes have been going on for a long time. But not until recently has scavenging been seen as having positive value for society.

Second, the increasing volume of waste generated and disposed of indicates the expanding amount of resources taken from the environment to be used and then discarded. In the long run, this will lead to the depletion of limited natural resources, both renewable and non-renewable.

Third, most studies point to the strains of industrialization on natural resources and the negative effects of increasing pollution, affecting the quality of the air we breathe. Industrialization also drives people from the rural areas to move into the cities and urbanizing sites. Many eventually settle in slums or "squatter" communities where improper waste disposal causes environmental degradation.

The search for alternative ways to handle wastes from the point of its production to its final disposal stemmed from the observation that wastes can be reused. Reuse, in turn, can avert depletion of natural resources and degradation of the environment.

The basic underlying idea is to retrieve reuseable wastes after disposal either for recycling or for use as new materials for new technologies or products. This system reduces the amount of wastes to be finally disposed of and results in cost savings and energy and resource conservation.

Resource recovery is now the alternative perspective that can make wastes useful in subsequent rounds of use and reuse. This contributes to **sustainable development,** meaning development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Report).

The concept of sustainable development was popularized in the publication entitled *Our Common Future* (Brundtland, 1987), based on the findings of the World Commission on Environment and Development set up by the United Nations in 1983 (Green Forum, Training Manual on Zero Waste Management, 1994, p. 3). The Commission, headed by Gro Harlem Brundtland, Prime Minister of Norway, pointed out that resources are limited and that the prevailing growth economic model has spawned the degradation of natural resources. Development is different from growth and quality of life does not necessarily mean consumption (p. 4). Resource recovery in solid waste management contributes to sustainable development because it conserves natural resources, making it available for man's continued use in the long term.

Attention has thus been directed toward alternative, appropriate technologies that can minimize the generation of wastes at its sources and maximize the use of wastes by recovery, recycling and reuse. Alternative technologies are expected to be affordable, efficient and economical with positive impact on health and environment.

The UNCHS initiated the study of practices and systems of recycling domestic waste and their socioeconomic, environmental and health impacts in the cities of Bangkok (Thailand), Jakarta (Indonesia), Kanpur (India), Karachi (Pakistan) and Manila. The reports covered existing formal and informal waste recycling systems, which for a long time remained unnoticed as mechanisms for reducing disposable wastes and finding new uses for throw-aways (UNCHS,

Sypnosis of City Studies on Waste Recycling and Reuse in Developing Countries, Manila, January 1993).

Waste minimization encompasses a range of activities directed at source reduction, resource recovery and treatment. Source reduction refers to activities that lessen the generation of waste at its source. Resource recovery involves reducing the amount and/or the toxicity of waste to produce valuable material or energy that is thereafter useful. Treatment as part of waste minimization refers to reducing the amount and/or toxicity of waste without generating valuable material or energy (Jago, et al., 1995; UNCHS Waste Recycling and Reuse, 1993; IEMP, 1995). Through these alternatives, the concepts of reuse, recycle and alternative utilization displace the old way of thinking that waste means to throw away or discard.

Altogether, the appropriate technologies for source reduction and resource recovery have been collectively called "clean technologies" or "low- and non-waste technologies." Other terms used are: environmentally sound technology, environmentally benign technology, waste recycling, residue utilization and waste recovery. In the Philippines, the terms often heard are zero waste, waste recycling or the 3 Rs (reduce, recycle, reuse). (Green Forum Data Bank, Training Module on Resource Recovery).

The alternatives call for shifts in perspectives, approaches and processes. There are good reasons to explore the possibilities of new technologies for handling waste. On the one hand, government has found it difficult to adequately provide the services for collection and disposal of solid waste. The usual technologies have created problems to health and environment. On the other hand, alternative technologies offer benefits to health and environment, to economy and livelihood, to social participation of communities, industries and institutions. Being new, the faults of these technologies are not yet obvious. It is now opportune to look into them and determine how best to maximize their strengths and avert their weaknesses and negative consequences.

Alternative and appropriate technologies in waste management can be appreciated and analyzed in the context of the conventional systems. Understanding the processes in the conventional systems and the problems they have created can point to the areas for intervention and the possible barriers to the installation of alternative systems.

Imperatives for Lifestyle Changes

The shift to the perspective of sustainable development and the alternative approaches to solid waste management entails changes in lifestyle — attitude and behavior patterns. It underscores the participation of the people as agents of change and the need to ensure that development is directed towards the socio-cultural, biological and spiritual benefits of the people. The emergent technologies-systems require changing attitudes and practices, as well as adjustments in the patterns of consumption and waste generation.

The Treaty on Consumption and Lifestyle agreed on at the International NGO Forum held in Rio de Janeiro, Brazil in 1992 seeks to promote self-reflection on consumption and production patterns. It seeks attention to the meaning of quality of life based on human relationships, creativity, cultural and artistic expressions, spirituality and reverence for the natural world as against increased consumption of non-basic material goods. It also calls for the restoration of life support systems — forests, seas, rivers, soil, atmosphere — to their previous state of ecological health and sustainability (Green Forum, Training Manual on Zero Waste Management, pp. 6, 16-17).

In sum, changes in solid waste management obligate people to re-examine and alter lifestyles and policies that use up essential resources, create wastes and degrade the environment. These should give way to lifestyles and policies that increase the recovery of materials and energy so that today's progress will not be achieved at the expense of future generations.

Chapter 2

People, Urbanization, Waste Resources

The rapid urbanization and industrialization now taking place in many countries, including the Philippines, impact a great deal on waste management. The congestion in cities provides the backdrop for the way people create and dispose of their wastes and use land and resources from the environment.

The Urban Environment

Where People Are There are Wastes— Population and Urbanization

It is said that "where people are there are wastes." Where rural folks have been attracted to the cities in search of a better life, they are introduced to and assimilated in communities characterized by new ways of living different from that of the rural. These include new modes of production and exchange and various types of employment in industries, trades and services. Eventually this urban influx has brought about overpopulation, lack of employment and many forms of imbalances such as seen in waste generation and waste disposal (Valencia, 1994, p.1).

The problem of solid waste appears to be more intense in the urban areas — in cities and town centers. What would be found in an urban area? According to the 1990 Census of Population and Housing (cited by Valencia, 1994, p. 2), urban areas consist of:

1. In their entirety, all cities and municipalities having a population of at least 1,000 persons per square kilometer.
2. Publicans or central districts of municipalities and cities which have a population density of at least 500 persons per square kilometer.
3. Publicans or central districts (not included in 1 and 2) regardless of the population size which have the following:
   a. Street pattern, i.e., network of streets in either parallel or right-angle orientation;

b. At least six establishments (commercial, manufacturing, recreational and/or personal services);

c. At least three of the following:

- town hall, church or chapel with religious services at least once a month;
- public plaza, park or cemetery;
- market place or building where trading activities are carried on at least once a week;
- public building like a school, a hospital, a puericulture and health center or library.

4. Barangays having at least 1,000 inhabitants that meet the conditions set forth in 3 above and where the occupation of the inhabitants is predominantly non-farming or non-fishing.

The problem with solid waste management cannot be taken away from its context of population growth, urbanization and industrialization (UNCHS, 1993). The United Nations Commission on Human Settlements (Habitat) estimated that 1.9 billion people would be living in the urban areas of developing countries by the year 2000. Urban growth in the Philippines was estimated at 1.5 million per annum and 750,000 to one million people stay in inaccessible areas for proper waste management. In 15 years, the estimate is that 12 million low-income people will be generating about 4,000 tons of waste a day, most of which will be uncollectible (EMB-IBRD, vol. 1, 1995, p.22). The Philippines is said to have "crossed the threshold to become more urban than rural" sometime in 1992-1993, such that in 1995 some 36 million of probably 68 million people in the Philippines are considered "urban" (EMB-IBRD, p. 22).

Solid waste management is more difficult in urban areas than in the rural areas. Waste disposal in the rural areas is said to be more environment friendly because garbage can be easily classified and there is plenty of space for its dumping (Pujalte, National Security, 1993, p 6). Food intake outside the home does not abound in the rural areas as much as in the urban, with its restaurants. Leftover food can be used as feeds for animals; a compost pit can be set up. Rural communities can be easily organized for some ecology-friendly technologies. By contrast, solid waste problems "only arise" in urban areas because of urban growth and dense illegal squatter settlements without garbage collection services.

The impact of population growth and urbanization can now be seen in the Philippines, in terms of the volume of wastes generated, with corresponding impact on the environment. Waste management will definitely be a major concern as urbanization advances into metropolitanization. This is shown by the situation in Metro Manila, which now covers the original four cities and 13 municipalities, plus the three municipalities transformed into cities, under a Metro Manila Development Authority (formerly Metro Manila Commission in 1975 and Metro Manila Authority in 1990). The waste management problem has reached a critical point with increased population and services. The Metro Manila or National Capital Region population is also said to expand during the daytime because of the influx of workers and students from nearby regions of Pampanga, Bulacan, Rizal, Cavite and Laguna (Padilla, 1993).

The Philippines has 14 regions with most of its local government units situated in rural rather than urban areas. But urbanization processes are fast outstripping rural development. Other regional areas are also in the process of developing into urban metropolises as in Cebu and Davao. The areas of Cavite, Laguna and Batangas are undergoing the stages of eventual industrial development. Consequently, the volume of wastes generated will increase. This will place the burden for solid waste management on the local governments under the devolution provisions of the Local Government Code.

Government services can hardly cope with increasing quantities of solid wastes. Local government units will also have to confront the pressures on the environment for food production, absorption of pollution and decreases in the stock of resources (Fuentes, 1993, p.2) The technologies used in the fast pace of urban life damage the environment. The situation definitely is a challenge to proper resource management.

Wastes and Waste Resources

Increased activities in the urban areas tend to produce volumes of waste, particularly **solid wastes,** described as "all wastes arising from human and animal activities that are normally solid and are discarded waste materials, which are often reuseable and may be considered a resource in another setting" (Valencia, citing George Tchobanogious, 1994, p.5). Another definition includes industrial activities as an additional source (EMB-IBRD, 1995, p.5)

Solid waste is distinguished from other kinds of waste such as **garbage, trash, litter, rubbish, dirt, disposable, throwaway, discard, valueless, useless, worthless, junk, reject,** etc. But according to Mrs. Luz Sabas of the Philippine

Recycling Movement, it is simply called in one word in Pilipino: *BASURA* (Handbook, 1994, p.15).

While garbage and refuse usually refer to solid wastes, there are various terms for specific types of wastes according to source and to nature. **Domestic waste** means garbage from households as distinguished from industrial waste, agricultural waste, or hospital waste. **Municipal waste** is used to refer to solid wastes from households, commercial establishments, markets, industries, institutions and streets.

Domestic solid wastes from various countries, particularly in the Asian Metropolis, have been found to consist of paper, glass, metal, plastics, textile, wood/grass, food wastes and ash/soil (Ouano, Imperatives for Recycling and Resource Recovery, 1993, p. 1).

Table 1
Typical Composition of Solid Wastes in Asian Metropolis

Composition	Bombay	Bangkok	Kuala Lumpur	Tokyo
Paper	10.00	13.90	11.70	42.00
Glass	0.20	2.00	2.60	1.20
Metal	0.20	1.80	6.40	1.20
Plastics	2.00	11.00	7.00	1.60
Textile	3.60	6.90	1.30	3.80
Wood/Grass	20.00	14.90	1.20	4.70
Food Wastes	20.00	36.50	63.70	32.90
Ash/Soil	38.00	12.60	0.90	0.10
Others	6.00	0.40	0.00	5.60

Source: E.A.R Ouano. Imperatives for Recycling and Resource Recovery. Seminar Workshop on Partnerships Towards Responsive Solid Waste Management in Southeast Asia, Penang, Malaysia, 1993; UNCRD (1988) Compendium of Facts and Figures on Solid Waste Management in Asian Metropolis.

The study on Metro Manila showed that its solid waste is composed of

food and kitchen wastes (31.7%), paper (9.8%) and cardboard (4.7%), textiles (1.3%), rubber and leather (1.1%), screenings (< 10mm, 16.9%), plastics (film, 5.9%; hard, 1.6%), yard/garden trimmings (7.7%), other combustibles (6.1%), metal (4.9%), glass (2.7%) and other noncombustible (4.6%). These were taken from residential areas (48.63%) , markets (12.91%), commercial and industrial sites (11.20%), construction and demolition (1.1%), institutions (5.16%), streets (18.45 %) and others (2.3%) (Passe, Jr.:1993, pp. 1-4).

Solid wastes have been generally viewed as materials that are no longer useful, have become unwanted and have to be discarded. A material is said to be waste when the owner or producer discards it with no intention of being paid for its inherent value (Cointreau, p.7).

At the point of disposal, solid wastes can be classified as (1) degradable or biodegradable and (2) non-degradable or non-biodegradable (recyclable/reuseable). Wastes can also be classified as toxic (hazardous) or nontoxic depending on metal content; combustible or noncombustible depending on moisture content (EMB-IBRD, 1995, p.5).

Biodegradable wastes are those made of natural raw materials and can be easily decomposed by natural processes. **Non-biodegradable wastes** are made of synthetic raw materials which require special treatment or process before disposal to minimize or eliminate its adverse impact on the environment. (Manimbo and Nombres 1994, p.1; Sabas 1994, pp. 3-4)

Municipal waste can still be further classified according to nature and source as follows (Manimbo and Nombres):

1. Garbage - food residues, food preparation wastes and spoilings.
2. Rubbish - paper and paper products, metals, plastics, rubbers, rags, clothes, process residues, yard trimmings and woods.
3. Junk or abandoned vehicles and appliances and white metal products (used as refrigerators and airconditioners).
4. Industrial wastes - (organic and inorganic residues, hazardous materials, hazardous and toxic chemicals and wood and paper).
5. Mining and mineral wastes - (slags, tailings and culms).
6. Agricultural wastes - small and large animal wastes (manures), process residues, fertilizers and erodable soils.
7. Special wastes - bulky wastes, sewage residues, street sweepings, pollution control residues, pathological (hospital) wastes,

nuclear wastes (radioactive isotopes) and construction and demolition debris.

According to its source, solid waste can be classified as (1) municipal-industrial, derived from households, markets, offices, schools, businesses, factories and industries; (2) mining and minerals, (3) agricultural and nuclear. (Ballescas: 1995, p. 2 citing Moran, Morgan, Wiersma, 1980).

Another group of solid waste comes from hospitals (public and private), clinics, laboratories, research offices and other institutions performing similar functions and storing, collecting, disposing of hospital solid waste (DOH Operational Manual on Hospital Solid Waste Management). Hospital wastes could be any of the following:

1. General Waste - generated from domestic types of hospital activities (kitchen, canteen, packing materials of drugs and related materials classified as noninfectious including housekeeping, building and ground waste; ward sweepings, laundries and hospital compounds sweepings and other debris.
2. Pathological Waste - includes tissues, organs, body parts, human fetuses, animal carcasses, blood and body fluids coming from patient services.
3. Radioactive Waste - generated from the nuclear medicine section, x-ray and therapeutic procedures that is in solid, liquid and gas form contaminated with radionuclides.
4. Chemical Waste - generated from diagnostic and experimental sections, research sections, cleaning and disinfecting procedures; classified as hazardous and non-hazardous in the form of gas, solid and liquid chemicals.
5. Infectious Waste - generated from surgery and autopsies on patients in isolation wards, dialysis sections and other potential wards and hospitals.
6. Sharps - needles, syringes, scalpels, saws, blades, broken glass, nails and the like.
7. Pharmaceutical Waste - generated from pharmaceutical products such as drugs and chemicals.
8. Pressurized Container Waste - containers or compartments that can be separated and maintained at constant atmospheric pressure.

Certain wastes are called **toxic and hazardous waste (THW)**. Often

toxic is interchanged with hazardous. Such kinds of wastes are also referred to as special waste or difficult waste. When there is significant threat to the environment, to people or to any part of the ecosystem, including plants and animals, the waste may be considered hazardous whatever the quantity, nature and degree of danger. This includes solids, liquids or sludges that can cause harm. Without a universal definition or classification system for THW, there are types that may simply be considered toxic and hazardous (Jago, et al. 1995, pp. 3-4):

- Inorganic Wastes - acids, alkalis, cyanide wastes, heavy metal compounds, asbestos wastes and other solid residue — dusts, sludges from metal manufacturing
- Oily Wastes - including waste oils that may be contaminated with toxic materials such as heavy metals and chlorine compounds
- Organic Wastes - including halogenated and non-halogenated solvents, highly toxic compounds as polychlorinated biphenyls and dioxins, paint and resin wastes, biocides as those from agrichemical industries and other organic chemical residues
- Other Wastes - including hospital wastes, laboratory chemicals and explosives.

Traditional vs. Alternative Approaches

While THWs are generally found in manufacturing and chemical industries, it is important to recognize that "ordinary" municipal solid wastes contain such dangerous materials, particularly in developing countries where wastes are not sorted and collected separately (Jago, p. 5-6). The so-called "invisible pollution" takes place when toxic and hazardous wastes "release gases and particles to the atmosphere, discharge liquids or sludges to surface water and contaminate the ground by solids, liquids or sludges." The long-term problems arise from leakages that can contaminate the ground water many years after.

Handling solid wastes from whatever source and type involves several functional components (Valencia; Manimbo and Nombres; Peralta and Valencia, 1992):

1. waste generation - throwing away or collecting disposal materials having no value;

2. separation of wastes and recycleables - done by scavengers (people who recover certain types of wastes for their own use or for sale to others) or by the crew-personnel of the management system;
3. collection - gathering solid wastes and recycleable materials and transporting and depositing them at the dumpsites; and
4. disposal - finally doing away with wastes in dumpsites and sanitary landfills, or by other methods.

Problems of the waste management system in many parts of the Philippines today can occur at each of these functional components. At the waste generation stage, it is important to determine what kind of human activities and lifestyle produce what waste, how much and where and how they dispose of it. Waste sorting is a much-needed process to identify what is biodegradable and non-biodegradable; what can still be reused and recycled; at what quantity it will be profitable for business and livelihood to retrieve or recycle it. Choices and decisions are critical in setting up the appropriate system for storage, collection and disposal, with as minimum negative impact on health and environment as possible.

At this point in time, the situation has reached a critical stage as more wastes are generated than can be collected and disposed of properly.

A positive aspect, however, is that there are immense possibilities for resource recovery from waste. There is "*Pera sa Basura*" (Wealth in Wastes). With alternative technologies and systems, labeled "ecological" or "clean technologies, low- or non-waste technologies," wastes can be recycled and reused, that is, converted into energy, or reprocessed for reuse. The wastes then become resources. The possibilities of recovering resources from wastes generate hopes of resolving the problems of ill health and environmental degradation arising from mounting garbage and lack of proper disposal sites.

Chapter 3

Magnitude of the Problem

The urgency with which the government, the private sector and the citizenry will act to resolve the solid waste problem depends on a number of factors. Simply put, a serious disaster or a major inconvenience can jolt public attention toward change. However it is expected that with growing awareness of the magnitude of the problem, various sectors can move with foresight to set up remedial measures leading to sustained and long-term benefits.

A solid waste management system involves technologies, processes-operations dealing with waste generation, storage, collection, transport, treatment and disposal. One side of the problem pertains to the volume of wastes generated at various sources and the manner of segregation and storage. The other side concerns collection, treatment and disposal of wastes using traditional open dumpsites, landfills and incinerators mainly undertaken by government. To some degree, businesses and industries, institutions and households work on their own waste management systems.

Available studies on sample areas as Metro Manila, Cebu City, Bacolod City, Olongapo City and Batangas City provide insights on the extent of the waste problem and the state of local government services. The causes and consequences, the deficiencies of the current system, can be gleaned from the case studies undertaken by various agencies. A holistic perspective of the government system, on the other hand, can help identify remedial policies, programs and institutional mechanisms.

The experiences and lessons in Metro Manila (National Capital Region) are highlighted because of the critical problem in the area. Regional urban sites are presented to indicate related difficulties with waste management at the regional, subregional and national levels. In the final analysis, a nationwide system of solid waste management that can respond to common and peculiar concerns must be adopted. Given the implementation of the Local Government Code of 1991, however, the imperative falls on local government units to respond to the problem.

Conventional Solid Waste Management In Metro Manila

Metropolitan Manila, known as the National Capital Region (NCR), occupies an area comparable to Singapore at 636 square kilometers. As of 1990, registered inhabitants totalled eight million in its four cities (Pasay City, Quezon City, Manila, Caloocan City) and 13 municipalities (UNCHS Study, Regional Workshop on Waste Recycling and Reuse, Manila 1993). The then municipalities of Pasig, Mandaluyong and Makati have now become cities. It is said that Metro Manila has a night time population of eight million, but a daytime population of nine million, as students and workers commute daily into the metropolis from as far as Bulacan in the north and San Pablo City in the south (Ouano, 1990, p. 3).

The city of Manila alone has an estimated population of about two million with a growth rate of 2.67 percent per year (Manimbo and Nombres, 1994, p.3). In the area around five river basins in the NCR covering 215 square kilometers, the squatter population was estimated at 1.6 million people in 1990 and projected at 1.8 million in 2000 (DENR, Pasig River Rehabilitation Secretariat, 1993, 9). Adjacent to rivers are communities of some 60,000 to 70,000 squatters.

In the face of continued population growth and squatter formation and rapid industrial and commercial development, government services for garbage collection and disposal have been found wanting. The common observation is that people are apathetic and indifferent toward garbage issues.

According to Salvador Passe (1993, p. 5), field investigations showed that the percentage of the urban population served by solid waste collection systems varies from 17 to 70 percent. Squatter communities in the peripheral and depressed areas usually cannot be reached by collectors because these are located in riverbanks, *esteros* or in areas where the roads are too narrow, preventing access of collection trucks. The depressed areas have not been provided with collection services to discourage the people from staying in such places which are denied of basic amenities. Despite this, people have kept coming as indicated by the increasing numbers of squatters in the cities, by uncontrollable migration of displaced people from equally poor rural areas and of those driven away by natural calamities (Valencia, 1994). Also, the lack of discipline among the residents of Metro Manila aggravates the problem.

Since squatter areas do not have garbage collection services, the people throw garbage in *esteros* or waterways, as in the cases of the Pasig River (DENR Pasig River Rehabilitation Secretariat, 1993) and Maricaban River in Malibay, in four creeks in Pasay and the southern district of Metro Manila (Valencia, 1994, p.9). This is a common scenario in many squatter colonies in Metro Manila.

From 1988 to 1990, collected garbage in Metro Manila increased by more than 10 percent with no formal system of waste separation but with scavengers collecting recyclables at source, during collection or at the disposal sites. According to Dr. Leandro Viloria, the number one environmental problem in Metro Manila is solid waste management as the 3.3 kg per capita in 1982 increased to 4.5 -5.0 kg per capita in 1986, to about 5.5 kg per capita in 1990 and to 6.5 kg per capita in 1992.

Manila, compared to neighboring cities and municipalities, generates the largest volume at 30 percent of Metro Manila's total daily garbage, followed by Quezon City at 19.20 percent. The waste generation, increasing since 1979, has been found to be highest among the high- and middle-income groups. About 50 percent of total volume of garbage come from residential and domestic sources and 26 percent from commercial and industrial activities. With respect to type of waste, about a third of Metro Manila's garbage is food and kitchen waste, 16 percent is screenings, 10 percent is paper and 8 percent is yard waste (UNCHS Study, 1993).

In Metro Manila, wastes are usually stored in various types of containers and then brought out for collection by government trucks or private haulers contracted by the MMA (Passe, 1993, p.4-7). The containers are usually metal or plastic pails, used supermarket or grocery bags and sacks or cardboard cartons. It was noted that households in affluent areas used plastic refuse bags which are more sanitary, easy to handle and reduce pickup and collection time and costs. There were also cases where communal containers were overly filled up. Some households have built their own garbage pits and done some composting.

The local governments of Metro Manila cities and municipalities are responsible for the collection and disposal of solid waste. The city/municipal council has a committee to oversee the complaints of residents, and at times would negotiate for possible disposal sites.

The Local Government Code of 1991 or Republic Act No. 7160 gave

Table 2
Population and Solid Waste Generation Rate

Cities and Municipalities	Population (1989)	Area (sq.m.)	Density (pop/sq.km.)	Est. Solid Waste Generation Rate (tons/day)
Caloocan City	619,500	53	11,689	310
City of Manila	1,910,300	39	48,982	955
Pasay City	376,500	9	41,833	188
Quezon City	1,590,600	154	10,328	795
Malabon	249,400	23	10,843	125
Navotas	168,700	9	18,744	84
Valenzuela	374,100	47	7,960	187
Mandaluyong	262,200	27	9,711	131
Muntinlupa	233,400	47	4,966	117
Paranaque	326,400	38	8,589	163
Makati	470,800	30	15,693	235
Pateros	56,800	2	28,400	28
Pasig	402,000	31	12,968	200
San Juan	155,150	16	9,694	78
Taguig	199,000	34	5,853	100
Las Pinas	290,000	42	6,905	145
Marikina	309,500	39	7,910	154
TOTAL	7,993,350	640	-----	4,025
AVERAGE	-----	-----	12,490	-----

Source: Dr. Ely Anthony R. Ouano. First Multisectoral Consultation on Solid Waste Management. DOST, Bicutan, Taguig, Metro Manila, 1990.

the responsibility for collection of solid wastes to local government units. On the other hand, the Metro Manila Development Authority (MMDA, created by RA 7429 effective March 1995) supervised basic services in the cities and municipalities that comprise Metro Manila, including garbage collection and cleanliness. It concentrated on transfer and disposal, while the local government units took charge of street sweeping and collection (EMB-IBRD, 1995, p.25)

The MMDA today evolved from the Metro Manila Commission set up in 1975 under the Marcos government (PD 824, November 7, 1975) to take the responsibilities of solid waste collection and disposal from local government. After the February 1986 revolution, the Metro Manila Commission was renamed Metro Manila Authority by President Aquino (Executive Order 392, January 9, 1990).

The MMA received some 116 trucks donated by the Japanese government in 1987 and 1988, half of which broke down after two years (Ouano, 1990, p.9). Recent data show it has 20 garbage contractors, with 244 dump trucks.

Garbage collection crew start at the office of the Environmental Sanitation Center, then follow a routine of picking up trash containers at street curbs or designated collection points or right from the houses. The streetcleaners also collect from public areas including markets. Then the trucks return for the measurement of their load, which should be full, then proceed to the transfer station or the disposal site where the checker takes note of trip tickets as indications of work done. Some commercial centers and high-income areas engage their own collection contractors but dumping is done in the sites of the MMA/MMDA. The MMDA does collection twice or thrice a week according to the volume of garbage.

The collection vehicles bring the load of wastes to the transfer station set up in Las Piñas — said to be useful only to nearby Makati, Parañaque and Pasay. At the transfer station, the garbage is unloaded and then compacted and brought by the transfer station compactor trucks to the sanitary landfill in Carmona, Cavite (Site Visit, August 1995)

In Manila, the collection rate has been placed at 85 percent efficiency, equivalent to 1,700 tons. The remaining 15 percent of uncollected wastes are those dumped in *esteros*, vacant lots, roadsides and riverbanks. The city employs 1, 400 sweepers and 1,500 garbage collectors. It spends P336 million a year for the collection and disposal operations of the Department of Public Services.

Manila used the Smokey Mountain as its open dumpsite until its closure by Presidential Directive in May 1993. It now uses the San Mateo (Rizal) sanitary landfill and the Carmona (Cavite) sanitary landfill, which are some 40 kilometers outside of Metro Manila. The closure of the Payatas dumpsite in Tondo was scheduled in December 1994. Manila uses the transfer station in Las Piñas to reduce the turn around time of trucks from San Mateo and Carmona back to Manila. Manila has used the open dumping system for years and this has been attributed to the lack of knowledge of and expertise in other technologies (Manimbo and Nombres, 1994).

The transfer station in Las Piñas was commissioned in May 21, 1993. Since then the volume of wastes brought to be compacted has followed an ascending pattern reaching 67,166.35 tons. Peak seasons at the transfer stations occur before and after Christmas as the volume of wastes increases and manpower is not available because of the holidays. During the rainy season, some of the personnel do not report for work (interview, MMDA).

The local governments generally use landfilling or landspreading as a disposal system (Valencia, 1994, p. 11). As of 1990, the list of disposal sites, mainly open dumpsites in the NCR targeted for subsequent closure, included (MMDA):

1. Payatas, Area 3, Fairview, Quezon City
2. San Miguel and Miapayo, Pinagbuhatan, Pasig - servicing Pasig, Mandaluyong, Makati; commissioned in 1979, 10 hectares; using line for site control, with 6 bulldozers
3. Barangay Karuhatan, Valenzuela; Malinta, Valenzuela - servicing Valenzuela; commissioned in 1977, 6 hectares; using insecticides for site control, 4 bulldozers
4. Napindan, Taguig - servicing Taguig and Pateros; commissioned in 1977, 2 hectares; using insecticides for site control, with 2 bulldozers
5. Barrio San Antonio, San Pedro, Laguna
6. Letre, Malabon
7. Balut, Tondo (Smokey Mountain), Manila - servicing Manila; commissioned in 1954, 8 hectares; using line and insecticides as site control, with 8 bulldozers, now closed.
8. Tiangco Property, Quezon City - servicing Quezon City and San Juan; commissioned in 1976, 18 hectares; using line and insecticides for site control, with 6 bulldozers.

9. J. Felipe, Caloocan City - servicing Caloocan City, Malabon, Navotas; commissioned in 1965, 2 hectares; using insecticides for site control, with 2 bulldozers
10. Pulang Lupa, Las Piñas - servicing Parañaque, Las Piñas, Pasay; commissioned in 1976, 2.5 hectares; using insecticides for site control, with 1 bulldozer
11. Tunasan, Muntinlupa - servicing Muntinlupa; commissioned in 1970, 2 hectares; using insecticide for site control, with 1 bulldozer
12. Montalban, Marikina - servicing Marikina; commissioned in 1977, 2 hectares; using insecticides for site control, with 1 bulldozer

The sanitary landfills in San Mateo, Rizal (1991) and in Carmona, Cavite (1993) were prepared in anticipation of the closure of open dumpsites starting with the Balut dumpsite in Tondo, called Smokey Mountain. By the year 2000, MMDA sources disclosed that the disposal sites in Camarin, Kalookan, in Letre, Malabon and in Karuhatan, Valenzuela have been closed while Catmon in Malabon continued to function. The Payatas open dumpsite was scheduled to be closed in December 1994 but continued to operate until the trashlide in July 2000 that buried the residents nearby whose livelihood came from the retrieval of wastes for recycling.

The sanitary landfill at the hilly area of Carmona, Cavite was opened May 21, 1993 with an area of 5 hectares in the interim phase with lifespan of three years. The area for the next phases was set at 10 hectares to last till six to seven years. It has a leachate consisting of flocculation and filtration and a biological treatment to be set in place consisting of one facultative pond and two maturation ponds lined with concrete (Valencia, 1994). It operates 24 hours daily. When filled up, the area will be used for housing settlements. The site visit (August 1995) showed that garbage compacted at the transfer station in Las Pinas is unloaded into the sanitary landfill and sprayed with insecticides and disinfectants to remove odor. The wastes are spread out by bulldozers and covered with clay soil daily.

The disposal site opened in 1991 in San Mateo, Rizal has a total area of 57 hectares, with 15 hectares set for use in the opening stage, and another 35 hectares being planned for expansion. By 1999, nearby residents including those from Antipolo have staged protests and advocated the closure of this sanitary landfill. Since 1993, more than 13 hectares

have been filled up, and preparation is under way on four more hectares. The dumpsite services practically all cities and towns of Metro Manila, including the nearby towns of Cainta, Antipolo, Montalban and Taytay (interview at MMDA, September 1995). There are 12 to 14 bulldozers, but only four are owned by the government, donated by JICA. The rest are rented from contractors (interview).

Collection and disposal goes on 24 hours a day using an average of 300 trucks. The waste is bulldozed when unloaded by compactor trucks and after two to three days, again covered with six inches of clay soil. The long-range plan is to use the 50 hectares which are expected to be filled up in 15 to 17 years. It uses a leachate treatment method, a biological process and has a pond where the aerator is expected to be installed. (Valencia, 1994, pp. 12-13). The insecticides and deodorizers used for spraying to maintain sanitation are imported. The commissioning of a transfer station near San Mateo is being planned as of this time.

Disposal at different sites was placed at 90 percent of collected waste, as in Manila (Manimbo and Nombres, 1994). Generally, collection service is delayed and inadequate because vehicles are mostly old and dilapidated and there are not enough garbage collectors (Valencia, 1994). Tight budgetary allocation results in the lack of vehicles and in the failure to repair or replace obsolete ones or to buy spare parts for new ones (Passe, 1993, p.5)

Before disposal, scavengers may be found sorting out wastes that can still be sold at junkshops. The usual types are paper, ferrous and non-ferrous metals, glass, plastics and wood, all estimated to be worth P1 billion annually (Valencia, 1994, p. 11). The scavengers go house-to-house to gather reuseable throw-aways. But there are itinerant scavengers who rip open the thrash bins and plastic containers, leaving trash scattered about (Ouano, p.12).

Scavenging is also done by the collection crew to add to their income, which can delay their schedule on the route. At the dumpsites, children and women, even old people, join in the scavenging.

At the dumpsite in Smokey Mountain in Tondo, the health hazards had become enormous until its closure. Respiratory profiles of the residents were found worse than those of jeepney drivers, the children's, ten times worse than those exposed to ordinary pollution. Ill health among the scavengers at Smokey Mountain resulted from using dirty hands to eat with as clean water was not available, from foul smells and parasites and from hazardous wastes such as pesticides in discarded containers (Torres, 1994).

The studies conducted by the UP National Engineering Center (NEC) noted that "past studies which sought to tackle the perennial problem of inefficient solid waste collection system in Metro Manila has so far been unsuccessful (Peralta and Valencia, 1992, p.ii)." Observation and analysis also showed that the solutions recommended in the past were heavily dependent on the engineering aspect with little consideration to the sociological dimensions of the waste management problem. The NEC study team initiated the approach of taking into account both the engineering and nontechnical factors.

In Regional Urban Sites

With the spread of urbanization to other regional sites, concern has emerged over the appearance of problems similar to Metro Manila. Understanding the patterns in some regional cities can provide leads toward prevention.Other subregional areas may need attention as transactions are interrelated.Nationwide strategies may be necessary when the situation in many areas is similar.

Bacolod City. The volume of garbage collected in Bacolod as of accomplishment reports in 1991 totalled 34,946 cubic meters, most of which came from domestic sources. Waste generation was computed at 0.269 kg per capita per day, at 57, 612 households, with an average of five persons per household.

The study of the UP National Engineering Center (Peralta and Valencia, Bacolod 1992, p.9) reported that Bacolod City's wastes come from seven public and flea markets, 57,612 urban and rural households and commercial establishments, schools, offices, hospitals and construction works. It is composed mainly of degradable organics (43.9%), paper and cardboard (17%), metals (14%), glass (4%), plastics (3%) and others (16%). It was observed that the waste generation and waste characteristics in Bacolod City parallel those of the middle-income group in Metro Manila.

The city government made efforts to improve its system of waste management. Fees have been collected but the amount still falls short of the costs of making improvements. Collection has to be made more efficient particularly during the rainy months, although it is said that proper road design and all efficient flood control program facilitated the operations. Complaints have already been aired concerning the conditions at the dumpsites (p. 26-27).

The cleaning of streets, collection of garbage and operations for disposal in Bacolod City have been done mainly by the city government's Department of Public Services. Bacolod City's workforce includes some

190 permanent and casual employees. Its collection equipment, donated by international agencies or bought with government funds, consists of 14 trucks three of which are compactor type and others are either skip hoist or open dump trucks (pp.10-17).

The households usually store garbage in containers kept inside the house and brought to designated curbs when full, then returned to the house for the next cycle (Peralta and Valencia, 1992, pp. 10-13). Called the curbside method, this is used for the residential areas. An 8-cubic meter steel container is placed at specific areas for the households to dump their garbage. On collection day, skip-hoist trucks pick up the loaded containers and replace them with empty ones. The truck collection service proceeds to the transfer station for dumping.

The other method is door-to-door or alley-to-alley done in commercial areas and in market places, supplemented by skip-hoist operations where containers are placed in front of the houses on collection day (p. 15). This requires the use of a vehicle suitable for alleys.

The NEC study reported that Bacolod City has 14 trucks, three of which are of the compactor type and the others are open dump trucks or skip hoist. This kind of equipment has made it easy to retrieve reuseable items. For receptacles, the city has 60 container vans of 11.6-cubic meter capacity which can be replaced by skip hoist trucks. It has drum containers of 200-liters capacity. Business establishments use small cans, plastic bags, and sacks which are collected by compactor trucks (16).

The trucks usually start from the City Hall and move around their designated routes, then proceed with their load to the city's disposal sites for load verification and unloading. This is done usually at night to avoid traffic and delays except for the residential areas where collection is done at daytime. The Villa Esperanza dumpsite, 4 to 5 kilometers from the city proper, has an area of 6 hectares. This was planned as a reclamation site when filled up to capacity in two years and returned to the owners or used for a housing project. The city government does not pay the owners of the land but has built a building for two classrooms and a barangay health station for nearby residents who work as sorters at the dumpsite. The area is leveled for smooth passage and dumping and bactericides and rodenticides are sprayed over the pile daily for sanitation (pp.16, 30).

Another dumpsite used to be the Sta. Clara sanitary landfill, 7 kilometers away and accessible by the national road. Residents complained of

the foul odor, which forced the city government to stop its two-year operations (p.16).

Olongapo City. In its study of Olongapo's solid waste management, the UP National Engineering Center (Peralta and Valencia, Olongapo 1992) found a number of positive factors accounting for the "culture of cleanliness" in the city. It is said that the American development of Subic began in 1904. In the 1940s, American shore patrol groups would go to the residents and order them to clean up or else their properties would be confiscated. This has left a lifestyle wherein the people and the government help clean up garbage.

By now the city is 100 percent urban, with an estimated solid waste generation of 0.48 kg per capita per day or 590 cubic meters of solid wastes from a population of 310, 640. With a 160-cubic meter collection daily, only 61 percent of total wastes are collected.

Despite this shortcoming, the perception is that the city is clean. This is attributed to the efforts of the local government, people's participation in sorting and recycling, volunteerism, the involvement of women and values education focused on discipline. The city planning office worked on the lyrics of a song and sent it to Dyna Records. The song became popular and was used for inculcating values on cleanliness, waste management and health. The musical jingle announces the arrival of the trucks in the streets to collect garbage (pp. 13-15).

There is a visibly high degree of volunteerism and leadership by example. The vendors in public markets themselves help clean up their wastes. The women's NGO, Kabalikatan, lead by then Congresswoman Kate Gordon, mobilizes the involvement of the women (Peralta and Valencia, pp.20-22).

The city's Environmental Sanitation and Management Office takes charge of street cleaning, collection and disposal of garbage, with 132 employees. The waste generation rate in Olongapo is 0.39 kg per capita per day with a density of 232 kg/cubic meter. It has eight open dump trucks collecting 360 cubic meters of refuse per day from three public markets and 62,130 households. Other equipment are for dumpsite and river cleaning operations (p. 4).

The barangays organize their volunteer brigades for dredging canals and hauling volcanic debris. The government garbage collection crew moves around residential areas twice a week and in the commercial areas at night. The trucks proceed to the dumpsite, located 7 kilometers from the collection area, at Barangay New Cabalan in a ravine suitable for sanitary landfill.

Scavenging is allowed only at the dumpsite with 57 registered refuse pickers organized into quasi-cooperatives and provided with medical assistance. Scavenging inside the city is allowed only on certain days when there is no collection schedule. Recovered wastes are sold to dealers near the dumpsite and 30 percent deducted as the dealer's contribution to a community fund for the health care of the pickers and as hauling fee to bring recycled materials from dumpsite to dealer (8).

Batangas City. The attention on Batangas City finds significance in the context of its position in the Batangas subregion and the master plan for urban development of the CALABARZON area. The Batangas City urban area consists of three municipalities with a population of 309, 331. There is also the Lipa urban group with 182, 957 people and the Lemery urban group with 111,000 people (EMB-IBRD, vol. 4, 1995, pp.2-3). Batangas is part of the CALABARZON (which stands for Cavite, Laguna, Batangas, Rizal, Quezon Provinces of Region IV). Batangas compared to the others is quite independent of direct influence from Metro Manila and closer to the provinces of Region IV (p. 7).

Batangas is still predominantly a rural municipality. Only 38 percent of the population or 78, 415 are serviced by collection vehicles or are within a short distance to collection points. The remaining 62 percent are not serviced. It has a total of 53 tons of wastes per day in the serviced area consisting of household, commercial market, hospital and institutional wastes. It has a generation rate of 0.39 kg per capita per day and a density of 262 kg/cubic meter (p. 31).

Its vehicles, donated by JICA in 1991, are still in relatively good condition, having been used only for single-shift work. The city has purchased two more. There are five compactor and two dump trucks but its truck utilization, including labor, is said to be very low due to traffic congestion (p. 33).

No leachate collection facilities are provided. As reported, only 40 percent of the original site is available with a remaining life span of three years. About 30 scavengers work at the dumpsite. They have built shacks to store recovered materials but do not reside there.

In the Asian Metropoles

Among the Asian countries, there are various ways of handling the collection and disposal of solid waste but some features were found to be common (Fernandez, Public-Private Partnerships, 1993, p. 3-5 citing

experiences from a survey of literature), as shown below:

1. Collection Practices

- single system of collection, as in door-to-door using vehicles
- collection in large metropolitan areas with more than one million population (no economies of scale for collection districts of greater than 50,000 population)
- economies of contiguity for collection services, when serving all collection points along a route results in lower average costs
- percentages of vehicles out of service usually at 10 to 15 percent
- using handcarts: one 6-bin handcart load for 50 dwellings at 8 liters per dwelling per day; one collector can serve 200 to 300 dwellings per day at weight per load of 200 kg excluding cart; radius of not over 1 kilometer. to transfer points is needed

2. Streetsweeping

- not subject to economies of scale
- case of Singapore, a streetsweeper handles 4,290 m of kerb length per day and 1,390 in downtown area; case of Kuala Lumpur, streetsweepers cover 1,600 m of kerb length per day at residential areas and 800 m at city center

3. Transfer stations

- needed when haul distances from collection area to the disposal site are greater than 15-20 km or travel times exceed 30 minutes

4. Treatment

- technical aspects for solid waste to be suitable for incineration, composting, conversion of refuse to methane gas

5. Waste Characterization

- waste density needed to determine required fleet payload capacity in tons; number of vehicles on collection routes per day can be calculated by dividing the payload capacity by number of trips per day
- analysis needed for five years before design; failure to fully comprehend waste properties could cause failure of the facilities

- three or four analyses are needed in one year to cover seasonal variation as a result of climatic cycle and food production cycle

By comparison, the Philippines also uses a door-to-door system, streetsweeping and integrated services — but mainly in Metro Manila, not yet in the regional sites. Transfer stations have been set up in Metro Manila but not in the regions.

Waste density between 300-320 kg/cubic meter is typical for the middle-income countries, compared to 90 to 150 kg/cubic meter in industrialized countries and 500 kg/cubic meter for poor countries (EMB-IBRD, vol. 2, 1995, p. 76). By comparison, the waste densities vary in the Philippines, but are found to be around the 200 to the 500 range.

The issues surrounding the Philippine system of solid waste management go deeper than the similarities and differences with other countries. There are characteristics and deficiencies that disable the prevailing systems of solid waste management in the different regions of the Philippines from coping with the rising tide of urbanization and industrialization.

Common Characteristics and Deficiencies

For Metro Manila and the regional urban sites, the common problems in solid waste management systems are improper collection, hauling, transfer and disposal. The problems stem from the use of "concepts, technology, management techniques and institutions incompatible with prevailing social, cultural, political and economic conditions in the area (Ouano, 1990, p.1)." The summary of the problems confronting the City of Manila by Engineers Manimbo and Nombres (1995) echo the situation in many other areas in varying degrees. To the list may be added other observations (EMB-IBRD, 1995) categorized as follows:

1. Institutional
   - organizational and operational deficiencies
   - lack of coordination between and among national and local agencies in planning and implementation of solid waste management programs
2. Technological
   - lack of administrative and technical expertise in solid waste management

- insufficient research and development activities
- inadequate equipment management
- uncontrolled scavenging from collection points, transport and disposal sites
- uncontrolled final disposal

3. Social
   - locational acceptance of a particular technology (not-in-my-own-backyard syndrome)
   - lack of awareness on the importance of proper waste management
   - overall lack of discipline of the community and weak enforcement of laws and ordinances

4. Political
   - lack of fundamental policy specific to solid waste management
   - lack of political support

5. Economic and Financial
   - government financially strapped
   - no reflection of the full and actual cost of solid waste management
   - inadequate financial management

These categories of problem areas can be analysed by stages of the solid waste management system: waste generation at sources, storage, collection, transfer and disposal.

At the stage of waste generation, there is yet no widespread systematic sorting and segregation to facilitate recycling and resource recovery. Business, industrial, commercial, hospital and construction wastes are supposed to be the responsibility of the concerned establishments or institutions. But hazardous hospital wastes, for instance, get mixed up with the rest of municipal refuse.

The common practice at the selected sites studied by various agencies is the use of plastic bags for storage, along with small or large pails, containers and drums. Left uncollected on the streets for a long time, the garbage can be scattered by stray dogs and itinerant scavengers and when it rains the garbage can clog drainages and cause floods. The manner of storage can affect the time spent by the crew to load the garbage on the trucks, the choice of trucks and the procedures for collection, segregation, recycling and disposal.

The local governments have relied mainly on garbage collection by trucks. The trucks donated by JICA were given initially to Metro Manila, but now these have been distributed to other urban areas as well. Even then many areas are left unserviced because the type of vehicles used — the compactor and open dump trucks — are either not adequate or inappropriate. Most appropriate collection vehicles, like pushcarts that are particularly suited to narrow streets and inaccessible areas, are lacking.

There is a need to examine the way garbage crews go about their routes. There are reports of ghost trips and of cheating on loads — reporting as fully loaded only half-full trucks. Citizens must vigilantly report the piling up of uncollected garbage, improper collection and nonappearance of trucks during scheduled service days.

Another critical issue is the design of trucks. A truck's design must facilitate easy movement and cause less fatigue on the crew. It should be able to enter and navigate narrow streets while keeping compatibility with the technical requirements for unloading at the transfer stations and disposal sites. The vehicles now used in Metro Manila and in the regional urban sites — large collectimatics, compactors and dump trucks — seem inappropriate to the situation.

Generally, domestic wastes have a high organic content that is suitable for composting. But this is not widely done. Systematic separation of wastes at source has not yet become widespread.

In both rural and urban poor areas, some kitchen and food wastes are fed to animals. Other wastes are thrown in backyard pits, some made into compost and some thrown into rivers, vacant lots and *esteros*. In many places, waste is burned as people know little of the bad effects on the air quality.

Various studies show that dumpsites are often not managed properly: there is indiscriminate dumping, open burning; no effective leachate or surface waste management; no lining or engineering of the site. The application of insecticides or in covering the waste to prevent odors or keeping away vermin and flies are inconsistent.

Medical wastes — considered hazardous and toxic — get mixed in with municipal solid wastes. There are cases where plastic bags from hospital wards are transferred to big plastic bags and brought to street curbs for collection. In some cases, wastes are dumped in a pit within the hospital compound. Discarded sharp medical instruments and syringes are sometimes mixed with

general refuse (EMB-IBRD, 1995, vol. 2, pp 83-84).

The operation of a transfer station is another matter of concern. At the Las Piñas Transfer Station, garbage collected from different cities and municipalites is transferred to a compactor that compresses the wastes, which are then transferred to the sanitary landfills. The traffic gives the garbage a daytime "tour of the city" and the station's distance does not make it accessible to other Metro Manila cities and municipalities other than Pasay, Parañaque, Makati and Manila (Site visit, August 1995). In the regional sites, local governments have not come together to duplicate this effort (EMB-IBRD, 1995)

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Studies of selected urban areas show that recycling takes place even before the arrival of collection vehicles. Sorting and recycling is done by the waste owners themselves or by itinerant scavengers who go from house to house or ransack garbage containers on street curbs. The truck collection crews also rummage through the garbage for useful items — and delay the collection. Retrieved wastes move into a network of trading for reuse, an informal system which has been in place for decades with the so-called "*bote garapa*," modeled after early Chinese junkshop "buy and sell" dealers.

From 1970 to 1990, 15 studies were undertaken on waste management in Metro Manila (Ouano, 1990, p.1). Except for the grants of collection vehicles, however, the implementation of the recommendations made by these studies was barred by the high cost of foreign-sourced equipment.

The lack of finances has been a major constraint, accounting for inadequate vehicles, manpower, equipment and treatment materials. Added to that is the lack of suitable dumpsites and the fact that communities do not want them near their homes. Other technologies, methods and systems have not been fully explored nor implemented. Some pilot and experimental efforts at alternative systems, as recommended by the various study groups, have failed for reasons that will be discussed later.

The negative consequences of the current system may not yet be fully visible but the findings of various studies show that, in the long run, the danger to surface water is real. Improperly maintained sanitary landfills can have bad effects. "Wastes deposited on porous soil may cause percolation of leachate — a solution containing dissolved and finely suspended solid matter and microbial waste products" (Valencia, 1994, p. 17). Also, the insecticides and disinfectants used to prevent odor and pests in dumpsites cannot be good for the surrounding communities.

Chapter 4

Institutional Framework

Deficiencies in the handling of wastes are the results of policies and management practices of the government. The technical, financial and management aspects are affected by the institutional-organizational framework, political processes, legislation and executive policies.

Structural Initiatives

Metropolitanism

Presidential Decree No. 824 (November 7, 1985) issued by President Ferdinand Marcos placed the original four cities and 13 municipalities of Metro Manila under the Metro Manila Commission. The Commission was headed by a governor and a council made up of representatives from each of the 17 local governments. The move was a concession to metropolitanization and to take advantage of economies of scale in providing common services.

The MMC took over the solid waste management responsibilities of local governments. Executive Order No. 5, signed in July 1976, created the Environmental Sanitation Center under the MMC. In 1983, the budget allocation for solid waste management was 54.1 percent and, by 1987, had risen to 74.3 percent (Ouano, 1990, p.3). This could be taken as an indication of the commitment of the MMC to address the problem.

On January 9, 1990, President Corazon C. Aquino signed Executive Order No. 392 renaming the MMC as the Metropolitan Manila Authority. It was now headed by a chairman elected every six years by the mayors who formed the governing council. A General Manager was responsible for day-to-day operations while the Assistant General Manager for solid waste management took charge of the Environmental Sanitation Center (p.3).

However, problems emerged when the local governments withheld payment of their contributions to the MMA which totalled P700 million in 1990 alone. The MMA soon operated on a budget deficit despite its levy of garbage fees and other taxes (p. 5).

The goal of effective collection of solid wastes was unrealized. The changes in leadership made long-term considerations difficult to carry through. In addition, partisan politics came into play since the managers were political appointees. There came calls to abolish the MMA or amend EO 392.

Eventually the MMA was transformed into the Metro Manila Development Authority (MMDA) as created by RA 7429 in March 1995. With respect to solid waste management, the MMDA (then MMA) had been part of the Presidential Task Force on Solid Waste Management created by President Aquino as the problems continued to worsen. The plan had been for the MMA/MMDA to focus attention on transfer and disposal while the local government units took back responsibility for street sweeping and collection services. The plans of the Task Force eventually extended beyond the MMA/MMDA.

Presidential Task Force on Solid Waste Management

On November 2, 1987, President Aquino created the Presidental Task Force on Waste Management (PTFWM; Memorandum Circular No. 30) with the Presidential Management Staff (PMS) as Coordinator. It involved the MMC, thereafter the MMA and several government agencies and departments, i.e., the Department of Public Works and Highways (DPWH), National Economic and Development Authority (NEDA), Department of Environment and Natural Resources (DENR), Development Bank of the Philippines (DBP), Department of Health (DOH) and the City of Manila (EMB-IBRD, 1995, p. 2).

The objectives of this Task Force included:

- identifying the effective collection and disposal system or technology sustainable over the long term;
- reviewing all relevant proposals, concept papers and studies on waste management and putting together a project with technical, economic and financial viability;
- identifying the most appropriate agency to take the lead and the agencies that would support it;
- providing scavengers alternative sources of livelihood that would prove viable over the long run (p. 3).

The Task Force engaged in talks with the World Bank in 1988. It started working on the pilot sanitary landfills in San Mateo and Carmona and the transfer station in Las Piñas. These projects were expected to be undertaken with locally generated resources. The Task Force succeeded in obtaining equipment from

the Japanese government in 1989 through the Grant-in-Aid program. A total of 491 collection vehicles, compact types of 5, 8, 13 and 15 cubic meters in capacity, some dumptrucks, and 23 other compaction equipment were acquired and distributed in phases (pp. 3-4):

Phase I 1989: 141 compactors — 40 to Metro Manila, 38 to Metro Cebu and 63 to 10 other cities and 1 municipality

Phase II 1991: 196 compactors, 71 to Metro Manila and 125 to 27 other cities and towns

Phase III 1992: 154 compactors/dumptrucks — 54 to Metro Manila and 100 to 34 other cities and municipalities; 23 landfill equipments — 10 to Metro Manila, 3 to Metro Cebu and 10 to other cities and municipalities

Other presidential initiatives on solid waste management that followed were:

- Administrative Order No. 90, signed October 19, 1993, gave authority to set up the Project Management Office on Solid Waste Management in the Environmental Management Bureau of the Department of Environment and Natural Resources. It also approved the draft of the Integrated Solid Waste Management Plan (p.5).
- Memorandum 161, approving and directing the Implementation of the Comprehensive and Integrated Metropolitan Manila Waste Management Plan; Memorandum 161 A, Providing Guidelines for the Implementation of the Comprehensive and Integrated Metropolitan Manila Waste Management Plan.

The Task Force placed the cost of this plan at P2.3 billion (at an exchange rate of P21 to $1). It involved the participation of 12 government departments (Ouano, 1990, pp. 5-6). Among other features, the plan provided for short-term construction, development and rehabilitation projects; in the medium term, the closure of all open dumpsites by 1994 and shift to environmentally acceptable systems by 1996 was to be mandated; and for the long term, the operationalization of a new Metro Manila Solid Waste Management body and Management Authority within the DENR, including capability-building for DENR and LGUs, was called for. (EMB-IBRD, pp. 5-6).

In the initial stages, the PMS acquired the trucks, collection

accessories, transfer stations and disposal sites. It transferred the trucks to the MMA for garbage collection and disposal. The PMS attended to the planning of facilities while the DPWH designed and constructed the sanitary landfills. The DENR engaged in pollution monitoring and control. Funding was assigned to the Department of Budget and education and information dissemination to the Department of Education. Local government units became responsible for collection and disposal of solid wastes. In Metro Manila, conflicts between local government units and the MMA had to be settled.

Two important points need to be stressed here:

1. The Presidental Task Force placed solid waste management within the responsibility of the national government and its agencies.
2. On the other hand, the Local Government Code of 1991 designated local government units as responsible for solid waste management in their respective jurisdictions.

There were obviously points of possible conflict here and organization realignments had to be undertaken. Since it would be too laborious to present a detailed historical account, an overview of the key points in the development of the roles of the respective agencies should suffice to clarify issues, gaps and problems (pp. 19).

- The post of chair of the Presidential Task Force, held initially by the PMS and Secretary of Cabinet, passed on to the DENR as lead agency. The Environmental Management Bureau (EMB) was assigned to matters of environmental management and conservation and pollution control, particularly the implementation of the Environmental Impact Assessment required by law (PD 1151 and PD 1586).
- The management composition was changed to include the Secretaries of these departments: DPWH, DOH, DTI, DILG and the Director General of the NEDA.
- The MMA was taken out and replaced by the Department of the Interior and Local Government (DILG) although the former remained a part of the arrangements involving regional development bodies.
- The DPWH was charged with the design and construction of sanitary landfills.

- The DTI was charged with preparing the guidelines on industrial waste management including solid waste projects in its Investment Priorities Plan.
- The DILG would now facilitate the regional and subregional levels of solid waste management.
- The DOH's role was to focus on environmental health, particularly the disposal of hospital wastes.
- NEDA would review solid waste management projects.

There was obviously a lack of coordination among the various departments and agencies. From the EMB's account of developments in the plan for an integrated system (1995, pp. 17-44), several issues can be highlighted:

- Solid waste management emerged as a new priority for the other national agencies except the DENR.
- For some time waste management had been part of local government responsibilities. Where the problem had been most critical, however (i.e., in Metro Manila), the waste management functions had become embroiled in the tug-of-war between the Metro Manila Authority and the local governments.
- The units within the line departments designated to the task of solid waste management had meager resources and already loaded with their work as to be effective in handling the additional responsibility.
- There is still disagreement as to which government agency should handle solid waste management. Putting the proposed Solid Waste Management Authority in the DENR's EMB needs reexamination because this unit has never been involved in operations.
- There is no unified piece of legislation on integrated solid waste management. There are separate environmental laws, sanitation codes, pollution control codes and local government ordinances. The Local Government Code of 1991 contains certain provisions on the matter as well.
- With the Local Government Code in force, the roles of the national government, the MMA and the local government units (LGUs) will have to be defined more clearly. The MMA Environmental Sanitation Center should have handed over street sweeping and garbage collection to local government units so it could concentrate on

transfer and disposal. The linkages between and among the regional development councils, regional offices of national government agencies, nongovernment organizations, provincial governments, city-municipal governments and the national government on the matter of waste management need to be threshed out.

- The regional urban sites of Baguio, Olongapo and Batangas can be models for subsequent development of solid waste management systems in other areas. The EMB found that municipalities do not generally have waste management plans or disposal sites of their own, depending instead on the provincial capital to provide such services. The delineation of urban groupings in the regions can be the starting point for developing subregional solid waste management systems and disposal sites.

Local Government and Devolution

It is important to underscore the role of the LGUs in the coming years with respect to their mandate and responsibilities for solid waste management. This would place in context the role of the MMDA and the plans of the Presidential Task Force for some institutional-organizational-management set up, including the policies and legal framework of an integrated plan for solid waste management.

The Local Government Code of 1991 states that:

> the territorial and political subdivisions of the State shall enjoy genuine and meaningful local autonomy to enable them to attain their fullest development as self-reliant communities and make them effective partners in the attainment of national goals (Ch.1 Sec.2).

With respect to solid waste management, these are the specific provisions of the Code:

> Local Government units shall share with the National Government the responsibility in the management and maintainance of ecological balance within their territorial jurisdiction, subject to the provisions of this Code and national policies (Sec. 3, I).

> Every local government unit shall exercise the powers expressly granted, those necessarily implied therefrom, as well as powers necessary, appropriate or incidental for its efficient and effective governance and those which are essential to the promotion of the general welfare. Within their respective territorial jurisdictions, local government units shall ensure and support, among other things, preservation and enrichment of culture... health and safety, enhance the right of the people to a balanced ecology, encourage and support the development of appropriate and self-reliant scientific and technological capabilities... (Sec. 16).
>
> ... Local government units shall exercise such other powers and discharge such other functions and responsibilities as are necessary, appropriate or incidental to efficient and effective provision of the basic services and facilities enumerated herein... (Sec. 17).
>
> For a municipality (2):
>
> Solid Waste disposal system or environmental management system and services or facilities related to general hygiene and sanitation (viii).

For a province, the section states that basic services and facilities include but are not limited to those enumerated (17b). Pursuant to national policies and subject to supervision, control and review of the DENR, the list includes forestry laws, pollution control law, small-scale mining law and other laws on the protection of the environment... (iii).

For the city, the Code states "all the services and facilities of the municipality and province," with certain additions. The national government or the next higher level of LGU may provide or augment the basic services and facilities assigned to lower LGU when such services or facilities are not made available or, if made available, are inadequate to meet the requirements of the inhabitants.

The functions, responsibilities, powers vested by the Code can be applied specifically to the conditions of solid waste management. The LGUs also have the power to create their own sources of revenue — to levy taxes, fees and charges. They are empowered to determine land use through zoning ordinances.

Role of Nongovernment Organizations

The involvement of nongovernment organizations (NGOs) in solid waste management is notable. There are NGOs working directly on solid waste management projects in communities, hospitals, markets, schools, industries and other institutions. Among those who have developed widespread networks are the Recycling Movement of the Philippines, Green Forum Philippines and International Resource Recovery Network.

NGOs provide advocacy and training and, in some cases, funding for voluntary, community-based organizations engaged in different aspects of recycling and resource recovery from solid wastes. These range from homeowners associations to core groups organized in residential communities, schools, offices and churches. Private businesses have also joined in by designating units or departments to take charge of solid waste management resource recovery. Private industry has also begun to look into technology on the manufacture of waste-derived products.

These nongovernment organizations, people's organizations and other associations work independently using their own resources. In many ways, they have succeeded in getting attention for and mobilizing efforts on solid waste management without assistance from government. Some have established linkages with LGUs for more effectiveness and greater outreach.

It would be worthwhile for government to tap the NGOs' wealth of experience in self-help and gainful waste management projects. The Local Government Code states that LGUs shall promote the establishment and operation of people's and nongovernment organizations for them to become active partners in local autonomy (Sec. 34). It may enter into joint ventures to engage in the delivery of certain basic services, capability-building and livelihood projects, develop local enterprises to improve productivity and income... promote ecological balance and the economic and social well-being of the people (Sec. 35).

Chapter 5

Policy and Legislative Framework

Historically, solid waste management did not get any specific attention in policy and legislation except as part of the larger domain of environmental concerns. The body of environmental policies and legislations encompass a wide range of issues on utilization, protection and conservation, management of natural resources and the regulation of behavior causing negative impact on the environment.

At the level of the LGUs, ordinances usually pertain to littering, garbage collection, street sweeping and the imposition of garbage fees. Clearly, there is still little understanding of the various aspects of solid waste management technology, institutional and organizational arrangements, management schemes and socioeconomic impact.

Only in 1975 and in 1990 did two presidential decrees (PDs 825 and 856) and Republic Act 6969 take direct action on solid waste management. Other than these, guidelines for solid waste management will have to be gleaned from the policies on fisheries, water, forests, wildlife, air, pollution control arising from the operations of industries, mining, petroleum industries and the like.

But all these together do not fully meet the pressing issues on solid wastes. The activities and the instrumentalities proposed by the Integrated Solid Waste Management Plan still need to be neatly packaged together through legislation. The present national policy and legal framework need an in-depth analysis of demands and prospects for alternative, appropriate technologies and systems that will allow waste minimization, resource recovery, development of waste-derived products and markets and development of technologies using local resources at reasonable costs.

National Policymaking and Legislation

Both the Philippine constitutions of 1935 and 1973 specifically referred to national patrimony and economy but the latter also called for ecological utilization, conservation and development of resources. The 1987 Constitution expresses a more enlightened policy on balanced and healthful ecology in line with the rhythm and harmony of nature. Article XII includes

specific statements on ecology, conservation, development, use of forest lands, national parks and watershed areas.

The review of policies and legislation on the environments, showed the paradigm shift in managing resources and environment to parallel economic and industrial developments (Balagot, 1992, 328-366). In its historical context, policies and legislation were crafted separately, revised, updated and even codified with respect to the utilization, protection, conservation and management of forest land, trees, wildlife (particularly endangered species of animals), as well as plants, fisheries, water quality, watersheds, minerals and mining resources. Only a few and fairly recent ones pertain directly to solid waste management.

PD 825 (1975) or the anti dumping law prohibits improper disposal of garbage and littering, punishable by imprisonment or payment of fine or both. PD 856 (1975) is a historic piece of policy as it mandates the LGUs to provide adequate solid waste disposal systems in their areas and industrial establishments to set up facilities only in designated places or zones. Where no ordinances or policies exist, the local health authority can determine the suitable location (pp. 336-327).

RA 6969 (1990) regulates the importation, manufacturing, distribution, use and disposal of chemical substances injurious to human life and environment (p.336). It prohibits the entry of hazardous and nuclear wastes and their disposal in the country. This law provides the guidelines for handling toxic and hazardous wastes from industries, hospitals and related institutions — for controlling the improper entry of toxic and hazardous wastes into municipal refuse.

Improper handling of solid waste causes negative impact on the environment. PDs 984, 600/979, 602 and 1067 ban the discharges of oil, noxious liquid substances and other harmful substances into water and air (pp. 335-366). Garbage thrown in *esteros*, rivers, canals, foreshores, and riverbanks causes pollution and endangers water quality. Leachates from sanitary landfills cause danger to groundwater.

Guidelines for the handling of industrial wastes, construction wastes, mineral and mining wastes are specified in the relevant presidential decrees and republic acts. PD 1251 imposed fees on mine wastes and tailings from the operations of mining companies, with the fees collected to be used to cover damages to lands, agricultural crops, forest products, aquatic resources, and infrastructure. PD 463 amending the Mining Act of 1936 requires mining

lease contractors to comply with pollution control laws and imposes a penalty for dumping sludge, tailings and other mine wastes in public areas.

When leachates are not controlled at sanitary landfills, they may affect nearby water and aquatic resources. Marine life habitats may also be endangered. PDs 704 and 1219 deal with such situations (p.334).

Three documents can provide a general legal framework for an integrated approach to environmental management (pp. 332-333). These are PD 1151 or the Philippine Environmental Policy (1976), PD 1152 or Philippine Environment Code (1976) and PD 1586 or the Environmental Impact Assessment Policy (1976).

Applied to solid waste management, PD 1151 mandates environmental impact assessments (EIA) for all projects affecting the environment; thus the EIA is required for projects proposing sanitary landfills. PD 1152 specifically stipulates the policy objectives and strategies for air and water quality management, natural resource development, land management and waste management. PD 1586 lays down the framework for implementing the EIA and delineates the development activities requiring EIA. Presidential Proclamation No. 2146 identified three environmentally critical projects and 12 environmentally critical areas (p.333).

These promulgations fill in the gaps in the historical development of policies and legislation. The pattern shows the initial perspective focused on pollution control and protection of endangered resources (fisheries, forests, flora, wildlife, water), starting from the era of Spanish and American colonial rule, to the period from independence to 1972. It was in the seventies that a shift in perspective concerning environment and solid waste management took place and a number of presidential decrees, republic acts and executive orders were promulgated. (pp. 328-332).

Local Ordinances

The local governments in Metro Manila, Cebu, Bacolod and the subregions of Baguio, Batangas and Olongapo — the latter covering 30 municipalities in five provinces (Benguet, Batangas, Bataan, Pampanga, Zambales) — provide examples of efforts to address the problem of solid waste management. These efforts range from ordinances prohibiting littering and dumping to ordinances stipulating how the solid waste management system or aspects of it should be done to ordinances imposing fees, even specifying the amount of the fee for particular types of wastes.

An example is Ordinance No. 105 of Bacolod City. It prohibits the throwing and/or scattering of dirt, paper, refuse or other materials considered as waste in public streets, sidewalks, public places or public offices. Section 1 forbids scavenging anywhere in the city (Peralta and Valencia, Bacolod, 1992, p. 22).

Another example is Ordinance No. 4 of Olongapo City (Series of 1989). It fixes the fees for the collection of garbage in residential buildings and establishments under the following schedules (Peralta and Valencia, Olongapo, 1992, p. 16):

- single detached dwelling unit with floor area of 100 square meters P20; less than 100 square meters, - P10
- multiple dwelling/apartment style, - P10
- accessorial or annexes, predominant use - prescribed rates shall be applied

Also in Olongapo, Ordinance No.1 (Series of 1989) prescribes rates of garbage collection fees for business, trade, occupation and other establishments and for other purposes.

In the study of the 30 municipalities of five provinces (EMB-IBRD, 1995, pp. 52-55), the following were noted:

- The local government's commitment to health and environment is indicated by the size of the budgetary allocation for these concerns.
- The first level of ordinances generally prohibits dumping in public playgrounds, roads, canals, waterways, beaches and public markets. This could be an indication of the lack of an adequate collection system and of a proper disposal site.
- The second level of ordinances defines the collection system for residential and commercial places. This represents an attempt to solve the problem at the source. The bigger the budget, the better it is for the system.
- The third level of ordinances sets a garbage collection fee or schedule of fees and penalties. This represents a deeper awareness and understanding of the long-term effect on the environment. The amount of the fees and extent of penalties make the cost of

compliance greater than noncompliance. Problems are encountered in the prosecution, leading to non-enforcement.

- The gap is definitely in the provision of a proper disposal facility. This indicates a lack of appreciation for the impact on health and environment.
- While legislation prohibits dumping, even the local government uses public areas as dumpsites.
- The critical situation in the municipalities emanates from any of the following: absence of disposal sites, disposal facilities built in environmentally critical areas, or disposal sites that are nearly filled up.

It is possible that these observations hold true in many other local government units.

Chapter 6

Technologies and Systems of Solid Waste Management

Given the problems associated with solid wastes in the different sample areas, particularly at the disposal stage, the question can be asked: Is there any way to solve this? Are there options to the traditional open dumping and sanitary landfills?

Questions of Suitability, Affordability and Public Acceptability

In selecting among various methods or technologies, three main issues should be considered:

1. is the method suitable?
2. is it affordable?
3. is it acceptable to the public?

Suitability or appropriateness responds to the concern for the conservation and protection of health and environment. Also, it means that the methods of storage, collection and disposal can be considered suitable in relation to characterization and density, sources and routes for collection and possible reuse of wastes.

Other questions need to be answered. Will the system cause pollution and ill health? Will it collect waste from as many segments of the population as possible? Will it dispose of as much wastes as possible? Will it allow reuse? Will it cause degradation of the environment and depletion of resources?

Affordability is the concern for the costs of adopting the system. What if it is suitable but the community or the government cannot afford the costs of obtaining and using it? On the other hand, what if it is affordable but not suitable?

Public acceptability refers to the consent of the people to adopt a particular system and to participate in almost all aspects of its operations. Recently, communities and organizations have strongly protested against the improper location and maintainance of open dumpsites and landfills. Protests

have also been registered against incinerators. On the other hand, other groups have advocated alternative methods, like non-waste or low-waste or zero-waste.

At this point, an overview of the different methods, technologies and systems used in solid waste management can help distinguish conventional systems from the so-called clean technologies and alternative systems.

Types of Techologies and Systems

The following technologies and systems have been used for waste disposal.

1. Incineration

Incineration has long been in use in many countries. It involves using thermal decomposition to convert solid waste to less bulky, less toxic material. It is an easy way to reduce the weight and volume of wastes. It can eliminate harmful and pathogenic bacteria, viral constituents and toxic organic compounds. It can also produce a residue useful as fill materials for low-lying areas. State-of-the-art incinerators now include waste heat recovery, such as those in the United States and Europe which can produce steam that can be used for industrial processes and turbine generators to produce electricity (Manimbo and Nombres, 1994, pp. 6-7). State-of-the-art incinerator systems are in place in Japan, US and Switzerland with an ability to separate metal, glass and other recyclable waste prior to burning (Pujalte, 1993, p.8). There are also incentives to recover ferrous metals from the incinerator ash. New techniques remove heavy metal contaminants, even ash which have prospects for reuse in some construction materials (Pujalte, citing Piasecki, 1992).

The use of incinerators has been found easy and expedient particularly for hospitals that produce pathological wastes (DOH Manual; EMB-IBRD 1995, vol. 2 p. 85). Opposition against incineration is mainly focused on air pollution and its effects.

2. Sanitary Landfill

Landfilling is probably the oldest method of waste disposal. But this has been modified in the last 30 to 40 years to minimize pollution of the environment. Sanitary landfills require a large area and a suitable location. Setting this up involves three phases: construction, operation and post closure (EIA Review Committee, EMB-DENR, August 4, 1995).

Landfill site preparation takes into consideration such factors as substrata composition, gradient and groundwater tables. Natural non-permeable liners have to be laid on the base and sides to support synthetic basal liners that would prevent leachates from reaching and contaminating groundwater tables.

At the proposed sanitary landfill in General Santos (EIA Review Committee, August 1995), baseline data on surface water and ground water quality were obtained through analysis of water samples. Air quality was likewise analyzed. Preparation also involved mapping the flow process from collection to disposal, providing for leachate treatment and drawing up contingency plans for the protection of the community, such as establishing a buffer zone between project site and communities in the vicinity.

Gas vents are installed to stop the escape of biogas, collect it and use it for ignition. Percolation pipes are strategically located to collect and lead the leachate to chambers for conventional or chemical treatment before disposal (Manimbo and Nombres, pp. 6-7).

The environmental impact assessment (EIA Review Committee, Environmental Management Bureau, Department of Environment and Natural Resources, August 3, 1995) for a sanitary landfill involves:

- protection of the health and safety of the public in the immediate impact area of the proposed site
- prevention of on-site pollution and off-site environmental damage
- economics of operation

The technical specifications for the operation of a sanitary landfill involve the following (EIA Review Committee, EMB; site visit to Carmona, Cavite):

- entry and exit of garbage trucks
- compacting and unloading garbage
- spraying with insecticides
- spreading and levelling by bulldozers
- periodic soil covering
- controlling water pollution by leachate collection pipes and treatment facilities

- setting up water drainage pass, vents for accumulated gases beneath garbage layers
- constructing movable litter fence to prevent wind from blowing away garbage
- planting of buffer tree seedlings and ornamental plants

Using bulldozers, the wastes are compacted into thin layers in the landfill, sprayed with insecticides and rodenticides to prevent odor and vermin, then covered with soil. Wastes need to be compacted and covered with materials in the right specifications for odor and vermin control — to prevent infestation by insects and rodents (DILG, Public Hearing on Solid Waste Management in General Santos, February 17, 1995). Improper maintainance endangers groundwater, public health and the environment.

The sociocultural and economic impacts must already be assessed at the planning stage (Test Consultants Inc., p.9). These include:

- the resettlement of the people affected by the site
- potential effects on crop yields, fish catch, water pollution, water availability
- public health problems due to flies and vermin
- problems arising from inadequate housing and sanitation facilities of the laborers
- safety of workers
- peace and order

It is expected that after closure, the landfill area can be used for housing and settlement. Sanitary landfills have a lifespan and provision should be made for alternative sites. In the planning stage, the post-closure elements must be factored in, such as possible increase or decrease in land value, post-closure land use, residual fire hazards and toxic gas emission (pp.9-10). Anticipating negative effects and working out mitigating strategies can enhance the usefulness of the closed sanitary landfill.

3. Composting

Composting is the biological decomposition of the organic portions of solid waste under controlled conditions. It produces compost, a soil-like material high in organic matter. Composting can be done by a mechanized method

where an enclosed unit sets and controls the required conditions. In the nonmechanized method, called windrowing, the wastes are arranged in elongated piles or windrows of 2 meters high and 4 meters wide. The wastes need to be aerated and mixed to hasten the natural organic digestion process. This can be done by manually stirring the mass, by inducing air into the mass, or by using a machine that breaks up and mixes the material (Manimbo and Nombres, pp. 6-7).

Compost is useful as organic fertilizer. But composting on land requires care to prevent bad effects on ground water.

In the composting process, microorganisms act on biodegradable organic materials under controlled conditions. There are two types. One is called aerobic composting, where oxygen is used; the other is anaerobic, wherein oxygen is not used. The decomposition of the biodegradable wastes depends on a number of factors: rate of aeration, availability of nutrients, moisture content, particle size of the waste materials, temperature and pH control. (Green Forum Databank, 1995-Training Module on Resource Recovery).

Aeration involves the supply of oxygen for aerobic composting. This helps eliminate odor and flies (p.12). The rate of decomposition depends on the carbon and nitrogen levels for microbial growth which is indicated by the ratio of available carbon to available nitrogen. Microorganisms need 30 parts of carbon to each part of nitrogen for metabolism.

To allow aerobic composting to take place, the moisture content must not be too high or too low as to inhibit the action of microorganisms. The optimum is from 50 to 60 percent (p. 12).

Particle size of the waste materials should preferably be 1 to 5 centimeters for more effective processing. This can be done by shredding or grinding to the desired size (p.13).

The right temperature must be maintained during the process and the optimum pH, or the measure of acidity or alkalinity for the growth of composting microorganisms, must range from 6.0 to 8.0. Both the temperature and the pH measurement must be monitored (p. 14).

There are two major types of composting systems. One is the nonreactor or open-piles or windrow system where composting occurs in the open space. The other is the reactor system where composting occurs initially inside a vessel called the reactor.

The nonreactor type is of two subtypes. In the first subtype, the waste is agitated or turned for aeration. In the second, air is blown into the waste pile.

There are two variations of the aeration type. In the first variation, the wastes are piled up and turned by shovel. In the second, the wastes are formed into windrows and turned by machine.

The static pile aeration system also has two variations. In one, air is blown over a period of time into the pile of waste materials. In the other, the material is "extruded into pellets, pressed into briquettes or formed into bales, stacked in piles and aerated by natural ventilation (p. 19)."

The reactor system has three variations. These are the vertical-flow, the inclined-flow and the horizontal-flow reactors. Initially the waste materials are in the reactor, then allowed to mature in the open (p. 20).

In composting, there is this precaution: improper dumping and handling of the composting processes can cause foul smell and endanger groundwater.

4. Refuse-Derived Fuel

The refuse-derived fuel method is a way of reducing solid waste into a source of heat (Manimbo and Nombres, pp. 6-7).

5. Pyrolysis

Pyrolysis is described as a "process of destructive distillation where complex polymers are broken down to produce solids, liquids and gaseous fractions." It is akin to incineration but differs from it because pyrolysis produces a valuable product or recovers energy (Manimbo and Nombres, pp. 6-7).

6. Vermi Composting

Vermi composting is the method used to change certain organic wastes — such as animal wastes, sawdusts, agricultural crop waste and other solid waste — into a useful product. Vermi culture speeds up the decomposition process of the wastes with the use of earthworms. The product is useful as fertilizers.

Vermi composting and other types of composting are reported to be

in use in the provinces, but not in urban areas except where space allows it. Urban households are encouraged to use composting as alternative technology for waste reduction and resource recovery. It can be done in plant pots, containers and in a hole in the ground.

Experiments for Change

As mentioned earlier, numerous studies have been done and proposals (15) put forward to solve Metro Manila's problem with waste management. Col. Rafael Rueda reported the initial trial runs or experimental pilot studies in the course of his experiences with waste management at the Department of Public Works, the Metro Manila Commission and various nongovernment organizations.

One of these involved an experimental pilot project on a planned 10-ton composting plant in Balut, Tondo. The facility was abandoned because of lack of financial suppport and the problem of marketing the composting product. The experiment with sanitary landfill in Pasig had logistical and resource problems (Rueda, p.2).

The pilot mini-incineration plant in Barangay Central, Quezon City failed due to high moisture content, low calorific value and low content of combustible materials in the waste, which resulted in the high cost of incineration. It required more diesel fuel to burn the wastes.

Foreign firms have proposed high-tech disposal systems like composting by rotating drum, shredding, pulverization and screening process and incineration plants with energy recovery and air-pollution control devices. These were expensive to purchase and maintain and also complicated to operate (ibid.).

These failed experiments raise the important issue of suitability of the technology to Philippine conditions. These may entail modifications of the Western technologies or the development of local technologies using less expensive materials, locally available resources and manpower.

There has been much debate as to what system is most suitable to Philippine conditions. Advocacy has been strong on alternative approaches involving waste reduction and resource recovery through sorting and segregation at source, composting and recycling. Studies and recommendations have pointed to the need to prepare new sites for sanitary landfills, along with countermeasures for the possible negative impacts.

Alternative Perspectives, Technologies and Systems

The trend toward alternative concepts, perspectives, technologies and systems of waste management emerged in recent years as the traditional open dumpsites and sanitary landfills proved inadequate to the needs of so-called one-way economies like those of Japan, the United States, Germany, France and others. Mass production, mass distribution and mass consumption go on in a one-way direction in these economies resulting in voluminous wastes disposed of mainly in landfills. In the United States, 80 percent to 90 percent of wastes end up in landfills. The projections point to the displacement of landfills which, in the case of Japan, is expected to happen in the next seven to eight years (Yasuda and Ueta, 1994).

The alternatives are given different names or labels.

Clean technology refers to "all feasible industrial processes that generate the minimum amounts of waste (International Association for Clean Technology, Vienna, Austria)." *Non-waste technology* means the "practical application of knowledge, methods, means... to provide the most rational use of natural resources and energy and to protect the environment " (United Nations Economic Commission for Europe, Paris, 1976). *Low-waste technology* is the "method of production under which all raw materials and energy resources are used in a most rational and integrated way in a cycle of raw materials-production-consumption-secondary raw materials, so that any impact on the environment does not disturb its normal functioning (United Nations Economic Commission for Europe, Tashkent, 1994)."

These different alternatives, according to various sources, have the common elements of waste reuse, recycling and alternative utilization. These are also known variably as *environmentally-sound* or *benign technology*, *appropriate technology* or as *resource recovery*. Their common target is waste minimization through source reduction, resource recovery and treatment.

Reduction at source entails any method that reduces the generation of waste, particularly in industrial production. This can be done by (a) change in the production process, (b) replacement of input-raw materials by other materials serving the same purpose but producing less wastes or toxicity, or (c) by substituting an original product with a different product that has the same use (Green Forum, Training Module on Resource Recovery Technologies).

Resource recovery includes recycling, materials recovery and production of energy or fuels, or any type of activity that produces a valuable material or energy. There are four ways to materials recovery or recycling: (a) when certain wastes are retrieved and used directly or indirectly, (b) when a secondary material is obtained, (c) when impurities are removed from a waste to obtain a reuseable material and (d) when wastes are processed to obtain a useful product (p. 6).

On the other hand, when materials recovery is no longer possible, energy or heat recovery is resorted to. New and advanced technologies are being developed to enhance energy output and reduce the cost of its production.

Treatment reduces the toxicity of waste, but does not necessarily produce a valuable material or energy.

In the Philippines, alternative systems have already been introduced, particularly zero-waste management, the 3Rs and recycling. Following is a brief description of the alternatives as disseminated in the Philippines, as well as those practiced in other countries.

Zero-Waste Management

Popularly advocated in the Philippines is the system of zero-waste management. According to the Recycling Movement of the Philippines, its main advocate, the present system of waste management has brought about a variety of health, ecological, economic and aesthestic problems.

Mass production and consumption and improper packaging at source produce an unmanageable volume of wastes. Streets and public places have become repositories of uncollected wastes and breeding grounds for rats, roaches, vermin and other harmful organisms in the immediate vicinity of residential areas. Waterways get clogged by trash causing floods. Lakes, bays, rivers and other water bodies have become polluted, poisoning the aquatic ecosystems.

The zero-waste advocates state their main goal as sustainable cleanliness, orderliness and enhanced ecological balance in the community. Specifically, they do not want open garbage dumps which breed diseases, rodents, pests, foul odors and harmful fumes; no greenhouse gases which contribute to global warming and thinning of the ozone layer; no leachate which pollutes soil and surface and groundwater; and no unhealthful scavenging activities in the vicinity.

According to these advocates, there is zero pollution or minimized pollution when:

- no harmful gases, smoke and particulates produced by needless burning and dumping get into the air;
- no polluted runoffs enter the water supply; and
- no hazardous elements, through prior separation or non-mixing with other household wastes, get into the soil.

The Zero-Waste Resource Management System is described as an "ecological method of handling wastes that does not degrade the environment nor pollute air, water and soil and facilitates their sanitary retrieval, reuse or recycling (Sabas, 1994; Recycling Movement of the Philippines)." This means eliminating or avoiding burning or incineration and open dumping. The zero-waste technology is said to be the combination of techniques or procedures which aims at maximum, if not total, utilization of wastes into healthful, beneficial, productive and esthetic purposes.

According to Luz Sabas and the Recycling Movement of the Philippines, the **Multi-F's Total Recycling Scheme** transforms waste into *factory returnables, fertilizer, feed, fermentables, fuel* such as *firewood* or as *flammable gases, fine crafts* and *filling materials.* Recyling is the reuse, retrieval and recommission of elements or matter for any and all purposes necessary to healthful and productive living. In Filipino, it means "***pagbabalikgamit.***"

In disseminating zero-waste management technology in the Philippines, the Recycling Movement of the Philippines sets three basic steps:

1. Sorting at source

Sorting at source means the segregation of wastes at the very place where they are produced. Wastes are classified and then separated into biodegradable ("***nabubulok***" or compostable) and non-biodegradable ("***hindi nabubulok***" or non-compostable) elements.

Examples of biodegradable or compostable wastes are food wastes fruit peelings, vegetable trimmings, soft shells, fish entrails, fowl innards, food leftovers and seeds; garden wastes (leaves, twigs, weeds, seeds); animal waste (manure and carcasses); and human wastes (excreta, pads).

The non-biodegradable elements or non-compostables include cans, metals, bottles, broken glasses, plastics, styrofoam, rubber, dry paper, cardboard, dry cloth, fibers, leather, feathers, hard shells and bones.

The retrieval of fuel materials is done to reduce global warming and thinning of the protective ozone layer caused by burning mixed wastes, by cooking, or by heating. It will channel wastes into beneficial end-uses and conserve fuel resources.

2. Packaging

The segregated wastes are placed in properly-labelled containers such as cans, sacks, bags and bins. This facilitates sanitary, efficient handling, storage, collection, transport and disposal at least cost.

The sorting is done with the aid of hangers — a simple and handy all-in-one stand where the labelled plastic bags or sacks are hanged or tied next to each other to facilitate quick and systematic segregation. Having the hanger within one's reach helps induce the waste producer/collector to shift from the usual mixing of wastes to sorting.

3. Ecologically-friendly use and disposal (no burning, no open dumping; adopt the multi-F's Recycling)

The multi-Fs recycling method is so-called because it aims to produce from waste the following "Fs": factory returnables, feed, fertilizer, fuel, fine crafts, fermentables and filling materials. As estimated by the advocates of total recycling, about 50 to 60 percent of domestic wastes can be utilized as factory returnables, about 20 percent as feed, about 30 percent as fertilizer and the rest as fuel, fine crafts and fermentables, with very little left for filling material. The more affluent the community, the more factory returnables can be gathered.

Food wastes (peelings, vegetable trimmings, fish entrails, fowl innards, spoiled fruits, leftovers, egg shells, rice/fish/meat washings, etc.) can be used as feed for hogs, chickens, ducks and fish.

Fermentables (fruit peelings, spoiled or overripe fruits, juices) can be made into vinegar, wine, *nata de coco* or *nata de pina.*

Compostables or biodegradables such as garden wastes (leaves, twigs, weeds), animal waste (manure, carcasses), human waste (feces, urine, blood,

all excreta) soiled wipes, pads, diapers (without the plastic portions) can be made into fertilizer for organic gardening.

Filling materials can be compacted, mixed with rice chaff and binders and used for construction projects.

Other non-biodegradable materials can be made into art works, toys and other livelihood projects such as paper mache, paper basketry, tin craft, metal craft, plastic twines or rope braids, feathercraft, woodcraft, glasscraft, even *labar* craft, candles and floorwax. Styrofoam melted in a small amount of gasoline solvent provides cheap glue or binder for many projects.

Green charcoal is a kind of fuel that can be manufactured from compostable, organic, cellulotic material. Using enzymes to break down the lining or binding material, the compost is molded and dried, then fed into charcoal stoves.

The technology of zero-waste management makes much use of composting, which is presented in easily doable steps, using low-cost or reuseable materials.

Composting is urged both for the rural and the urban areas. Households or the entire community can engage in vegetable farming or gardening by using the compost as fertilizer. Income can be earned also by selling the compost.

However, not everyone agrees with this zero-waste approach, no matter that the system has been disseminated in easy-to-read materials with simplified illustrations and prescribing technology using local, available and cheap materials. The Recycling Movement of the Philippines has led numerous training programs in different parts of the country and helped organize and mobilize core groups in hospitals, schools, offices, industries, churches and most especially, in residential communities.

The 3 Rs — Reduction, Recycling, Reuse

Other environmentalists and advocates of waste minimization and resource recovery are pushing the so-called 3 Rs, *reduction, recycling, reuse.* Some 3-Rs advocates do not think that composting and reuse can prevent some residue waste from being disposed of. After wastes with potentials for materials recovery have been retrieved, what is left over can still be used for energy

recovery by applying new and advanced technologies. Consequently, 3-Rs advocates say, little is left to be disposed of at sanitary landfills. Even wastes already at sanitary landfills can be used for energy recovery while leachates can be properly treated. The point is to avoid the use of "incinerators" and other "burning" equipment and processes.

Whether the term used is zero-waste, low-waste, non-waste or 3 Rs, the main component is **recycling-resource recovery**. Basically, 3 Rs includes the elements practiced in the zero-waste approach.

However, there are other technologies, processes and systems of recycling and resource recovery, as shown by the findings of the state-of-the-art review by Sandra J. Cointreau — practices in different countries at different stages of the solid waste management system (1994).

International Experiences

For Non-Biodegradable Solid Wastes

1. Waste Generation and Segregation

The segregation can take place at source, for example, at the household. The owner can deliver the wastes to a redemption or purchasing center or sell directly to the buyer. This practice is observed in Sri Lanka where the National Paper Corporation pays the same price for waste paper whether brought to the redemption centers or procured from door-to-door buyers. In other countries, as in Germany, redemption centers are set up in supermarkets (p.6).

The home owner can allow others to retrieve wastes for reuse, such as the itinerant scavengers who are in contact with the informal system of buyers and sellers. In Istanbul, Turkey and Cairo, Egypt, collectors come to the door. In Katmandu, Nepal, street sweepers go door to door and collect edible wastes. In Mexico, there are well-placed informal networks for recycling (p.7).

Without efforts at resource recovery, the owners of the wastes could simply send these out for collection and disposal. Retrieval would still be possible in the next stages.

2. *Storage, Collection, Transport*

The recovery of reusable wastes can be done by scavengers or by garbage collectors at designated sites on street curbs where the containers are placed. The containers are emptied into collection vehicles and left at the curb or, if disposable, are taken with the garbage. The collection crews in Bangkok, Thailand, Mexico and the Philippines have found supplementary income by retrieval and sale of wastes in this manner.

3. *Disposal*

Various studies show that the recovery of materials at dumpsites by scavengers is relatively common in most cities. Metro Manila has some 5,000 scavengers; Mexico City has 10,000; Lima Metropolitana, 1,000; and Cali, Colombia, 400(p. 9).

Retrieved wastes can either be (a) cleaned then directly reused, (b) repaired before use, (c) remanufactured by disassembling and reassembling, which may include replacing some parts, or (d) used for other purposes. The waste can also be reprocessed into a new product, or processed into a different material or form of energy.

A number of technologies and systems are now in use to process wastes into a different material or form of energy (Green Forum Data Bank, Training Module Resource Recovery Technologies; sources cited include the United Nations Economic Commission for Europe, Compendium on Low and Non-Waste Technology, Geneva, 1985 and United Nations Environment Programme, Low and Non-Waste Technologies, Paris, 1987).

For Biodegradable Solid Wastes

1. *Composting*

The biodegradables are separated at source, then are put into the composting processes to produce organic fertilizers. The different technologies and systems for composting and vermi culture-composting were explained in the preceding sections.

2. Energy Recovery

Existing technologies to derive energy from wastes are the following: (pp. 20-30)

- methane generation and recovery from landfills
- waste combustion for steam and electrical production
- anaerobic digestion with recovery and use of methane gas

Other types which are in the stage of advanced technological development are:

- production of refuse-derived fuel
- pyrolysis processes for conversion of domestic refuse to solid, liquid and gaseous fuels

Still being developed are (pp. 30-34):

- conversion of garbage and organic solid wastes into gasoline
- biomass liquefaction and reductive formulation to convert solid wastes into fuel oil
- thermal gasification followed by liquid fuels synthesis to produce liquid from solid wastes

As previously mentioned, landfills must comply with specifications of design and construction with liners to prevent leachate from contaminating groundwater and sanitary maintenance with insecticides and soil cover to prevent health and environmental hazards.

Wastes at the landfills undergo biological and biochemical processes that eventually result, depending on moisture and pH range, in the production of methane gas. In some instances, this has caused fires and explosions, endangering nearby areas. To utilize the gas, technology has to be used and several factors such as depth and quantity of biodegradable wastes, timespan of landfill and absence of ground water table at 5 meters below the landfill need to be considered (p.26).

Other state-of-the-art technologies in waste combustion include mass-burn facilities and modular combusters and various types of refuse-derived-fuel-fired facilities. Very interesting developments in science

have taken place for the conversion of solid wastes to powdered fuels, carbon char, solid fuels, gasoline and oil. Each of these technologies is geared towards certain types of wastes and for specific results.

Deriving Benefits from Recycling

Studies have shown that recycling results in energy savings. The energy equivalent of recyclable materials could exceed the potential energy generated from the conversion of solid wastes by using incineration, refuse-derived fuel, pyrolysis or anaerobic digestion technologies. These conclusions were derived from the following data (pp.2-4):

- producing copper from already segregated scrap metal requires only one-tenth the energy required for production from copper ore;
- recycling magnesium results in 97 percent energy savings; aluminum, 96 percent energy savings;
- using scrap instead of iron ore to make steel means a 74 percent energy savings;
- recycling of office-grade paper also results in energy savings over production from raw wood materials;
- 50 percent savings in energy from 1 percent of cutlet (broken glass) above 15 percent
- producing recycled rubber offers energy savings potential of over 70 percent; and
- manufacturing a product from recycled rubber tires uses as little as 60 percent of the energy required by using raw rubber.

Sandra J. Cointreau points out that composting can reduce dependence on chemical fertilizers. Composting can turn biodegradable wastes into organic fertilizers and anaerobic processes can produce a usable medium BTU gas (biogas) (p.3). Organic fertilizers are able to hold nutrients in colloidal forms and provide micronutrients for crops. Studies have shown the activation of enzymes such as urease and proteinase. Composting brings about a higher rate of mineralization of nitrogenous compounds and increases the overall supply of nitrogen to the crop. Besides these, it brings about erosion control, soil moisture retention, soil density improvements, increased ion-exchange capacity and trace minerals availability (p.4).

Cointreau (p.4) cites other results of recycling:

- Field experiments in China showed that the application of 500 kg/hectare of refuse-derived compost has increased rice grain production by 25 to 50 kg/hectare.
- Shredded paper wastes have been used successfully as soil mulch — where organic matter is spread on top of the soil around plants, limiting soil erosion, weed growth, evaporation of soil moisture, and as buffers against temperature erosion.
- In Rome, recycling since 1964 has resulted in estimated annual savings of over 400,000 trees, 60,000 acres of agricultural land and 30,000 tons of fuel.
- In China, the Shanghai Donghai Oil and Chemical Recycling Works has diverted over two million tons of liquid and solid industrial and hazardous wastes from the landfill since 1956 by an active waste exchange program using spent acides from one industry as feedstock to another industry. The Shanghai Materials Recovery and Utilization Company has since 1957 retrieved more than 20 million tons of waste metals, paper, cloth, plastics, rubber, etc.

Why Recycling Is Not Widespread

But why is recycling not widespread? Various sectors in the Philippines have observed that recycling is not a part of the people's way of life. There are no ordinances and sanctions and no support system to sustain it. The experiences in recycling confirm Cointreau's observations about the pervading attitude that it is not convenient nor economically worthwhile. There is no compelling incentive for people to take time out to sort, segregate and store reuseable wastes, particularly among the high-income groups. It is also quite troublesome to store such recyclables for long periods of time or to attend to disposal when there is no efficient system of collection.

There has also been a disdainful attitude toward retrieval of wastes for reuse because this is done mostly by scavengers or by people of low incomes. Those who do not derive income from recycling may not perceive it necessary to keep the recyclables segregated and clean.

Cited also as a reason for mixing up wastes is the lack of public awareness of the benefits of recycling. Documentation and public information on the negative impact of the existing systems of dumping and sanitary landfills compared to the positive impact of recycling are gravely lacking.

Optimal-Integrated Waste Management and Recycling System

Some advocates of resource recovery prefer to use the term *optimal waste management* and *recycling system* or *integrated solid waste management system*. The basic principle is to change the conventional thinking and practice of generating and throwing away wastes without returning resources of the environment. In short, the **one-way cycle** of production, consumption and waste disposal with **no recovery of resources** (Yasuda and Ueta, 1994) must be changed.

Optimal waste management and recycling system involves the use of combined techniques of source reduction, energy recovery, incineration and sanitary/safe landfills. It is defined as "socially efficient" with regard to social benefit versus social cost where the "social benefit and social cost include external benefit and external cost in case of market failures (p.8)."

In line with this system is Japan's attempt to deal with canned beverage containers by recycling instead of burying them. The system adopted the following method:

1. collection of separated used containers by volunteers from neighborhood associations, children's groups, primary schools, etc.
2. a deposit refund system was set up for reuseables.
3. a law on resource recycling was promulgated, though not fully operational.
4. container manufacturers and bottlers were made legally responsible for collecting, recycling and reusing containers.

Yasuda and Ueta reported that in the United States, the refund or redemption value of five cents is printed on cans and more than 90 percent are collected and recycled. Varying refund schemes have been operational in almost 1,000 places in Japan.

By comparison, a systematic exchange and refund system has yet to see implementation in the Philippines. This gap in the alternative system partly explains failed attempts at recycling.

Optimal waste management implies the creation of a continuing supply of recyclable resources for the recycling industries. In effect there is a return domain of economic resources. It also means returning resources to the natural ecosystem. This happens when used resources undergo composting.

In optimum waste management, the intermediate disposal can be done by combustion. The final disposal occurs at the sanitary landfill. Instead of open dumpsite and landfill, the alternative is called sanitary controlled landfill biogas. The gas created in the landfill can be converted to biogas. The biodegradable wet market wastes are first collected and placed in a landfill area without oxygen. The wastes are placed at the bottom of a well sealed cemented area where each layer of waste is covered with soil. Tubes are strategically placed for collecting biogas. The decomposed waste as organic compost can be used as fertilizers. The leachate produced in landfills can also be fed to a gas reactor to produce additional gas.

Integrated solid waste management involves sorting of wastes at source, composting the biodegradable wastes, processing recyclables into waste-derived materials and using the incinerators for the other wastes to produce energy and construction materials from the ash left over (Pujalte, p.8). Modern state-of-the-art incineration systems used in Japan, US and Switzerland begin with the separation of metal, glass and other recyclable wastes before burning whatever is left. There are incentives for operators to separate the recyclables and to recover ferrous metals from incinerator ash (Pujalte citing Piasecki, 1992).

Dr. Pujalte cites the US Environmental Protection Agency, the World Health Organization and certain scientists as supporting the use of incinerators. Waste reduction at source and recycling cannot adequately resolve the problem of volume of solid wastes and the leachates produced at landfills. The solution is in developing incinerators of the size and type that can be used by communities and be integrated into recycling programs with more efficiency. The suggestion is for the integration of "aggressive waste reduction, scaled down waste-to-energy plants and sustained recycling" (p.10).

There are those who caution against the use of incinerators for energy recovery in developing countries, as cited by Cointreau (p.16). This is because kitchen wastes are in high proportion and high in moisture (40-70 percent in developing countries and 20-40 percent in developed countries), thus they will tend to use up more fuel to burn.

In discussions with some experts, the question has been asked: Which is the most suitable system for the Philippine situation? Will any one method suffice? One trend of thought suggests a multi-pronged strategy of (1) sorting at source and recycling, (2) transforming scavenging into an entrepreneurial system, (3) industrial manufacture of waste-derived products; (4) energy co-generation; (5) the ashes and other remnants can finally be

disposed of in controlled sanitary landfills with the proper handling and treatment of leachate; and, (6) transformation after some time of landfill wastes to products and energy.

While these prospects can stimulate enthusiasm, one must be cautious about the possible harmful effects of each of these technologies. For instance, composting produces bad odors (p. 79). Combustion produces emissions and ash causes pollution (pp. 82-84). The technologies used must be able to control these ill effects.

Alternative Schemes for Hazardous Waste

Toxic and hazardous wastes (THW) must be properly handled. By law, hospitals and related institutions are held responsible for their transport and disposal. In dealing with the problem, two principles have been proposed (Jago, 1995, p. 7):

- The Proximity Principle

  THW should be dealt with as close as practicable to where they are produced, reducing what has been called "waste tourism" and the attendant transport risks.

- The Polluter Pays Principle

  The full cost of disposing THW safely should be paid for by the producer, an incentive to minimize the quantity and toxicity of the waste produced.

- The Precautionary Principle

  It is not necessary to prove cause and effect or the link between the waste and its effect on the environment before taking steps to reduce or eliminate the potential risk that may exist.

Reports have noted the following order of interventions practiced in the European Union and in many other countries (Jago, p. 7):

1. elimination or minimization of the quantity and toxicity of waste produced
2. recovery, reuse and recycling of the material that comprises the THW

3. recovery of the energy inherent in the waste
4. safe and effective treatment and disposal, minimizing effect on people and environment

To properly handle THW, it has been suggested that major investments in new facilities be made. The options are (Jago, p.8):

1. THW landfill site
2. THW incinerator
3. THW treatment plant

The Basel Convention now bans the export of toxic and hazardous wastes by the developed countries to developing countries. But even developing countries have joined the convention, recognizing the need to develop their own national facilities for THW (Jago, 1995, p.10).

In the US, THW disposal has been done mostly by the private sector. Legislation has dealt with the improvement of technical and operating standards and attention is drawn to the reduction of solid, sludge and liquid wastes, particularly toxic and hazardous materials.

By contrast, Denmark has set up state and municipal ownership of toxic and hazardous waste facilities. This implies a high tax burden and high charges to producers of THW and other wastes. However, there is a tax incentive to encourage waste minimization (p. 11).

In the UK where there is a heavy reliance on landfills, a "landfill levy" has been introduced to ensure that disposal charges cover the full environmental costs. However, because the landfills have not been lined, problems of groundwater contamination have emerged. In the long run, it is expected that there will be greater reliance on treatment and incineration for THW disposal.

In Indonesia, a phased government regulation of special waste is in place. The first phase led to the construction of a THW landfill facility in 1994. The second phase will entail expansion and development of physical/ chemical and industrial effluent treatment plants and the third phase will include the development of a THW incineration facility (p.12).

For the Philippines, RA 6969 prescribes the proper handling of toxic and hazardous wastes and the Department of Health has issued its operating manual regarding the use of incinerators. Recycling of materials that cannot

cause contamination is allowed, but even this has been mishandled, hence the need for both sanctions and incentives through policy legislation and monitoring of implementation.

Possibilities of Resource Recovery

The United Nations Environment Program study on low- and non-waste technologies (Industry and Environment Information Transfer Series, 1987) in the United States, Canada, France, Germany, Switzerland and other countries in Europe covered the following industries:

- Food Manufacturing
- Textile, Wearing Apparel and Leather Industries
- Manufacture of Chemicals, Petroleum, Coal, Rubber, and Plastic Products
- Iron and Steel Basic Industries
- Non-Ferrous Metal Basic Industries
- Manufacture of Fabricated Metal Products
- Manufacture of Electricity, Gas and Water

In the Philippines, industrial organizations have begun to engage in waste resource recovery as a new dimension of waste management. The Industrial Environmental Management Program of the Department of Environment and Natural Resources is currently working on changing attitudes and practices toward waste minimization by process changes, recycling-reuse and waste exchange (Araza, et al., 1995).

On resource recovery from municipal solid wastes, the possibilities depend on a number of factors. One basic consideration is the composition of municipal refuse. Table 3 presents the typical composition of municipal refuse in low-, medium- and high-income countries.

Recycling systems have been tried in different countries such as Japan, Korea, Taiwan, China and Singapore. Their experiences prove that as difficulties and problems are settled, the benefits follow. They also help identify the elements that need to be set up in a comprehensive and inter-dependent way to make the system work (Yasuda and Ueta; Cointreau; Ouano, Imperatives for Recycling, 1993).

Table 3
Typical Composition of Municipal Refuse in Low-, Medium- and High-Income Countries

Waste Generation & Composition	*Low-Income Countries*	*Middle-Income Countries*	*High-Income Countries*
Waste Generation kg/cap/day	0.4-0.6	0.5-0.9	0.7-1.8
Composition (% by weight)	1-10	15-40	15-40
Paper	1-10	15-40	15-40
Glass, Ceramics	1-10	1-10	4-10
Metal	1-5	1-5	3-13
Plastics	1-5	2-6	2-10
Leather, Rubber	1-5	-	-
Wood, Bones, Straw	1-5	-	-
Textiles	1-5	2-10	2-10
Putrescibles	40-85	20-65	20-50
Misc. Inerts	1-40	1-30	1-20
Particle Size (% < 50 mm)	5-35	-	10-85

Source: Cointreau, S.J. Environmental Management of Urban Solid Wastes in Developing Countries. World Bank, 1986.

Waste composition in selected sites in the Philippines point to the possibility of recovery based on the volume of bio-degradable wastes. Recycling of non-biodegradables has been found profitable. Table 4 presents the waste composition in Metro Manila; Table 5, the estimated wastes retrieved at the dumpsites.

Table 4
Metro Manila Domestic Composition

COMPONENT	*% BY WEIGHT*
Food Waste	11.0
Fines and Inerts	12.9
Paper and Cardboard	10.2
Glass	1.9
Plastic and Petroleum Products	9.8
Yard and Field Waste	33.50
Textiles	4.1
Leather and Rubber	1.8
Metals	3.3
Wood	11.50

Source: Consoer-Townsend and Associates, 1990. This report is often cited in many papers on solid waste management.

Two observations make it imperative for the Philippines to shift to resource recovery systems. One is the lack of suitable sites for dumping and landfills based both on physical availability of and on the objections raised by communities against these facilities. Second is the sheer increase in the volume of wastes generated.

Credit is due to the advocacy of environmental NGOs for the trend towards community-based waste management projects and for the development of entrepreneurship in the local manufacture of equipment and in initiating technology for recycling-resource recovery and of products derived from wastes. However, this informal system has yet to gain widespread attention and support from various sectors, particularly from the government. The institutional resources and legal authority in the hands of local government units can provide the support system and the mandate for a shift to new alternative systems.

Chapter 7

Initiative-Projects in Alternative Technologies

A limited exploratory survey in Metro Manila was undertaken to identify the organizations engaged in alternative waste management systems — their specific projects, line of activities, strategies and results. Representatives of organizations were interviewed; brochures and handouts were obtained. The projects at Sta. Maria, Bulacan and Fort Bonifacio were visited. Consultation meetings, interviews and round table discussions were undertaken among a selected group of representatives from NGOs, academe, hospitals, industries and government to map out the scenario for this study (1995-1998). Also viewed were waste-derived products (exhibits of the Technology and Livelihood Resource Center; exhibits at project sites). The papers and proceedings of some conferences on environment also provided data.

Ecological Perspectives

The nongovernment organizations engaged in using alternative waste management technologies and systems advocate an ecological perspective that views the interconnectedness of all living things — plants, animals, people. The wastes of one are the resources of the others in a cycle of production and consumption. People are responsible for using their environment for sustenance. The ecological perspective emphasizes resource recovery, recycling and reuse for the conservation and preservation of the environment. The goal is sustainable development, meaning that the current use of resources should not deplete and degrade the environment in a way that endangers and deprives future generations.

There are NGOs that categorically use the term zero-waste management (ZWM). Its advocates consider the zero-waste approach as an ecological method of handling wastes. It is anchored on the concept of the 3 Rs, that is, reduce, recycle, reuse. The advocates say that such technology, method and system do not degrade the environment but facilitate sanitary retrieval and reuse and maintain the balance of people, plants, animals and nature (Sabas 1994; Green Forum, Training Manual for Organizing Community for Wastes Management, 1994, p.24).

On the other hand, there are those who have reservations about using the word zero waste as it is currently practised by its advocates. They prefer to say ecological waste management (EWM) or the 3 Rs. There are other groups who consider the use of new high technology machines for pollution control and waste conversion to energy or new products for resource recovery inconsistent with their ecological stance. Some propose an integrated ecological waste management approach.

The proponents of such orientations consider their respective approaches as ecological waste management (EWM) because these involve waste minimization or waste reduction at the source with sorting, segregation, recycling, resource recovery and reuse. The common operational element is recycling of biodegradable and non-biodegradable wastes. Biodegradables (organic wastes, food and kitchen wastes) are recycled by composting into fertilizer, or used as feed, fermentables and fuel. Non-biodegradables (cans, bottles, metal, paper, etc.) are recycled as factory returnables, or reprocessed into new materials and products such as handicrafts. The details of such alternative technologies and systems were presented in the previous chapter.

The survey respondents explained that EWM is not only a technology but also a frame of mind and a lifestyle. Consumers-buyers of goods make it a habit to consider the recyclability of their purchases. Producers manufacture and package products that are "environment-friendly," meaning, protecting and conserving the environment.

For its advocates, EWM is a total approach to sustainable development using grassroots participation. It makes people responsible for their behavior and allows participation in the efforts toward a healthy environment. It promotes skills training, livelihood and income generation, helping people become creative and innovative in the reuse of wastes as resources.

Types of Eco-Waste Projects

The following activities dealing with solid wastes were mentioned by the respondents as the focus of projects undertaken in various schools, communities, industries, business, commercial establishments and hospitals. Some projects involve only one of these activities while others showcase a multiple of them.

- Information, Education, Communication, Advocacy
- Training and Organizing
- Sorting, Segregation, Sale of Factory Returnables

Table 5
Estimate of Materials Recovered from the Dumpsites

COMPONENT	*WEIGHT BY %*	*TONS/DAY*
Paper	9.8	179.4
Cardboard	4.7	86.0
Food and Kitchen Waste	31.7	580.5
Textiles	1.3	23.8
Rubber and Leather	1.1	20.1
Plastic, Film	5.9	108.0
Plastic, Hard	1.6	29.3
Yard Waste	7.7	141.7
Other Combustible	6.1	111.7
Metal	4.9	89.7
Glass	2.7	49.4
Other Noncombustible	4.6	84.2
Screenings (< 10mm)	6.9	309.4
Special and Hazardous Waste	1.0	18.3
TOTAL	*100.0*	*1,830.8*

Source: Metro Manila Solid Waste Management Study, World Bank funded project, July 1982.

- Sorting, Segregation, Crafts and Waste-derived Products
- Sorting, Segregation, Composting, Vermi Culture-Composting
- Paper Exchange
- Industrial Waste Exchange
- Herbal Garden
- Cleanliness, Streetsweeping
- Back to *Bayong*
- Energy Conversion
- Eco-Aides and Junkshop Cooperatives
- Waste-derived Products and Livelihood Projects

Information, Education, Communication

Most of the organizations advocating EWM engage in projects on information, education and communication. These are intended to stimulate public awareness on the need and importance of ecological waste management. This stage is the vital first step towards motivating the community and encouraging them to take action. It orients the target audience about the technology and the system and infuses values and attitudes toward participation. It is the first step in the possible formation of a core group of volunteers who can initiate the setting up of the system in the community, hospital, market, office, or institution. Activities include: distribution of pamphlets, flyers, brochures, handouts; setting up of posters, streamers; conduct of training programs, workshops, seminars, lectures, symposia; exhibits; visits to pilot and demonstration sites; and presentation of slides and films and use of multimedia technology.

The respondents mentioned that information and training activities have reached the following target participants in the Metro Manila areas:

- residents and officials of barangays, particularly those near the Pasig River
- out of school youth and youth leaders
- homeowners associations
- teachers, principals, academic administrators
- hospital officials, managers and supervisors, personnel
- janitorial staff

- technicians and laboratory personnel
- professional associations
- health workers
- local government officials
- engineers
- office personnel

Training, Values Formation, Organizing

The next most common set of activities of eco-waste NGOs are training and organizing of leaders and volunteers to set up the system in residential communities, hospitals, schools, offices, business and commercial establishments. Training materials and implementation models are used to transmit knowledge, attitudes, values and skills in setting up the ecological projects. The topics are presented in detail in a week of intensive training sessions.

A sample training manual for zero-waste management (Green Forum, 1994) contains four modules:

Module # 1:	Sustainable Development
Module # 2:	Zero-Waste Management
Module # 3:	Organizing your Community for Zero-Waste Management
Module # 4:	Towards an Action Plan

The first module intends to make the trainee familiar with the current state of the environment at local and global levels, to understand fully the key concepts of sustainable development, and to comprehend the impact of individual actions on the environment through an assessment of one's personal lifestyle. This is reinforced in the second module to make the trainee realize the extent of Metro Manila's waste problem and its negative effects on the environment, economy and public health. The principles, technology, system and practice for successful zero-waste management are taught. It takes a considerable amount of time to make the participants understand the proper way for successful implementation.

The importance of the materials recovery system is emphasized since this is the area for storage of the eco-aide equipment, for buy-and-sell of

segregated materials and for forming linkages with big company buyers and junkshop dealers (pp.33-35). One of the keys to success is the marketing of the waste materials — knowing what can be recycled, what junkshop dealers are willing to buy and where the junkshops are located (pp. 50-52). Lists of junkshop dealers in various areas in Metro Manila are provided (p. 52; DENR Metropolitian Environment Improvement Program Linis Ganda Project; handouts of the Recycling Movement of the Philippines).

The third module focuses on the key concepts and strategies of community organizing. The goal is to mobilize members to act and help make the community empowered and self-reliant (p. 53). It is important for the organizer to solicit and develop cooperation and communication in the community.

> Community organizing "begins and builds upon local and concrete issues which people want to do something about. It emphasizes intensive and disciplined preparation of as many people as possible from identification of the issues, the clarification of issues, the decision-making on the course of action to the evaluation and reflection of the action." (p. 56 quoting the Tagisan Group, Manila, Philippines).

Certain considerations are emphasized (pp. 58-59) during the training sessions for the participants to apply in the community. First, consciousness raising is attained by experiential learning, by participating in action, not by lecture. Second, action is done in response to an issue identified by the community to give them a sense of ownership and responsibility for the action taken. Third, the community organizer is not the community leader. Fourth, evaluation is done for each activity to derive lessons from the experiences and take corrective measures.

Annex 1 shows the nine steps for the process of community organizing. This model has been tested for effectiveness in getting the commitment of core leaders and the members of the community which is an essential factor in sustaining the initiative when the NGO organizers have left.

The last component of the training program is making the participants prepare the action plan. This is an important element for successful implementation. It should contain the specific objectives and steps for three key strategic elements, namely:

1. education: information dissemination, motivation, persuasion, training; handouts

2. engineering: basically, sorting bins, plastic bags, compost area, collection and linkages to market buyers; also, shredders, pushcarts, facilities area or materials recovery area; equipment and materials for livelihood projects such as crafts
3. enforcement: incentives, monitoring, follow-up, sanctions.

A worksheet (Workplan or Action Plan) is presented and used during the training program and community planning sessions. This sets up the activities to be taken, the schedule or time frame, the resources needed and the people in charge. The plan facilitates implementation in various settings, in the office, household, community, market, school or commercial establishment. Annexes 2, 3, 4 show the three key strategic elements and the sample action plan worksheet.

In planning and executing the implementing scheme, there are suggested procedures for the specific setting where the zero-waste system will be installed — in a school, household, community, office, or market. The general framework is applied to the specific setting. The process follows a pattern:

- orientation, clarification, understanding of the concepts, principles
- technology of ecological waste management
- appointment of an ecology officer/recycling officer
- formation of a core group
- grouping of area into sections
- appointment of a person in charge of the section
- selecting a pilot area
- prepare action plan
- schedule dry run before full implementation
- monitor and supervise
- evaluate to modify, make changes
- record and document developments from the beginning to the succeeding stages

This flow of implementing steps are done in the context of the nuances of the setting (school, market, community, office). These are shown in Annexes 5 to 9.

Factory Returnables, Eco-Aides, Junkshops, Redemption Centers

At the implementation site, the practice of the eco-waste system includes the indispensable component of sorting and segregation. There are bins or containers specifically designated for specific types of wastes. This is the main source of income and livelihood as factory returnables are retrieved for sale. Segregated organic wastes are set up for composting. This stage requires attitude and lifestyle changes for efficient and effective waste reduction at source and for the following stages to take place.

Factory returnables such as bottles, paper, metal, glass, etc. are collected properly and regularly to sustain the effort. The linkages with junkshops and buyers have proven to be indispensable in making the efforts worthwhile.

The junkshops employ eco-aides and provide them with capital each morning before they make their rounds (Camacho, 1994). The eco-aides wear green T-shirts, carry identification cards and use green pushcarts or bicycles. They buy the wastes, such as paper, bottles, plastics, cans, batteries, etc. and bring these back to the junkshops where they get paid for their collection. Junkshops in turn sell to the factories.

Without this as a component of the ecological waste management system, the motivation and practice could die. People would find it inconvenient to sort, segregate, package and store without anyone collecting on a regular basis. The money paid for the retrieved wastes makes their effort worthwhile.

At this stage of the system, the implementing organization must consider the importance of the so-called material recovery center as the place designated for the following activities:

- storage of the sorted factory returnables and the equipment such as the pushcarts
- monitoring and supervising the eco-aides
- training on the technology and system
- research on markets for the waste materials
- transactions of eco-aides — providing loans and capital
- linking up with district level (Mother) Materials Recovery Centers,

buyers, junkshop dealers

The district level Materials Recovery Center does the work on a larger scale. This is an important component of the system that sustains the motivation to sort and segregate because there is someone to collect and to buy.

The eco-waste system necessitates the setting up of redemption centers or market linkages with junkshop dealers and other buyers of recyclables. Lists of junkshop dealers and company buyers in different areas have now been prepared. Junkshop dealers have also been organized into cooperatives (Metro Manila Linis Ganda, Inc., River Rehabilitation Secretariat and Clean and Green Foundation).

Paper Exchange

The paper exchange is a project to collect waste paper from corporate offices. Its basic assumption is that business corporations are among the largest sources of waste paper and a major consumer of paper, paper products and packaging. The project intends to collect sufficient volumes of paper for the local paper manufacturing industry and to develop and enlarge the market for recycled paper. In the long run, corporate paper needs should be met by recycled paper products (Makati Business Club Handout, 1994).

Cleanliness Drives

Projects like streetsweeping and cleanliness campaigns dramatize the possibility of getting rid of litter, garbage and stored wastes by community efforts. However, such activities have not been sustained and need to be accompanied by the eco-waste system of waste reduction at source.

Composting, Vegetable and Herbal Gardens

Projects on composting food and kitchen wastes and other biodegradable wastes have produced fertilizers useful for small vegetable and flower garden. Herbal gardening has yielded medicinal plants for common illnesses. Compost practitioners in Metro Manila have been able to do composting with simple old reused bins, containers, plastic bags and tires. In the provincial areas, bigger land area has allowed large-scale composting.

Livelihood Projects and Waste Derived Products

The implementation of the eco-waste management system has provided employment, livelihood and income from the creation of new materials or products from the wastes. Persons in residential communities and students in elementary and high school have been trained to do handicraft and produce new materials from wastes.

Among the ongoing livelihood projects are the following:

1. paper making from old and used newspapers, magazines, directories and office paper
2. paper products: baskets, trays, decorative items
3. mats and hats from used straws
4. vinegar from banana and pineapple peelings
5. roofing materials from used cans and tetra packs
6. candle making
7. floorwax making
8. organic fertilizer for *palay*, *mais*, vegetables, grains, fruit bearing trees, flowering plants, herbal plants for plant nurseries and fishponds

Inventors have gained by innovating technologies for solid wastes such as shredders to cut the wastes into small sizes and mobile plants to convert garden refuse, coconut shells, mats, debris into green charcoal. Entrepreneurship, products and markets has been developed for waste conversion technologies and waste-derived products.

NGO Advocates and Implementors

A number of NGOs focus their advocacy, information dissemination, training, organizing and project implementation on ecological waste management. Nongovernment organizations (NGOs) are nonprofit, private, voluntary, cause-oriented groups that organize their beneficiaries for purposes of empowerment and self-reliance into people's organizations. A number of organizations deal with environmental concerns such as protection, preservation and conservation of wildlife, flora, forests, fisheries and water resources. Some confront the problems of air and water pollution and other forms of degradation. There are those that include ecological solid waste management

as part of their concerns, while others do not. There are also NGOs that specialize in ecological waste management.

NGOs that focus on ecological waste management provide the speakers, resource persons, trainors and facilitators in orientation sessions. This usually sparks interest and leads to the training and organizing of core leaders.

NGOs help establish and mobilize organizations in the communities, schools and offices to set up an eco-waste system. Some of these are associations of homeowners, employees, parents and teachers, or multi-sectoral organizations. The people's organization or association sustains the initiative(s)-project(s) on its own resources. Eventually, the NGO detaches itself from the association when the latter becomes self-managing and independent. The NGO may continue to monitor or provide assistance, however.

The active NGO advocates and implementors are the following:

- Recycling Movement of the Philippines

The RCP is an umbrella organization of various NGOs, POs and community-based associations involved in the advocacy and practice of zero-waste management. It provides resource persons-trainers-facilitators for orientation, training, organizing activities to set up the zero-waste management system in schools, hospitals, industries, business offices and communities. The advocacy has reached a number of communities that have adopted the practice. The livelihood projects are a significant part of the system that motivates participants.

- Green Forum

Green Forum is a national network of NGOs, POs and church groups working for social equity, sustainable development and environment. It published a training manual for organizing a community for zero-waste management. It has conducted orientation and training programs and mobilized communities for environmental action.

Green Forum initiated the *Balik-Bayong* consumer campaign in March 1991 to minimize the use of plastic shopping bags and replace these with biodegradable substitutes (Training Manual for Zero Waste, p. 26). The project expected to deal with the problem of drainage systems clogged by

plastics. The Department of Public Works and Highways spent over P1 million to remove the plastics from the clogged drainage system. The SM chain of stores, Rustan's Supermarket and the school-based environment NGO, Miriam P.E.A.C.E., joined the campaign (p. 27). Youth volunteers in display booths disseminated information and sold *bayongs*. Green Forum also produced a television commercial aired on prime time television for six weeks with the assistance of the Philippine Information Agency.

- Ecology Center

The Eco Center in Quezon City engages in a large scale vermi culture and composting. It has piloted various ecological projects in the Quezon City area using zero-waste management with strong values formation. It promotes the concept and practice of composting even in one or two pots. It also advocates the use of organic pesticides.

- Green Coalition

The Green Coalition is a multi-sectoral organization geared towards raising public awareness for environment and sustainable use of natural resources. One of its program areas is community-based environmental management. It conducts training, public info campaigns, organizing and networking with industry, community, LGUs and business. It is also involved in the industrial waste exchange program.

- The Philippine Business for Social Progress (PBSP)

The PBSP is an organization for social development supported by funds from various business organizations. Among other concerns, the PBSP started ecological waste management projects in Taguig. These efforts have been replicated in seven other areas — two in Marikina, one each in Mandaluyong, Makati, Parañaque and Las Piñas. The pilot project covered training, materials preparation and organizing.

- The Families and Children for Empowerment and Development (FCED)

The FCED organized ecological waste management projects in 10 pilot barangays in the City of Manila. Other barangays with similar programs are being assisted by other NGOs.

- Center for Advanced Philippine Studies (CAPS)

The CAPS has done a survey of 979 junkshops. It links people's organizations, barangays and nongovernment organizations and deals with training, information, education and communication. It has conducted studies on the urban environment with the MEIP documenting community initiatives. Its research on recycling activities (on how to recycle 10 materials) was funded by the Netherlands.

- International Resource Recovery Network (IRREN)

IRREN is a network whose concerns focus on the problems of solid waste management. It pursues both community organizing and project management.

- Foundation for the Philippine Environment (FPE)

The FPE is widely engaged in various environmental issues, primarily in funding projects with an environmental goal. It is the coordinator for the Philippine Federation of NGOs on waste concerns. At the time of the survey, the FPE did not have a specific thrust on solid waste management but said it was working on the prospects of a "brown fund." Its publications serve as a medium for information dissemination on waste minimization done in industries, businesses and communities using new alternative, ecological technologies.

Initiatives of Business Organizations

The Makati Business Club (MBC) has initiated the Paper Exchange project in cooperation with the Bankers Association of the Philippines, the Philippine Business for the Environment, the Philippine Business for Social Progress-Center for Corporate Citizenship and the Makati NGO Network (Handout; MSP Conference, 1994). This involves the collection of wastes from business corporations and recycling them into new paper and paper related products. It is premised on the observation that the business sector is one of the biggest consumers of paper and paper related products, generating a lot of waste in the process.

The Philippine Business for Social Progress (PBSP), the Philippine Business for Environment (PBE) and the Environmental Management Bureau

(EMB) of the Department of Environment and Natural Resources jointly co-sponsor the Industrial Environmental Management Project. This is an industrial waste exchange program based on the premise that one industry's output of wastes is another industry's input of resources. The companies can sell and exchange their wastes. The waste generator saves on disposal costs and earns from the sale of the wastes. The waste buyer saves on processing costs and finds a stable source of raw materials. The PBE has enlisted business organizations and industries as buyers and sellers with corresponding information on materials needed and available (PBE and IWEP brochures). A directory lists the company name, business address and telephone number for prospective clients. The list now contains 11 classifications of waste materials: acids, solvents, plastics, rubber, metals and metal sludges, alkalis, oil and waxes, textile and leather, organic and inorganic chemicals, and wood and paper. These are further classified into solution aggregate, slurry solid, sludge dust and cake gas.

Government Agencies in Environment

The Pasig River Rehabilitation Project (PRRP) of the Department of Environment and Natural Resources (DENR) collaborated with the Sagip Pasig Movement involving the participation of 25 different NGOs and the Linis Ganda. It organized junkshops into cooperatives for recycling and micro programs in Sta. Ana. The project provided pushcarts, forklifts and garbage bins for dry, wet and biodegradable wastes. Organizing was done in the market areas of nine municipalities and four cities.

The DENR was the lead agency of the Pasig River Rehabilitation Project, a cooperative undertaking with the Government of Denmark's Danish International Development Agency (DANIDA) and the Carl Bro International (a Danish consulting firm). The River Rehabilitation Secretariat (RRS) was the special project office under the DENR tasked to strengthen the coordinating capacity for 40 agencies and organizations with sectoral policies, plans and projects affecting environmental quality in and around the river (RRS Secretariat).

The Metropolitan Environmental Improvement Program (MEIP) of the DENR was funded by the United Nations Development Programme (UNDP) and administered by the World Bank. One area of concern was solid waste management. The MEIP worked on information, education and communication materials on ecological waste management for public awareness (DENR MEIP files). It published "how-to-do" manuals and pamphlets for

setting up the ecological waste management system in schools, offices, households/communities and public markets. The MEIP's concerns extended to industries for pollution prevention and reduction, waste minimization and clean technology.

The former First Lady of the Philippines, Ms. Amelita Ramos, had been at the forefront of the Clean and Green Movement which worked with the Metro Manila Linis Ganda project and the DENR River Rehabilitation Secretariat on environment cooperatives. The junkshops had been organized into cooperatives, one each for the cities and municipalities of Metro Manila.

International Organizations

The United Nations Center for Human Settlements-HABITAT has recognized the need for a waste recycling program because of the increased costs of waste disposal, inadequate government services and the lack of landfill space in the country. It said that the first phase is the mobilization of the population to minimize waste generation and production. The next step is an information dissemination campaign and the implementation of a recycling and reuse program. In addition, a waste disposal program is needed for the low-income sector as well as livelihood projects for the communities.

The United Nations Development Progamme (UNDP) in the Philippines assists the DENR's Metropolitan Environment Improvement Program. On the other hand, the Asian Development Bank placed the problem of solid waste in the context of land pollution. It has since called for government policy and action on natural resource management, investment in environmental infrastructure and a policy dialogue focusing on conservation.

Community-Based Eco-Waste Initiatives

According to respondents, the ecological waste management system has been adopted and practiced in an increasing number of urban poor barangays, subdivisions, private and government offices, markets, schools and institutions. Some of these have become demonstration sites and showcase successful projects.

- Schools

Among schools, the following were identified as using the eco-waste system: Legarda Elementary School; UP Los Baños; Project 6 Elementary

School; Pag-asa Elementary School; Emilio Aguinaldo Integrated School; Tomas Earnshaw Elementary School; Miriam College; Adamson University.

The case of the Project 6 Elementary School provided interesting insights into the process and results. The zero-waste management system was incorporated in Science and HELE classes. A place was designated as ecology center which served as display area for recycled products and composting technologies. Income has been earned from the sale of the paper waste products. A part of the schoolgrounds was used for composting and for a vegetable and plant garden. Products were made by the school organizations such as the homemaker's club which created handicrafts out of old clothes and the science club which made floor wax out of plastics. The school linked up with civic organizations, such as the Rotary Club and with barangay officials, to undertake outreach programs.

- Barangays-Communities

A number of barangays were mentioned as having an eco-waste program. In Sta. Ana, the youth were recruited into the Kabataang Malinis Brigade.

Some universities had extension programs in "adopted" or "pilot" communities, such as in San Andres by De la Salle University. A pilot area in Intramuros was spearheaded by a network of four universities with the expectation of eventual self-reliance and independent implementation by the barangay. Two subdivisions had publicized projects with eco-aides. These were the BF Homes Subdivision and Tahanan Village in Parañaque. The community based eco-waste system in Villamor Air Base was used as a working model on zero-waste technology.

The BF Homes Homeowners association started with three activities on waste management: the eco-aide program, compost waste project and the speakers bureau on environmental protection. The Kilusan Para sa Kinabukasan ng BF was organized to stimulate awareness in individuals. It advocated the 3 Rs and was also involved in the establishment of the nursery and in tree planting activities.

The ecology center at Fort Bonifacio, Bicutan, Parañaque has been a popular demonstration site. Previously sorted wastes in the community were collected and stored in a facility where livelihood projects were undertaken. People were engaged in paper making, candle making and paper handicrafts. They also converted coconut shells to produce chars. Specific plots were

designated for the shredder machine, for composting and for the vegetable and plant gardens. The sale of the products has generated significant income.

- Local Government Units

The Sta. Maria Waste Processing and Recycling Project was a joint undertaking of the municipal government of Sta. Maria, Bulacan, the Sta. Maria Economic Foundation and NGO named AWARE Inc. (Site visit; Handout, 1995) This was an example of what joint collaborative efforts can do.

The project demonstrated the zero-waste management's composting, recycling and waste-derived livelihood projects. It produced the Kalikasan Organic fertilizer in considerably large quantities useful for the planting of palay [600 kgs Kalikasan at 100 kgs of 14-14-14), corn [750 kgs Kalikasan at 150 kgs 14-14-14], vegetables, trees and flowers.

The case of Imus, Cavite also demonstrated the possibilities of collaboration among government and other sectors in the community such as the vendors association, Rotary Club, business club and elementary school. The example showed how local government units can use the powers of government to initiate change.

The mayor adopted the zero-waste management program as a centerpiece activity, considering that only 37 percent of the area had regular collection services. An information dissemination and education campaign involved distributing 45,000 copies of the ZWM brochure, holding seminars, monitoring of activities and contests. In 1995, garbage collection was scheduled according to type of wastes: Mondays, Wednesdays and Fridays for biodegradable organic wastes; Tuesdays and Thursdays for hazardous wastes; Saturdays and Sundays for non-biodegradable wastes.

- Business Organizations

The RFM Corporation started zero-waste management with the segregation of office wastes consisting mainly of paper. Old files were shredded and reused as layers for chickens.

La Tondeña Foundation funded its first pilot project among the urban poor in Intramuros, Manila. An ecological waste management system was set up, integrated with a concern for health and livelihood. A project within the offices and the plant was also considered by the La Tondeña Foundation.

The Unilever Philippines started a pilot project on waste management

at the Paco Market in cooperation with the Department of Environment and Natural Resources.

- Offices

Added to these were offices that had similar initiatives going such as those in the city governments of Manila and Quezon City; in some churches; and in organizations such as medical societies, women's clubs and socio-civic associations.

- Hospitals

In the case of hospitals, incineration was the main system for hazardous and toxic waste disposal. But sorting and segregation were also practised in color coded bags. Seminars had been conducted to orient hospital personnel.

One respondent said that at the Philippine General Hospital, with its 3,600 employees and 3,500 patients, the pathological wastes were segregated from the dry wastes. Infectious wastes were placed in black bags, noninfectious in green bags, biomedical and sharp wastes were kept in plastic yellow bags. On a daily average, the volume of wastes reached 4,000 kg with 50 kg of pathological wastes. PGH spends P48,500 for bags a month; P47,000 for pathological waste a month. Ten people take care of gathering the wastes. Three incinerators were not fully functioning and there was danger of resultant pollution.

Other hospitals that sorted and segregated wastes, in addition to using incinerators were FEU Hospital, Muntinlupa Municipal Hospital, Makati Medical Center, Batangas Provincial Hospital, Jose Reyes Memorial Medical Center, Fabella Medical Center, Philippine Heart Center, Medical City, UST Hospital and East Avenue Medical Center.

Results and Benefits

The initiatives undertaken in communities, offices, institutions and the continuing trend of advocacy and implementation, show the potential of the ecological waste management system in attaining better conditions of health and environment. The experiences in training, organizing, networking, multisectoral collaboration of local government unit, community, NGO and private sector provide useful lessons for replication.

It has been proven that the commitment to lifestyle changes in handling waste can result in resource recovery, waste derived products,

livelihood and income. Despite some gaps that still have to be addressed, the results and benefits have been encouraging.

Lifestyle Changes. The communities have just begun to learn and practice eco-waste management, providing models for a new lifestyle. In implementing the system in various settings, new attitudes, values and behavior were developed. These were volunteerism, commitment, participation, leadership, thriftiness, concern for preservation and conservation of the environment and concern for health.

People realize that it will take time for new behavior to develop. But with the results of the initiatives, an increasing number of people are showing interest.

Health and Environment. Benefits take the form of properly segregated wastes. In sample sites that were visited, surroundings were kept clean. Garbage volume bound for the dumpsites/landfills was reduced. Combining the efforts of the current areas engaged in the system, the volume of waste reduction will be bigger. Cleanliness breeds good health as the absence of flies, rats and roaches attests to.

Resource Recovery, Livelihood Projects, Waste-Derived Products, Income. The volume of biodegradable and non-biodegradable wastes in the project sites enabled the production of waste-derived handicrafts and livelihood projects. The product list includes baskets, trays, decorations, candles, floor wax, compost-fertilizers and the yield of vegetables, herbal plants, flowers. To some extent, the handicrafts and materials production have provided income, livelihood, skills training and exercise of creativity and innovation.

Scavengers, junkshop dealers and company buyers have participated in the beneficial buy-and-sell of waste products. The waste materials returned to the factories as resources to be reused for less costly production.

Chapter 8

Lessons And Policy Directions

There are significant patterns in the scenario of solid waste management, based on the data presented in the previous chapters. These are:

1. the conventional system of government services for solid waste management, from collection to disposal in dumpsites and landfills;
2. the informal system and business of scavenging and junkshop operations;
3. alternative technologies in solid waste management, tested in many countries in Europe, Asia and in the United States, focused on waste minimization, resource recovery, recyling and reuse in relation to ecological waste management and sustainable development;
4. local initiative-projects in ecological waste management by non-government organizations, community-based people's organization, associations, business and industrial organizations, government and international organizations; undertaken in schools, residential communities, offices, industries and establishments.

Lessons can now be derived from the years of experience with dumpsite disposal. On the other hand, the recent years of implementation of pilot ecological waste management and alternative technologies projects already point to some success and failure factors. These serve as useful guides for strategies or interventions to sustain and replicate the efforts. The experiences can help set the direction for policy decisions on the appropriate schemes for solid waste disposal.

Case Against Dumpsites, Landfills, Incinerators

A number of voices say "no" to dumpsites, landfills and incinerators for waste disposal. The closure of the dumpsites in Metro Manila indicates that even government has recognized its dangers.

For the conventional open dumping and landfill used by government, the significant lessons can be derived from the case of the Smokey Mountain, or the Balut dumpsite. The unsorted and unsegregated garbage encouraged

scavenging for useful waste materials. Such activities were done even by women and children under unsanitary conditions. The mound of wastes had been found to create methane gas that can badly affect environment and people in the long run.

Landfills also pose dangers to the environment, to ground water, to nearby water bodies and to aquatic resources. The improper handling of the leachate is still a principal problem even for the supposedly controlled sanitary landfills in Carmona, Cavite and San Mateo, Rizal. The landfill in Carmona endangers Laguna de Bay, while San Mateo may contaminate the Marikina River. The lifespan of these sanitary landfills run to approximately five to six years. The first phase of Carmona is already almost filled up and the second phase is being prepared. With the increasing volume of unsorted wastes dumped in these landfills, the areas will soon be filled to capacity. The next problem is looking for other sites and responding to objections of the people.

Another case is the objection registered by some groups in the NGO sector against open burning and the use of incinerators. The hospitals, in particular, resort to incinerators as a major means of disposal for toxic and hazardous wastes. The main argument against incinerators is pollution and damage to air and health. However, some other groups claim that incinerators are now in an advanced state of technology and can be used for converting waste to energy.

Also, a serious environmental problem is garbage disposal in *esteros*, foreshores, rivers and empty lots. This situation does not only occur in Metro Manila as a result of squatter formations, but also in some regional urban and suburban sites due to inadequate collection systems and lack of available disposal sites.

Various studies have found that local government units do not have enough funds, manpower and collection vehicles to reach 100 percent of its constituencies, especially those in far-flung and inaccessible areas. The type of trucks donated and in use were also found to be incompatible with the type and density of wastes generated locally.

Need for Resource Recovery, Ecological Schemes, Citizen Participation and Government Policy

Data analysis on the current system of waste collection and disposal establishes the fact that it is no longer capable of absorbing the volume of waste generated. This situation underscores the need to resolve the problem considering the options presented by alternative ecological waste management systems.

The pilot projects on ecological schemes demonstrated the potential benefits that can be magnified with more widespread practice. So far, a small group of scavengers and junkshop operators have received the benefits of income and livelihood from organized cooperatives in Metro Manila. Elsewhere, the informal system still prevails. Even with these, partial data from limited studies revealed that the supply of waste materials is still much less than the demand of companies using recyclable recovered materials. Costs of production are much less than using virgin materials. The positive impact to the environment is evident. It helps control the depletion of resources.

Expanding the practice has the potential of increased volume of recovered and recycleable materials. This also elevates the status of scavengers to eco-aide collectors who are given proper work status, identification, sources of income and livelihood. It allows sanitary storage and retrieval of wastes that are sorted and segregated, and lessens the load headed for the sanitary landfills.

One critical element in the practice of eco-waste management is citizen participation. Much credit is due to nongovernment organizations, socio-civic organizations and individuals who pushed for the practice of ecological waste management.

However, the experiences point to the serious need for government action. Collaboration among local government units, citizens in the constituency, nongovernment organizations and private businesses showcases examples of good practice that can be replicated in other areas. This can happen when local government executives take the lead and make the eco-waste system a centerpiece program.

Replicating the practice of eco-waste management requires nationwide public awareness, acceptance, skills-training, implementation and monitoring. The NGOs have done the work of advocacy, information dissemination, training and organizing, to spread the practice. What is imperative is the

support of national and local government in terms of political will and leadership and a policy and legislative framework to set a mandate for national and local implementation.

However, there are gaps in this eco-waste system that need to be addressed. In sustaining and replicating the system, it is important to learn from experience and to understand the factors for success and failure. As these are absorbed, policy and decision-making and program planning and implementation can be based on more solid ground.

Sustaining and Replicating Local Initiatives in an Eco-Waste Management System

Success and failure factors follow a common pattern among the various initiatives-projects in eco-waste management. This observation is based on the similarities in responses to questions on the implementation of various initiatives-projects in eco-waste management undertaken in communities, schools, market, hospitals and business organizations. The following profile of critical success factors in implementation were derived from the limited survey of organizations and literature from proceedings of conferences, seminars and workshops:

1. Information Dissemination, Advocacy, Training and Education
   - materials are easy to understand; also, appealing to the youth
   - media support
   - effective speakers and facilitators
   - people's awareness and understanding of the problem with solid waste management and environmental degradation; and consequentialy, commitment to implement the eco-waste system

2. Community Empowerment
   - campaign for involvement and mobilization of the people — house to house, community meetings, bulletin boards, contests
   - leadership of an individual and/or core group determined to vigorously push and maintain the initiative and achieve success
   - individual participation in group planning and implementation such that each one acquires a sense of ownership and becomes a stakeholder (following the

community organizing process of involving the members of the community in problem identification, training, action planning, sharing of tasks in the implementation process, evaluation)

- continued training, education for values and habit formation, for skills in technology and project management

3. Linkages, Partnerships, Multisectoral Collaboration
   - NGOs, the local government unit and private business organizations and industries with respective tasks and roles
   - willingness to participate and share resources
   - communication, coordination, monitoring among the participating groups
   - political will or committed leadership of the local government officials particularly the mayor; immediate response of local government to needs of the project
   - training programs attended by committed and involved representatives of participating groups

4. Market Linkages
   - linkage to junkshops and other junkshop buyers
   - a collection scheme set up and monitored
   - a facility or place designated for recyclable and recovered materials, for making products from wastes, and display of the products

5. Behavior and Lifestyle Changes in Individuals
   - containers set up in the household or office or area designated for specific types of wastes
   - containers always used to sort and segregate wastes
   - practice of reuse, recycling and sale to waste collector
   - habits and values formation

6. Project Management
   - small doable projects; pilot project launched and evaluated before full implementation
   - mandate obtained from top officials or support from key people
   - incentives and recognition
   - monitoring of the activities
   - members' participation in evaluation
   - self-reliance, sourcing of funds and proper accountability

Failures and Areas of Concern

The failure of some of the initiatives can be traced to the absence or inadequacy of the above mentioned success factors. However, there are specific factors to consider, namely:

- no build up of community awareness; waning interest
- people are too busy to segregate, hence the need for strategies to induce behavior change
- self-interest, defiance, indifference, negative attitudes
- lack of funds
- lack of logistics

Aside from these, there are other issues to be considered. One pertains to the poor quality of the recyclable and recovered waste materials, and of waste-derived products.

The income potential of recovered materials is hindered by constraints in the market. According to Ouano, the demand for and the price of raw material sources are determined by uniformity in quality, sufficiency in quantity and availability when needed (Imperatives of Recycling, 1993, p.7).

Ouano further explained (pp. 7-12) that the quality of recovered wastes is marred by the presence of impurities and antagonistic properties. One difficulty can be traced to the mixing of different kinds of recovered wastes. It is therefore imperative to separate the wastes at sources. Impurities in the recovered wastes can result in inferior products that are sure to be rejected. Other considerations are the seasonal supply of recovered wastes and the uncertainty of its availability when needed.

In some cases, it was observed that products made from recovered materials tend to be more expensive than products from virgin materials. There are a number of factors to explain this case. One is that the prices of virgin materials do not fully cover the costs of extraction from nature. The other factor is that the economic and social system favors production with virgin materials in terms of the incentives, infrastructure and market conditions that exist (pp. 11-12). Efforts must be directed to increasing the competitive advantage of recycled products.

Policy Directions

Various sources tend to agree on common points for policymaking and legislation, and the role of national and local government with respect to resource recovery, recycling and ecological waste management systems. The support of government is vital to ensuring that current initiatives of nongovernment organizations and the private sector are sustained. Government intervention is needed in order to integrate alternative technologies into the government's formal system of solid waste management.

Legislation and policies at national and local levels are needed in the following areas:

1. public-private partnership; collaboration of national and local governments with community-based orgnizations, NGOs, socio-civic organizations and the private business sector
2. public information and education
3. recycling system set up at sources of waste generation, integrated with the restructuring of the scavenging and junkshop operations
4. industrial base for recovered waste resources
5. incentives and sanctions
6. market and product development

Public-Private Partnership and Multi-sectoral Collaboration

Interventions in solid waste management require the participation of government, private business sector, nongovernment associations and people's organizations. According to Fernandez (1993, p. 1), these can be interpreted as role-sharing and can be demonstrated by schemes for stakeholder involvement, such as:

- municipal service
- municipal public enterprise/corporation
- intergovernmental agreement
- multi-jurisdictional government organization
- joint public-private venture
- management contract

- grants
- community arrangements
- voluntary arrangements
- self-service
- franchise
- lease
- private service

Such partnership and collaboration must be based on common understanding of issues. In the context of the Philippine experience, local government units play an important role under devolution.

The advocates of zero waste management provide a specific list of tasks and roles for government and other sectors (Sabas 1994) as shown below:

- **Role of Government:** Leadership to lay out the plans, the administrative machinery, appoint the personnel, provide logistics for the various stages of the project; Enact necessary laws/ statutes/ ordinances to support or make possible the proposed changes, innovations, as well as give incentives, to the industrial sector, to the barangays, to the schools; Through tax incentives, encourage factories to use more recyclables, motivate firms to devise manufacture equipment needed to carry out the project, e.g. shredders, mixers, for large scale composting; and Law enforcement, supervision, monitoring and evaluation.
- **Role of Schools:** Put up ecology learning centers and demonstration centers or show windows for the concept of zero waste through total recycling of refuse; Curricular approach — through all possible subject areas, teach pupils/students the concept and enable them to be exemplars as well as demonstrators in their own homes or barangays; Co-curricular approaches — YDT, CAT, BOY and GIRL SCOUTS.
- **Role of Barangays:** Plan for local implementation of the scheme taking into consideration the particular needs, problems, resources of the barangay; Implement basic procedures, each household must presort all wastes into two kinds; Disseminate and demonstrate in all areas; and Survey, identify, train collectors, as well as interested end users, or identify markets for recycleables, including compost, seedlings, fine craft products.

- **Role of Community Organizations:** Establish suitable operational procedures to implement the scheme; Inform, instruct, educate, communicate; Sponsor campaigns, drives, competitions, awarding of prizes, recognizing accomplishments, giving incentives; Finance, conduct research studies to continually evaluate, document, improve procedures, processes involved; and, Lend prestige and influence to the legitimation and favorable acceptance of the project.
- **Role of Business and Industry:** Provide the market for recyclables; Devise systematic operational procedures for collection and delivery of recyclables from homes and barangays to factory or end-users to provide funding assistance or seed capital for the buying operations; Devise or employ labor intensive methods in the operational schemes of collecting and sorting, mindful of the health of scavengers, collectors; Pool resources with other sectors in designing, devising, giving proper awards, incentives and recognition for those contributing to the success of the project.
- **Role of Media:** Inspiration, information, instruction and evaluation.

Focus on Information and Education

Public awareness is generally regarded as the most important intervention to achieve lifestyle and behavioral changes. This should be directed at the youth and be a primary concern of all sectors but particularly of the educational system. The education component should consist of the following:

- problems of increased volume of solid wastes;
- dangers of dumpsites and landfills to health and environment;
- effects of consumer and waste generation behavior;
- need for changes in attitudes, values, behavior;
- need to form new habits to sustain sorting, segregation, recycling, reuse; and
- importance and benefits of recycling to the individual, the house hold, the community, the organization and society.

The targets of public information campaigns should include politicians and policymakers, school children and the youth, middle and high income groups, neighborhood associations, scavengers and (junk) middlemen.

The formal and informal channels of education are potentially effective in the dissemination of recycling schemes. Other communication interventions and campaigns can reach out to the population using appropriate language and media.

Focus on Setting up Recycling Systems

Setting up recycling systems in neighborhoods is an area for partnership and collaboration among local governments, people's organizations and associations. This requires policy and legislation from the local government to mandate installation of facilities and compliance with waste segregation practices. At the same time, voluntary commitment and participation from the people would make it more effective. To this can be added the personal leadership style of the local chief executive in pushing the recycling program.

Setting up a recycling system encourages the practice of sorting and segregation at grassroot levels of waste generation. This operationalizes waste minimization and reinforces the shifts in behavior.

However, policy and program interventions are necessary to restructure the role of scavengers as collectors and the role of middlemen and junkshops. This involves the participation of the local government's collection crew and changes in their schedules and style of hauling wastes to reinforce waste segregation at source.

The development of legislation is also necessary to set up waste recycling industries, establish markets, to improve the products from wastes and to put up demonstration programs. There is a wide arena for intervention, among which are: minimizing impurities and antagonistic properties of waste to ensure the quality desired by buyers; standardization of bottles, plastic containers and other reuseable packaging materials; loans and incentives for entrepreneurs; and skills training, product development and market linkages for handcrafted and processed waste-derived products.

Focus on Incentives and Sanctions

The new market-based incentives have taken over the command and control approaches to implementing regulatory standards and compliance monitoring. MBI or market-based incentives encourage change behavior by creating markets for wastes, for goods and for services used in pollution

prevention and waste reduction, and providing financial packages for waste reducing behavior such as refunds or surcharges for recyclable materials. Such incentives are needed particularly for industries to engage in waste minimization, for individuals to change behavior and even for inventors and entreprenuers to regard waste products and technologies as business opportunities. Taxes can also be imposed for sanctions and enforcement while tax exemptions can provide incentives.

It has also been suggested that research be done to develop products from recovered materials, to test and establish quality control standards for recovered materials for various industrial uses,and to study the feasibility of putting up a clearing house of waste management information (Ouano, Imperatives for Recycling, p. 14). Research is also needed to study the various areas in the recycling and resource recovery processes, the technology, as well as its socioeconomic and institutional aspects.

Conclusion

The hazards of the traditional solid waste management system practised for decades by the government clearly establishes the basis for change. That system endangers health and perpetuates environmental degradation. It cannot cope with the rising volume of wastes generated by the increase in population, business, commercial and industrial activities particularly in urban centers. The collection system is clearly inadequate. The dumpsites and landfills are fast approaching capacity levels and new sites are not readily available.

Ecological waste management, with its recycling and resource recovery components, offers a possible option that is consistent with the concept of sustainable development. As the saying goes, "waste is a resource that has not found its right place." Its potential for resource recovery has been tested to some extent, showing that waste materials can be used in place of virgin materials. This prevents the "depletion of today's resources for economic development at the expense of future generations." However, the full potential of waste resource recovery has not been reached. The amount of wastes generated reflects the amount of resources taken from nature. To reverse the situation, the amount of wastes generated should reflect the amount of resources that can be reused without having to take anything away from nature.

Wastes also indicate lifestyle, production and consumption behavior. To change the pattern, attitudes, values and behavior must be transformed.

This starts with the initial step in ecological waste management, that is, sorting and segregation at source. Such behavior has yet to become a habit. This has to be followed by sustained commitment to reuse and recycle. This involves conscious efforts at composting, reusing and selling the wastes. Reinforcing or sustaining the initiatives requires an integrated support system.

The experiences with pilot projects and pioneering initiatives have shown that certain factors are necessary for success. The list includes: (1) continued public awareness, information dissemination, advocacy, education and training to create a constituency committed to the eco-waste system; (2) partnership and collaboration among the government, nongovernment organizations, community associations and the private sectors in all aspects of the system; (3) establishment of an integrated system of recycling and resource recovery at the level of communities of all income groups as well as in industries and institutions; (4) restructuring the informal system and business of scavenging and junkshop operations to allow maximum resource recovery, conformity to buyer's specifications of quality and quantity, increase in income and stability in livelihood; (5) sanctions and incentives, policy and legislation; (6) community organizing, continuous training and education for maximum citizen participation; (7) financing; (8) technology, product and market development.

Government is confronted with the option and the imperatives for decision-making to shift to better ways of handling solid waste. The process is long term but the initial steps must start now.

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ANNEXES

ANNEX 1
Nine Steps in Community Organizing

Steps	*Process*
1. Integration into the community	establishing contacts to gain entry in the community; organizers understand the dimensions of the people's problems
2. Social investigation	data gathering by participatory methods to elicit involvement of members of the community
3. Identification of leaders leaders to take over the	identification of the indigenous leaders of the community; core group of role of the community organizer; core group undergoes training and education
4. Planning and strategizing	translating goals and objectives into specific activities—making the action plan
5. Organization development	consolidating the organization by forming committees, doing skills training and mass education
6. Mobilization	launching the activities to attain goals
7. Monitoring and enforcement	monitoring by the community organizer to ensure success of program
8. Evaluation and reflection from failures and limitations,	gathering feedback on the project's progress to learn make adjustments in the plans, strengthen activities with positive impacts
9. Process documentation	documentation of the process *so that what is learned from the* community experience will benefit other communities undertaking similar initiatives

Source: Green Forum. Organizing Your Community For Zero-Waste Management (A Training Manual), 1994, pp. 57-59.

ANNEX 2

Key Elements of the Implementation Scheme

Education

1. Information dissemination: leaflets or instruction or letter for implementation multimedia billboards, radio, TV, newspaper, meeting, general announcements
2. Trainers training, community leaders, coordinators, eco-aides; livelihood projects
3. Audiovisual aids or teaching kits

Engineering

1. Containers for sorting
2. Collection equipment like pushcart
3. Market-buyer

Enforcement

1. Persuasion: awards, publicity, contests; economic gain, community fund, household fund, barter, raffle
2. Compulsion: barangay ordinance, homeowners regulations; municipal or city ordinance, provincial laws, executive directions legislation, judicial decisions

Source: Zero Waste Resource Management Systems vol.1 no. 3. (Handout produced by the Recycling Movement of the Philippines Inc., Diliman, Quezon City). Supplement to Handbook on Zero Waste Technology vol. 1. no. 1.

ANNEX 3

Sample Worksheet in the Training Program for Organizers: Workplan

Objective	*Activities*	*Responsible Party*	*Resources Needed*	*Time Frame*
1.	1.	1.	1.	1.
2.	2.	2.	2.	2.
3.	3.	3.	3.	3.

Source: Green Forum Organizing Your Community for Zero Waste Management (A Training Manual), 1994, p. 76.

ANNEX 4

Sample Action Plan

Problem	*Action Needed*	*Ways & Means*	*Resources Materials*	*Resources People*	*Time Table*	*Outcome Evaluation Criteria*
1.	1.		1.	1.		1.
2.	2.		2.	2.		2.
3.	3.		3.	3.		3.

Source: Zero-Waste Resource Management System vol. 1 no.3 (Handout produced by the Recycling Movement of the Philippines, Diliman, Quezon City). (Supplement to Handbook on Zero-Waste Technology vol. 1 no.1).

ANNEX 5

Model of Ecological Waste Management for Community-wide Implementation

I.	Understand the entire concept.
II.	Designate an Ecology Officer or Recycling Officer
III.	Form a core group to help in implementing the procedure and monitor each aspect of the project.
IV.	Organize the houses in groups of 10 to 20 for easy monitoring of the sorting, composting and other activities.
V.	Assign a coordinator for every area, one who resides in the area supervising the implementation of the project.
VI.	Set a "zonal dialogue" or meeting in the area to be attended by a representative of each of the households.
VII.	Choose a pilot activity-area.
VIII.	Prepare an action plan with time schedule for the three areas of concern: education, engineering, enforcement
IX.	Schedule - launching date, dry run before full implementation
X.	Monitoring, supervision
XI.	Evaluation and Modification
XII.	Documentation, recording, reporting

Source: Zero-Waste Resource Management Systems vol.1 no. 3. (Handout produced by the Recycling Movement of the Philippines Inc., Diliman, Quezon City). Supplement to Handbook on Zero-Waste Technology vol. 1. no. 1.

ANNEX 6

Ecological Waste Management Implementation Model (Steps) for Schools

I. Orientation on concept of Ecological Waste Management
II. Appointment of Project Officer or Recycling Officer or Ecology Officer
III. Formation of Committee or Core Group to formulate guidelines for implementation of the role of the school in Phase I (on-campus) and Phase II (off-campus)

Phase I: On-campus

A. School as Ecology Learning Center, Exemplar & Demonstration Center for Ecological Waste Management
(sorting at source in classrooms, corridors, canteens, toilets, grounds; proper packaging or containers)
B. Curriculum Approach
(integrate in feasible subject areas as Health and Science, Home Economics, Civics, Biology, etc.)
C. Co-curricular approach
(Boy or Girl Scouting, Eco-Clubs, Science, Technology Clubs, CAT, YDT, Non-Formal, etc.)
D. Research and Innovations

Phase II: Off-campus (Outreach Activities)

A. Parent-Teacher Association
B. Display of School-Community Vicinity Map
(activities to enhance community awareness, interest, involvement)
C. Organization of pupils/students by streets, barangays, with help/leadership of teacher-adviser or volunteer

IV. Implementation
V. Supervision, Monitoring, Evaluation, Reporting

Source: Zero-Waste Resource Management Systems vol.1 no. 3. (Handout produced by the Recycling Movement of the Philippines Inc., Diliman, Quezon City). Supplement to Handbook on Zero-Waste Technology vol. 1. no. 1.

ANNEX 7

Ecological Waste Management Implementation Model (Steps) for Households

I. Assemble the family including helpers to understand the concept of Ecological Waste Management

II. Demonstrate sorting and segregation of wastes in specific containers in each room, part of the house and garden.

III. Assign a person in charge of:
- sorting and disposal in proper containers; collection
- segregation of left over food and kitchen wastes as feed for animals or give-away
- segregation of plant seeds (Seed Bank), peelings (vinegar making, pickles making) segregation and use of food wastes for composting
- segregation of recycleables: cans of milk, bottles, etc.

Source: Zero-Waste Resource Management Systems vol.1 no. 3. (Handout produced by the Recycling Movement of the Philippines Inc., Diliman, Quezon City). Supplement to Handbook on Zero-Waste Technology vol. 1. no. 1.

ANNEX 8

Ecological Waste Management Implementation Model (Steps) for Markets

I. Orient and clarify the concept of ecological waste management.
II. Designate a Recycling Officer
III. Organize a core group.
IV. Group the stalls in the market.
V. Assign a coordinator for each group of stalls.
VI. Select a Pilot Section
VII. Prepare an action plan with schedule for education, engineering, and enforcement.
VIII. Schedule the launching date and dry run before full implementation.
IX. Monitor, supervise, evaluate each step from the start to change, modify, correct the gaps.
X. Document and record, starting with the survey of the problem, data gathering, waste characterization study, progress reports of all developments.

Source: Zero-Waste Resource Management Systems vol.1 no. 3. (Handout produced by the Recycling Movement of the Philippines Inc., Diliman, Quezon City), Supplement to Handbook on Zero-Waste Technology vol. 1. no. 1.

Annex 9

Ecological Waste Management Implementation Model (Steps) for Offices

I. Mandate from top management for adoption of Ecological Waste Management System followed by dissemination to all personnel.
II. Appoint Recycling or Ecology Officer
III. Form Core Group to include supervisory staff representing all departments and representatives of employees organizations.
IV. Cluster into easily monitored sections.
V. Appoint coordinator for each cluster/section.
VI. Draft action plan with timetable covering education, engineering, enforcement.
VII. Select Pilot Section.
VIII. Set and prepare launching date/dry run before full implementation.
IX. Monitor, supervise, evaluate all phases, from the beginning to next stages
X. Document, record and report.

Source: Zero-Waste Resource Management Systems vol.1 no.3 (Handout produced by the Recycling Movement of the Philippines Inc., Diliman, Quezon City). Supplement to Handbook on Zero-Waste Technology vol.1 no.1

RESOURCE RECOVERY IN SOLID WASTE MANAGEMENT: Strategies, Initiatives, Policy Issues

The search for alternative ways to handle wastes from the point of its production to its final disposal stemmed from the observation that wastes can be reused. Reuse, in turn, can avert depletion of natural resources and degradation of the environment.

The basic underlying idea is to retrieve reusable wastes after disposal either for recycling or for use as new materials for new technologies or products. This system reduces the amount of wastes to be finally disposed and results in cost savings and energy and resource conservation.

Resource recovery is now the alternative perspective that can make wastes useful in subsequent rounds of use and reuse. This contributes to sustainable development. — *From the Introduction*

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