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Small-Scale Composting Enterprise Initiatives:
A Study of Four Jakarta, Indonesia Based Small-Scale
Composting Schemes within the Solid Waste
Management Framework

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ABSTRACT

Urban development creates its own problems. Solid waste management is one of them. The Municipal Government of Jakarta, Indonesia deemed it urgent to cope with this problem in a more integrated manner that includes 'Reduce, Reuse and Recycle' approaches.

Composting is deemed importance in the solid waste management process. It process refused materials into fertilizer and, thus, puts them back in the food production cycle. Moreover, since lack of budget is one of the problems in dealing with waste, the growing interest in community-based and participatory approaches and the growing importance of NGOs role, are seen as more economical.

This study focuses on the small-scale community-based composting enterprise schemes for the purpose of generating recommendations for the improvement of the scheme within the framework of solid waste management system in Jakarta.

A study case was conducted and semi-structured interviews was employed to address the following questions: what were the benefits of the scheme for the people involved and their local neighbourhoods; what were the roles of NGOs and the municipal government in the scheme; what were the methods and approaches applied and how to ensure projects success?

A case study framework was used to examine data collected during the field research in order to understand how the small-scale community-based composting schemes could contribute to the municipal solid waste management system in Jakarta.

The results of this study were used to generate options to enable the municipal government to improve the scheme implementation in the future. The research concluded that this scheme is beneficial and could help the municipal government in coping with urban solid waste problems, in terms of decreasing the amount of waste to be landfilled, reducing the costs to be borne by the municipal government, providing a better service to those living in a lower socio-economic areas and creating employment opportunities. In the long run, together with the reduce and recycle approaches, it can be headed toward an urban agriculture, to create a more toward self-sufficient urban area.

This research also generated suggestions for privatization and encouragement of people's participation through among others, the provision of simpler and easier credit loans schemes, education regarding the importance of compost and the participation of NGOs and other support institutions, such as universities/academic institutions in the process. Amongst the options is to put these organizations in the front line to disseminate information and conduct training on recycling and composting.

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Abbreviations

BSD	Bumi Serpong Damai
CBU	Cipinang Besar Utara
CPIS	Centre for Policy Implementation Studies
DK	Dinas Kebersihan (Sanitation Agency)
ERCP	Enterprise for Recycling and Compost Production
GMB	Gumalar Mardya Bumi
LPA	Lokasi Pembuangan Akhir (final disposal site -landfill)
LPS	Lokasi Pembuangan Sementara (temporary dumping sites)
MSW	Municipal Solid Waste
NGO	Non Governmental Organization
P.T.	Perseroan Terbatas (Company Limited)
R.E.	Real Estate
SA	Sanitation Agency
SWM	Solid Waste Management
UDPK	Unit Daur Ulang Produksi Kompos (ERCP)

Chapter I

Introduction

1.1. Background

Increasing world population, especially in the cities, has created problems for governments as well as for residents. Problems related to housing, employment, public services, such as water and refuse removal and disposal, as well as those of natural resources and environment. It has become significant problems in urban management. The Indonesian Government also faces these same problems: the provision of sanitation and public services, especially as most urban growth occurred in cities with a population of more than one million. From 1971 to 1990, the percentage population living in urban areas rose from 17 percent to nearly 31 percent, nationally. Jakarta, the capital city, had 6,503,449 in 1980, 8,259,266 in 1990 and 9,112,652 in 1995 (BPS, 1996), whereas the total population in Indonesia was 194,754,808 in 1995 (BPS, 1996) and estimated to reach 224,784,210 in 2000 (http://www.asiagateway.com/Indonesia/country_guide/?=people).

Even though Jakarta has 30 percent of all telephones in the country, 25 percent of all cars and 30 percent of all physicians, it still has problems with essential sanitation and public services, such as the provision of clean water, sewage and refuse removal and disposal, as well as housing. This study will concentrate on municipal solid waste management, as this is one of the major problem areas. Such management covers activities ranging from efforts to reduce the amount of waste generated up to and including its disposal. Waste handling is important since inadequate waste collection and disposal, especially in developing countries, has resulted in air pollution and degradation of water bodies (Paz-Bergonia, 1998:1). Further, uncollected refuse may obstruct streets and drainage channels and can further aggravate street flooding (Lopez-Real,

1995b). Poor waste disposal will also promote the transmission of various diseases, including diarrhoea and dysentery, as well as skin diseases. It can also promote diseases associated with rats and mosquitoes, such as endemic typhus, dengue and yellow fever (Cairncross, 1993).

1.2. Waste Problem Management

Countries have been dealing with solid waste problems by various means, according to their financial and human resources. Referring to Chapter 21 of Agenda 21, an environmentally sound waste management system must go beyond the mere safe disposal, or recovery, of waste that is generated, and seek to address the root cause of the problem by attempting to change unsustainable patterns of production and consumption along the way. This implies the application of the integrated life cycle management concept, which presents a unique opportunity to reconcile development with environmental protection (UNCED, 1990).

The framework for the necessary actions to be taken in order to cope with the waste problem, according to Agenda 21, should be founded on a hierarchy of objectives, and be focused on the four major waste-related programme areas as follows:

1. minimizing waste;
2. maximizing environmentally sound waste reuse and recycling;
3. promoting environmentally sound waste disposal and treatment
4. extending waste service coverage (UNCED, 1990).

These four programme areas are interrelated and mutually supportive, and must therefore, be integrated in order to provide a comprehensive, and environmentally responsive framework for managing municipal solid waste. The mix, and emphasis, given to each of the four programme areas will vary according to local socio-economic and physical conditions, rates of waste

generation and waste composition. All sectors of society should participate in all areas of the programme (UNCED, 1990).

Given the importance of public health, and presumably the enormous cost the solid waste can cause in terms of health, more priority should be given to the question of establishing effective organic waste collection, treatment and disposal methods (Lopez-Real 1995b). Municipal Solid Waste (MSW) is, indeed, a very urgent problem, and it is now recognized that waste must be managed in a more integrated, comprehensive, long term and strategic manner with regard to the above mentioned programmes. Ideally, in an integrated management system, such wastes will not only be collected, but also separated into an exclusively organic fraction for treatment by recycling, utilising and harnessing the power of micro-organisms in order to convert the material into a safe (non- polluting and pathogen free) and useful end product, such as compost for use in urban horticulture (Rodrigues 1996). The integrated recycling and microbially mediated process of composting are, therefore, the ideal route for this, and are applicable at both a low and high technological level.

Rising unemployment, another problem of urbanization, has also given extra impetus to resource conservation schemes, such as waste recycling and composting, that generate jobs and offers opportunities for training in new skills (Davidson, 1988:8). The recent support of Community Based Organisations (CBO) has led to the establishment of smaller scale, and successfully operated, organic waste composting operations that have suited the needs of urban horticulturists (Lopez-Real 1995). Some community-based recycling and composting initiatives in developed countries have begun and are still organized by the voluntary sector, while others involve close working relations with local authorities (Davidson, 1988:9). This 'move' happened in developing countries as they were facing an ever-increasing waste, especially solid waste, crisis and found that one way to deal with it is to process the waste into something useful (compost) for another cycle of food production (Smit and Nasr, 1997). An

evaluation of Jakarta's composting enterprises programme (as one of the forms of material recovery, as well as an integral part of the city's solid waste management programme), therefore, is the subject of this study.

1.3. Growing Interest in Composting

International development organizations, government agencies, as well as NGOs, have been looking at composting projects as one of the ways to minimize and reuse solid waste. It is viewed as essential in reducing the amount of waste to be landfilled, therefore, would be able to minimize the problems of land availability, waste collection and transport costs. It is also quite an efficient way to reduce, recycle and reuse the local solid waste, since by producing compost, people can sell this compost and sell the recyclable materials, or reuse them for business purposes, and gain financial profit. Composting activities, and all that goes with them, bring social and environmental benefits as people can work together, make economic and environmental profits, be responsible and in charge, for their own neighbourhood's welfare.

Further, compost, as a fertilizer, is more 'friendly' to the soil since it can reduce soil erosion and improve topsoil quality. It works as a soil conditioner by increasing soil organic content, and maintains, and enhances the productivity of agricultural soils. Therefore, in the long run, compost is going to both improve soil conditions and help land to be able to produce better results (Urban Development Sector Unit :1-2). Moreover, a composting process employs a socially appropriate technology for the intended beneficiaries who mostly live in lower socio-economic areas.

1.4. Composting Scheme in Jakarta, Indonesia

In Indonesia, some small-scale composting projects were established in the early 1990s, but some of them closed down not long after. Most of them were community-based activities, part of the projects initiated by the World Bank and

the Jakarta Municipal Sanitation Agency (Dinas Kebersihan -DK), together with the Centre of Policy Implementation Studies (CPIS), a non-governmental organization based in Jakarta. In most cases, the local community had been asked to run a composting industry in their area, given the initial funding and assisted in marketing their product. Training had been conducted simultaneously¹: separating recyclables (paper, plastic and aluminum); setting up household backyard worm and bin composting, as well as how to promote recycling and composting within the community (Perla, 1997:48). The idea was to encourage people's active participation in the project so that they would be able to continue after the project ended, to ensure a participatory development process.

There should not be a problem with resources, since organic components of municipal solid waste in Jakarta is estimated to be as high as 75 percent. Further, composting is not something new to the Indonesians. During the pre-industrial period it was an informal, individual and community level method of disposing and reusing organic waste but was, abandoned in the wake of the industrial and economic growth, that began in the early 1970s, when the use of locally produced compost was gradually replaced by chemical fertilizers in order to increased food crop yield, especially rice, as the main staple food for the majority (O'Brien, 1990).

Within the composting scheme, the community ran community-based composting enterprises in order to cope with the waste, and to gain profit from it. They were allowed to fully participate in, and to apply any ideas they had to their own composting sites. Further, they received support from the municipal government, the World Bank as well as from the NGO involved in the project scheme. This project, however, failed. Most of the composting enterprises are not

1 Training was conducted specifically for the 'recycling entrepreneurs' and the community that live in the neighbourhoods (Perla, 1997).

running anymore due to a lack of success with marketing and the considerably non-standardized compost quality (Mockler, 1998:annex 2).

Given the fact that this scheme was not successful, this study intends to look at small community-based composting enterprise programme in order to find strengths and weaknesses. The study will investigate why such small enterprises failed, or succeeded; how to minimize the faults and to allow for better outcomes in the future; as well as to what extent such schemes may be able to contribute to solid waste management in Jakarta: economically, socially and environmentally.

1.5. Objectives

The objectives of this thesis are as follow:

1. To find the advantages, and disadvantages, of establishing composting enterprises in terms of environmental, economic, as well as social benefits for the people involved;
2. To analyze the extent to which these enterprises can contribute to the solid waste management system in Jakarta;
3. To compare and further assess factors that can ensure the projects' success;
4. To assess the strengths, as well as the weaknesses, of the surviving and non-surviving enterprises;

1.6. Thesis Organization

This study will cover some key issues of small-scale composting enterprises within the solid waste management framework in Jakarta. In doing so, figure 1.1. illustrates how chapters of this thesis are connected, leading to the above research objectives.

The next two chapter provides the literature background to the composting initiatives within the municipal solid waste management programmes. It covers

all the concepts of urban sustainable development: solid waste management, composting initiatives, participatory development, and also empowerment, especially in order to encourage people to participate more in development activities. It embraces community-based projects approach and how this study can be viewed within the broader framework of these various concepts. Chapter II focuses on the development and urbanization issues as a challenge to developing countries. The discussion of concepts of participation in development, then will follow. Chapter III focuses more on more specific issue of development and urbanization, solid waste management and then move to composting as an integral part of a supposedly sustainable solid waste management, especially in developing countries.

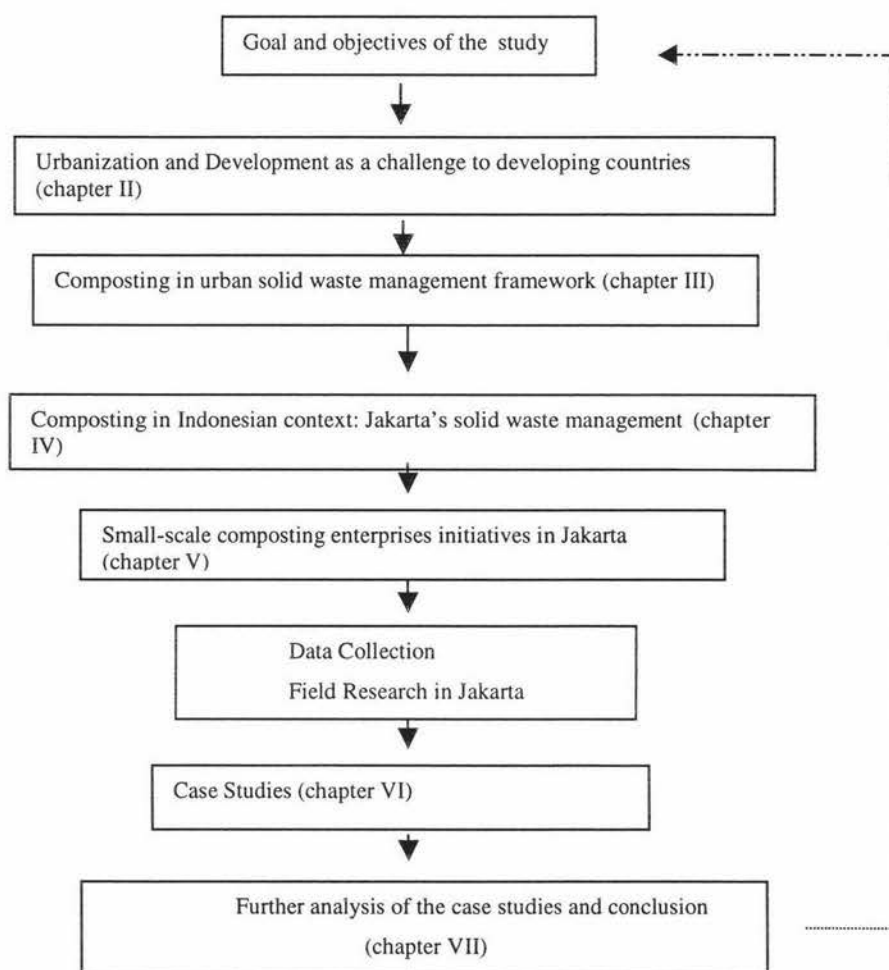
The following chapter, Chapter IV, focuses on local information on the subjects covered in the literature review, especially on the Jakarta context of solid waste management problems as well as how the composting scheme fits into it.

Chapter V deals with the small-scale composting initiatives' issue (starting from the early 1990s), the initiator, the pilot project and how the municipal government finally decided to be involved in the project. It also covers data on more local and specific information on the composting enterprises initiatives, including: composting trends in Jakarta; the UDPKs initiatives, as well as factors affecting the sustainability of the ERCs.

Chapter VI delivers the case studies of two different kinds of enterprises, surviving and non-surviving. It focuses more on what problems they had or still have in order to keep the enterprises running.

Chapter VII reviews, and explains in more detail, the research findings, suggests recommendations for the improvement of small-scale composting enterprise projects in Jakarta, and concludes by suggesting areas for future research.

Figure 1.1. Thesis Organization



1.7. Methodology

1.7.1. Literature Review

A literature review was carried out in order to study the background, theory and rationale behind the implementation of small composting enterprises, in various areas in Jakarta within the broader framework of integrated solid waste management in Jakarta.

Reports, and other literature, relating to similar projects were also reviewed. These included:

- (1) municipal government plans and reports;

- (2) local and national journals;
- (3) NGO reports and papers;
- (4) World Bank reports and papers;
- (5) similar project reports

1.7.2. Justification for Approaches Employed

A primarily qualitative approach was employed in this study in order to understand, and further assess, the advantages and disadvantages of the project on the people directly, and indirectly, involved, and also how it contributed to the municipal solid waste management framework. Further, both qualitative and simple quantitative methods were utilized to assess the project's weaknesses and strengths, and how they contributed to the application of integrated municipal solid waste management in Jakarta. These approaches are more focused on finding satisfactory explanations of activities related to the composting industry that require a substantial appreciation of the perspectives, culture and 'world views' of the participants involved. It is more concerned with understanding the actions of the participants on the basis of their active experience in the project, and how they view the project in terms of the economic and the environmental as well as the social benefits they have gained from it (Allan and Skinner, 1991:178). Quantitative approaches were used in dealing with measurable indicators. Further, all data was assessed in order to find, and define, the extent of contribution these community-based enterprises have given to the broader framework of urban waste management in Jakarta, Indonesia. Qualitative and quantitative data were collected by conducting semi-structured interviews through structured surveys and field observation.

Semi-structured interviews consists of a list of pre-formulated questions, or prompts, with more open-ended questions to allow for expansion on the questions raised; and to leave room for additional questions to be asked and it

also contains a flexible sequence of questions which allows for some interviewer discretion (Broughton and Hampshire, 1997: 61).

The structured survey was used to collect quantifiable information through interview with respondents. In this case, the respondents were those who were involved in the composting project. Since three of the project failed, interviews were conducted with the caretakers of the sites, the ex members of the CPIS composting team and with officials from the World Bank and from the Municipal Sanitation Agency. At BSD site, interviews were conducted with the BSD project manager and the site manager as the sources. An informal interview was also conducted with some of the employees.

This study also applied an open-ended question format that allowed respondents to answer the questions more freely (Broughton and Hampshire, 1997 p.73). By using this approach, this study has built a more flexible involvement with those from, or about whom the data is being collected by placing them as equal partners. The researcher had also spent more time in the site as part of the field observation activities in order to build the confidence of the interviewees (Allan and Skinner, 1991:178).

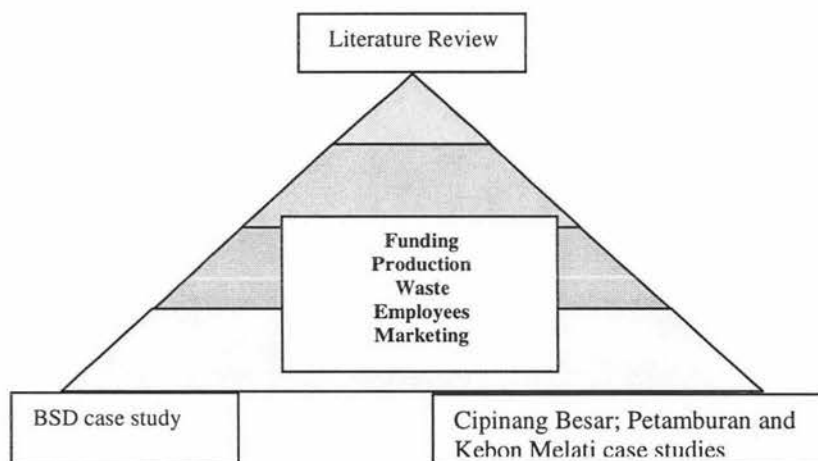
1.7.3. Case studies as a Research Strategy

This study utilized case studies. It is an empirical inquiry that investigates a contemporary phenomenon within its real life context (Yin, 1981:13). The composting enterprises were chosen with underlying thoughts given to those that survived relatively longer than the others, and those which still have people who look after the sites. Moreover, all four enterprises studied were all part of, more or less, the composting scheme set up together by the CPIS and The World Bank, along with the Jakarta Sanitation Agency.

The case study conducted was designed to address a broader range of historical, attitudinal and behavioural issues. Therefore, it should be able to deal with technically distinctive situations in which there are many variable interests,

such as the distinctive situation underlying the establishment of the BSD plant as compared to the others. Moreover, case studies using multiple resources of evidence are of a greater quality than those relying on a single source of information (Yin, Bateman and Moore, 1983). The most important advantage of this is that the use of multiple sources of evidence can be developed into converging lines of inquiry via a process of triangulation. This then provides multiple measures of the same phenomenon (Yin, 1994:92 and Patton,1987), as shown by the following figure:

Figure 1.2. Triangulation of Data



Source: Adapted from Yin and Patton, 1987 and Paz-Bergonia, 1995:6).

1.7.4. Data collection

Information needed for this study was generated by eight weeks of field research, specifically by conducting interviews with the targeted interviewees (composting site employees), and those related to the project, such as World Bank representatives, sanitation agency officials, as well as NGO representatives. Municipal government reports, and other recorded data, on the project were examined as well. Interviews were designed to collect data relating to the advantages and disadvantages that the projects brought to the people involved,

and to the community in general. The interviews also helped determine the strengths and weaknesses of the projects, how the projects were run, as well as how these projects could contribute further to the broader scheme i.e. solid waste management in Jakarta.

Difficulties experienced during the field research included: composting site workers being reluctant to answer questions, as they were told not to talk to 'strangers' by their supervisor. In fact, this problem occurred even at the successful site, though after the BSD project manager consented, these difficulties were overcome. At the other three, the caretaker mentioned their reluctance to answer questions because for many years people kept coming and interviewed them, gave them promises that something would be done to help the composting enterprises, but nothing had ever materialized. Only in one of the sites that there are still people actively working, though not on composting but only on buying and selling recyclable materials. The site 'manager', however, was the one who did the interview. Furthermore, most of the necessary project documents were lost, thus making it difficult to double check data and some of the sites, or former composting sites, were neglected, thus making it difficult to engage in more case studies.

Chapter II

Urbanization and Development: Challenges to Developing Countries

2.1. Urbanization and Development

Urbanization is usually discussed in the context of economic processes, although one can also see it as one phenomenon in a series of changes that have been taking place in the different phases of development. “These series of changes include the polarization of national development to ‘core regions’, trans border regional developments and the emergence of international growth corridors. They are linked to critical changes at the global level, although the nature of each process is also rooted in its local history, culture and politics”. McGee (1995) has identified three broad forces affecting the urbanization process and its sustainability that includes globalization, the transactional revolution and structural change (Drakakis-Smith, 1996:vii).

Globalization has also been closely interwoven with changing regional and international divisions, characterized by the emergence of world cities and the growth of intense global and regional competition. All of the above processes have interacted to produce urban regions throughout the Third World, some of which have been developing for several decades, some of which are relatively new, but all have emerged within their own particular environmental, cultural and political contexts. These three are closely interconnected and cities compete with one another, by the quality, and efficiency, of their built and transactional environments, to attract investment. The more they offer, the more concentrated becomes this investment that would allow them to acquire their own world trade centres, telecommunications complexes, international schools, prestige retail stores and the like. In many ways, these changes have been dependent upon the second factor, the transformation of

transactional space-time in which information, capital and decision-making are able to be transmitted electronically. People and commodities, however, still have to be physically transported, and much more of the interchange of increasingly complex information must be undertaken face to face. Nevertheless, “while the various transactional revolutions have been fundamental to the creation of urban, or mega urban areas, with more than ten million population (Hardoy *et.al.*, 1992:31, UN, 1991), they have been unevenly layered, and poorly managed and are responsible for some of the most pressing urban environmental problems, such as congestion and pollution”. (Drakakis-Smith, 1996:viii).

Urbanization usually refers to the proportional rise of the total population of a nation living in urban places. It also denotes changing balance between rural and urban populations caused by the migration of people from rural to urban places which leads to the differences in the rates of population increase in the two areas (Pernia, 1993). Cities usually function as the centre of business, industry and finance, aspects of development and change that make them attractive for people wishing to migrate looking for a ‘better’ life. The dominant perception that money is the symbol of success had also encouraged people to go to cities looking for employment that can offer them more money. The imbalanced focus of development on industrialization thereby neglecting agricultural fields was usually the case for developing countries also having an accelerated urban growth trend (Dutt, 1994). Indonesia was a similar case as it focused more on industrial activities, in urban areas, in order to boost the economic growth. However, as an agricultural country, this imbalance has made people in rural areas gradually have more difficulties meeting their basic needs and growing rural poverty has led to their migration to cities.

2.1.1. Developing Countries' Urban Growth and Its Problems

When people talk about the Third World countries, there are several dominant views regarding urbanization problems. These include a perception that there is rapid and uncontrolled growth of population, that there are millions of people living in 'slums', that there are very high rates of unemployment and that there is a tendency towards mega city development. Most developing countries cities in fact, are not growing as rapidly as people might think and the majority are certainly not heading toward mega city development (Hardoy, 1989:7-8), although there are cases of a rapid and sometimes uncontrolled growth of cities population in most countries. This is mostly because a mega city needs a strong urban-based economy to support its existence and many Third World nations do not have the economic base for the development such mega cities (Hardoy *et.al.*, 1992:31-32).

In developing countries, rapid urban growth was initially caused by accelerated industrialization. Government policies to encourage a growth in agricultural production may end up encouraging increasing migration to urban areas due to the less labour intensive farming methods applied and land availability. In effect, such policies may encourage an increase in wealth for a few and impoverishment for many and this makes the gap between the poor and the rich wider (Saint and Goldsmith, 1980).

Urbanization resulted in the massive growth of cities in the Third World. This growth is, in most cases, far beyond municipal governments' efforts to provide basic services to their citizens, such as clean water supply, sanitation, solid and liquid waste management, housing and other urban necessities. It is not the urbanization itself that cause the problem since it has arisen from the development of stronger and more diversified economies. Urbanization may also reflect the increasing corporation into a global economy. The main causes of the problems are inadequate and inappropriate responses from both the government and aid agencies (Hardoy, 1989:7).

In most Third World cities, however, urbanization combined with the 'slow' response from the municipal government have resulted in an extremely uneven provision of urban services where some areas may be up to western standards, usually in affluent residential and commercial districts, deficient in low-income areas, and practically non-existent in squatter settlements. Refuse removal and disposal has become a problem due to its improper management, whereas problems relating to clean water, sewage, drainage, refuse removal and minimum building standards, coupled with a general lack of concern for environmental controls on sources of air, water and land pollution, combine to make Third World cities living monuments to late twentieth century environmental degradation (Sicular, 1992: 87, Shafik, 2000).

In developing countries, uneven economic growth is probably the main driving force behind urbanization. Some immigrants would come to cities because that is where economic opportunities exist and that makes survival more certain, but some migrate because they are forced to do so, for instance small farmers forced off their lands, or agricultural labourers because of soil erosion, low crop prices or the increasing concentration of land ownership with consequent changes in crops and the means of producing them (Hardoy, 1989:52). Some problems can be rooted in the international economic order due to globalization and foreign investment trends that focus only on economic growth and government policies in general; some because of the lack of action in dealing with the real problems, such as the high cost of infrastructure and services in both cities and the countryside (Hardoy, 1989:53).

The development programmes and projects that have been implemented, however, have created both winners and losers (Hardonjo, 1983) because those who bear the costs may not be those who enjoy the benefits of development (Adams, 1990:172). Poverty is still the main problem of most Third World countries. Regarding environment and social impacts of development, it is more likely that

poor people will suffer more due to their limited financial sources and their lack of education.

Furthermore, culture, society and economy are so dynamic, complex and unpredictable, that development based on programmes and policies externally conceived, and imposed, is unlikely to work in the economic sense, and is likely to have adverse effects that will worry the ecologist as well as the sociologist (Adams, 1990:202). Thus, it is essential to include local environment and social as well economic aspects in development planning, including in waste management, in order to ensure the sustainability of development, of the people as well as of the environment.

As noted by Smit and Nasr (1997) “cities of both the Third and the First Worlds are having increasing difficulty dealing with solid and liquid wastes, a paradigmatic change in the way these wastes are viewed may be starting to emerge globally. Wastes (with exceptions of the hazardous ones) are beginning to be seen, not as a problem to be disposed of, but as a resource for sustainable development”.

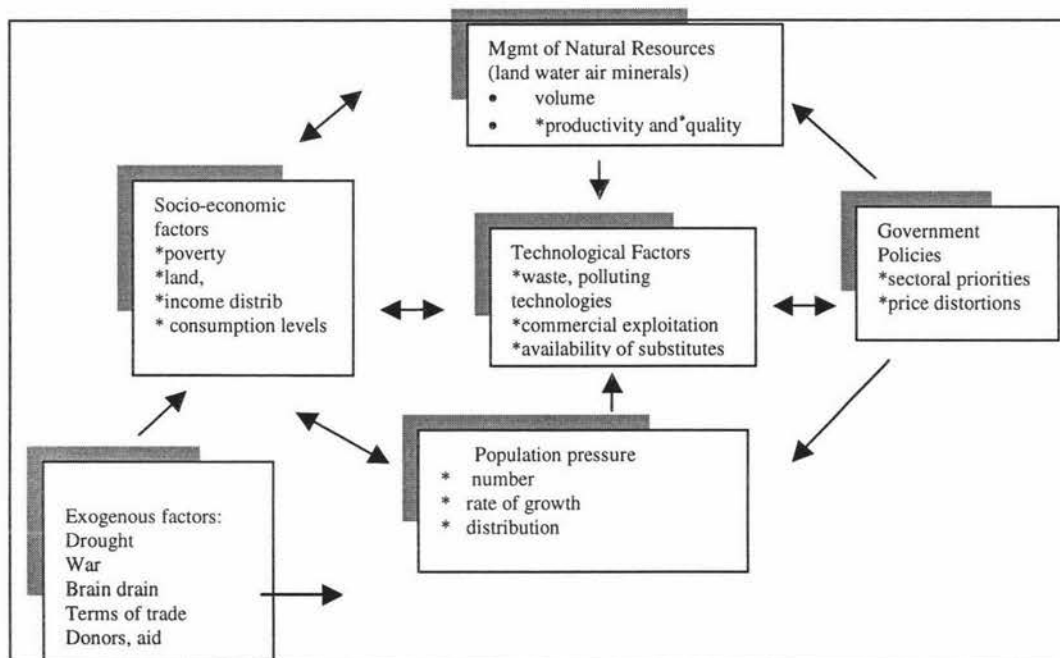
2.2. Sustainable Development

Simultaneously, environmental sustainability has become an important consideration in almost every country in the world, mostly because the growing population has created more and more problems. In considering responses there are linkages between demographic and natural resources issues (see figure 2.1.)

This figure has been developed as a simplified representation of the complex system of linkages between population pressure (i.e. number, growth rate and age/sex/geographic distribution of people) and natural resource management (i.e. the volume and productivity of land, water, air and mineral resources). Some argue that increases in per capita income are associated with greater resources given to conservation, others have said that commercialisation of consumer tastes in developing countries are associated with greater degradation, as well as government

policies, particularly with respect to resource allocation between sectors, and the impact of macroeconomic instruments such as taxes, subsidies and price controls on market price distortions.

Figure 2.1. Linkages between demographic and natural resources



Source: ADB Environment Paper, 1991:6.

Therefore, population and economic development can provide benefits to the environment, such as more people can spend more time in caring for the environment and be able to act on it. On the other hand, they can produce a negative pressure on the environment, such as more people will mean less open spaces, less space for trees and other conservation areas. It also means more amount of waste generated per day which leads to another problem of waste collection and disposal and health problems as well (ADB Environment Paper, 1991).

Nevertheless, the degree and strength of the negative impact of this demographic pressure may vary significantly among areas according to differences

in a number of factors including pressure on natural resources pressure, the degree of commercialisation of production and the degree to which the economy is open, as well as the levels of accumulated capital formation which enables productivity increases and the ability to pay for imported substitutes (ADB, 1991:3-4).

“The degree of the impact is likely to be strongest in the lower socio-economic areas” (ADB, 1991:3). This is because these people do not have as many options of what to sacrifice in order to survive. There are many examples of how these people have cut down trees to make and sell firewood, or that they cannot afford to pay for any government restitution, for instance refuse removal and disposal fees, for they are ‘forced’ to dump their refuse somewhere else

Growing population pressure exacerbates the inability of the resource base to sustain the growth of population at the prevailing level of technological development, reinforcing poverty and leading to further deterioration in the socio-economic conditions underlying rapid population growth (ADB, 1991:3-4). The environment will suffer because people who have too much (the wealthy), sometimes want to have everything that money can buy. It, however, is also related to key elements of a material-based economy, which has been practiced for years in both, developed, and developing countries that has created more waste than ever generated before (Gardner and Sampat, 1998:47). Simultaneously, environmental degradation may occur because people have too little (the poor) (Durning, 1989:16). When this happens the poor are more likely to suffer directly from the degraded environment because of their limited options. The same options that might have ‘forced’ them to sacrifice the environment in exchange for their survival. Therefore a concerted attack on poverty and environment protection should be implemented. It can be started small, like the efforts to raise economic productivity and generate incomes for people living in poverty combine with community based and participatory approaches by: providing a credit loan for small entrepreneurs or

subsidy for the poor on the basic social needs, such as, water provision and refuse collection (Rao, 2000).

Recognizing negative impacts of development, especially on the people and their environment, governments have been trying to balance the economic, the social as well as the environmental pace in order to reduce, or even eliminate, negative environmental and social consequences brought by development, which is mostly their responsibilities. For years, more and more government institutions and officials, as well as Non-Governmental Organizations (NGO) are aware of the environmental consequences (which will lead to social and financial consequences in the end) in store for us if we continue to conduct careless and unsustainable development. This is in line with what stated in the Agenda 21 (1990) that “The participants in the Earth Summit recognize that sustainable development is primarily the responsibility of governments, and this will require national strategies, plans and policies. The efforts of nations need to be linked by international co-operation through such organizations as the United Nations. The broadest public participation, and the active involvement of the non-governmental organizations and other groups should also be encouraged” (Agenda 21, 1990).

Although some argue that sustainability is not something to be defined but to be declared because it is an ethical guiding principle (Peet, 1992:209), most agree with the Brundlandt Commission definition: “a development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987:43). Therefore, development should consider at every aspect that affects or may affect people’s lives, at present or in the future. Sustainable development is viewed as the best approach to deal with the ever-decreasing environmental and social conditions, especially in developing countries. The case of Bangladesh can be a good example of how environment condition has been deteriorating as the cost of human’s survival. As one of the most densely populated and low per capita income countries, land is very scarce source. Therefore,

intensified agricultural practices (mechanization) and increased use of chemical fertilizers (while the use of farmyard manure was dropped) were considered basic necessities for expanding food production and meeting the food demand. The trends in the yield of major crops, however, have indicated a decline in their productivity, even with sound management of plant nutrients. This is a clear indication of the degradation in land quality and its productivity (World Bank, 1995 and Pagiola, 1995).

In an urban context, there are certain prerequisites for the pursuit and management of sustainability. There are five prerequisites identified: equity in the distribution of the benefits of economic growth; access to adequate basic human needs; social justice and human rights; environmental awareness; and integrity and awareness of linkages of change over space and time (Drakakis-Smith, 1996:iv). The elimination of poverty would be one of the ways to create sustainability as long as along with it comes the equity and social as well as economic justices. The more problems would be created when the relatively poorer people migrated and concentrated in urban areas, which usually is the case.

In terms of urban development, as cities have become the centre of activities (as the result of better infrastructures, better opportunities to find a job as well as being a centre of economic activities), their population pressure means more problems in terms of public services provision, among others, of solid and liquid waste management and disposal, clean water, sanitation, as well as preventive actions against environmental degradation, related to water, air and soil quality. In most Third World cities, refuse removal and disposal are, like other basic services, deficient. When refuse is not properly managed, it becomes a problem in several ways. If people have no other way of getting rid of refuse (maybe because they do not have enough money to pay for this service), they may allow it to accumulate, or throw it onto open land, in which case it will pollute the surface of land and leach into the soil, into the water table, and into waterways. They may burn it, in which

case it will pollute the air. Or they may throw it into streams and drains, in which case it will pollute the water, hamper drainage, and exacerbate flooding (Sicular, 1989, p99-100). Therefore, urban perspectives on development must be changed to accommodate environmental and societal considerations within it.

In the broadest sense of environment, the urban perspective must include three major components:

1. the natural environment - the ecological setting and its use, misuse, adaptations and contribution to both economic productivity and quality of life;
2. the built environment and its influence through various technologies on the form and functions of urbanized settlements;
3. the institutional environment and the ways in which urban organizations of all kinds mediate and adapt to changing global force and realities (Gappert, 1993:70-72).

Refuse collection and disposal, then, is part of the requirements for cities management sustainability, especially because uncollected and untreated waste can cause health, environmental as well as social, especially aesthetic deterioration problems, at both community and regional level (Gottinger, 1991:11).

Mitlin and Satterthwaite (1996) suggest that the issues and concerns described above might be taken to constitute the development aspect of sustainable development in human settlements. The sustainable component, they argue, requires action to prevent depletion or degradation of environmental assets so that the resource base for human activities may be sustained indefinitely.

Specifically they identify:

- (i) minimizing the use of non-renewable resources, including cultural and historical assets and energy and material consumed in industry, in commerce and domestically;

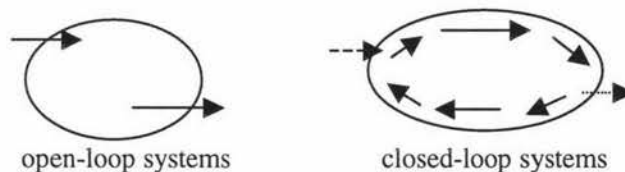
- (ii) sustainable use of renewable resources, such as water, crops and other biomass products;
- (iii) ensuring that waste, be it solid or liquid, can be absorbed by local and global 'sinks' such as rivers, the sea and the atmosphere (Mitlin and Satterthwaite, 1996:22).

Point three above is important in terms of how to deal with solid waste problems, especially in time when increased urban population and land availability have made the landfilling options narrower.

Another terms for a city or urban area that can use most of the production outputs as an input for another cycle of production is an ecological urban community. This term refers to a community who practice recycling and waste recovery as a way of life and try to imitate nature efficiency where there is a balance of inputs and outputs of energy, products and waste, with some the surplus of material still valuable to the community (Saunders, 1997:114).

A vision of urban areas is, therefore, simultaneously, evolving from primarily open-loop systems (linear metabolism) with one-way flows of resources (in) and wastes (out), to primarily closed-loop systems (circular metabolism) in which the definition of wastes and resources becomes blurred as illustrated by the following figure.

Figure 2.2. Loop systems of Urban Areas



Source: Adapted from Smit and Nasr, 1997; Girardet, 1992:22-23).

Cities, nowadays, are seen as able to become more resourceful in both the literal and the figurative senses. Urban agriculture plays a significant role in converting the consume-dispose open loops into consume-process-reuse closed loops by converting the wastes (outputs of city's food production) into inputs again and significantly minimizes the waste to be disposed of (output). Converting food waste into fresh food has its own benefits, such as reduces food costs, improves its quality, improves the environment, creates jobs, and also reduces municipal management costs. The recycling of urban organic wastes is particularly critical because without it, nutrient and pathogen pollution may damage health and further reduce the capacity of the environment to sustain future generations. This approach may play a significant role by recycling both liquid and solid waste (Smit and Nasr, 1997).

Closely related to the efforts to achieve a sustainable and integrated solid waste management is the increasing awareness to encourage popular participation within both the government, especially local/municipal governments, or non governmental organization (NGO) programmes. Governments in developing countries rarely have adequate resources, including human resources, nor the capacity to provide services, infrastructure and housing to the increasing number of urban poor (Cheema, 1992:29). Drawing on people's and other private organizations/institutions would certainly help, since the government they cannot do everything alone. Embracing people and private sector's participation would give an advantage for the government as more participation means reduced implementation costs for the government. Enhanced participation would also increase the skills and capability of the people to be able to deal with their own problems, be it economically, socially or environmentally. The next part, therefore, would discuss more of the participatory development approaches.

2.3. Participatory Development

Along with the ever-increasing popularity of sustainable development, there is a growing emphasis (from the late 1980s) on participatory development, or grassroots development. Participation by beneficiaries has become a major component in development, and many development projects. It is seen as a means of increasing the effectiveness and efficiency of projects (Paul, 1987) and the coverage of a project with a given budget through cost-sharing as well as the sustainability of a project through the enhanced commitment of the beneficiaries, especially if they share the costs (Dichter, 1992). To the advocates of 'building from below', participation is a means of building the capacity of grassroots and local institutions (Bhatt *et.al*, 1987) and involves people who are to be affected by changes starting from the planning through the implementation (Glaeser and Vyasulu, 1984:26).

Grassroots development means direct improvements in living standards by groups of the poorest people in local communities. Promoting development at this level implies working directly with such groups on projects designed and run collaboratively with them. The idea of empowerment takes this notion of collaboration a stage further by indicating that development should be undertaken with the direct aim of increasing the power and control of groups of intended beneficiaries over the circumstances of their own lives so that they are in a position to become their own development agents in the future (Wuyts *et.al*. 1992:117-118).

The focus of development shifted from government-initiated 'big' projects to how to involve people right from the beginning of the development process. 'Big' projects were chosen as they were seen as instruments of policy implementation that could absorb many employees and produce large profits for the project itself, its employees and both donor and recipient governments. In relation the waste management, 'big projects' mean mass systems of waste collection and disposal that are usually conducted by local governments.

During the 1960's and 1970's 'big' projects became the primary means through which governments of developing countries translated their plans and policies into programmes of action. The rationale was that comprehensive and detailed development plans were of little value unless they could be translated into specific projects that could be designed and implemented efficiently. Projects came to play a central role in the political economy of developing countries. In theory, projects would promote economic changes by integrating markets, linking productive activities in the public and private sectors, providing economically and socially useful products and creating physical infrastructures needed to increase exchange and trade (Uphoff and Ilchman, 1972; Rondinelli, 1993:5).

This study cannot be separated from the concept of a project in order to illustrate the disjunction between methods of planning and implementation used by governments and international or national agencies, as well as the nature of development problems. It is because most problems of development usually arise from attempts to plan and manage projects, aimed at generating social change, with techniques and procedures intended for physical facilities and industrial construction projects. Therefore, the argument for greater flexibility and innovation in development administration rests in part on the observation that development policies are complex, uncertain and require flexible and experimental methods of implementation (Rondinelli, 1993:6-7). A project is a programme which has a specific objective, outputs and activities; an estimated start and a finish date, a specific geographic location (or area of coverage) and targeted beneficiaries and it clearly has specified inputs and costs (Broughton and Hampshire, 1997:22).

Further, an implementation of a project can be incorporated within the various levels in which development, environmentally sustainable, can be operated. From global level (such as concerted actions to prevent ozone depletion, or greenhouse effect, to national level (more locally adaptable industrial policies and

prevention of resource exploitation) and also at a local level such as actions against wildlife poaching or to eliminate farm problems (Barrow, 1995:375).

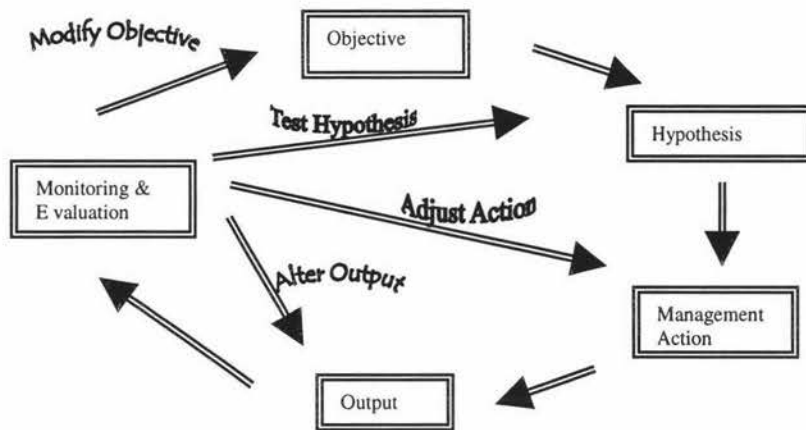
An environmentally sustainable development will have to operate with marginalized, intermediate, as well as dominant groups. People may be persuaded by education, economic or other incentives (e.g. honours, awards etc) or even compelled (by licensing, rules, policing etc) (Barrow, 1995:375) in order to participate.

During, and even before and after, the project implementation, evaluation and monitoring are the essential parts to ensure that the intended beneficiaries get the benefits from the project activities. Such an adaptive management is also useful in encouraging and ensuring people's participation (see. figure 2.3.)

This approach, however, is not a guarantor of success since external as well as other internal factors play significant roles as well. The composting enterprise schemes in Jakarta, for instance, have applied the concept of adaptive management. This initiative, however, failed due to the actual implementation of the concept and other tangible and intangible factors, such as lack of 'education' to a broader audience, lack of skilled human resources (in both government and community's side) and budgetary constraints.

Besides the above concept, a participatory approach is also a significant factor for both a government decision-making process and a project's sustainability. In this study participation is defined as a process through which stakeholders influence and share control over development initiatives, decisions and resources that affect them. By stakeholders they refer to people, as individuals or institutions, who either affect or are affected by the government policies and actions (Adams and Rietbergen-McCracken, 1994:36-37).

Figure 2.3. Adaptive Management



Source: Adapted from R.B. Martin, 1994.

Participation is achieved by finding ways to draw local people, their associations and their government into systematic and reciprocal interaction supported by some capability and willingness to find out who the stakeholders are and to identify culturally suitable participation strategies (Adams and Rietbergen-McCracken, 1994:38). Social inputs from the local people are deemed as important: (a) to organize, interpret, check or supplement centrally available information on the project population (numbers, distribution, growth, mobility, socio-economic profile); (b) to verify that what the intended project beneficiaries want corresponds to the planners and project designers' assumptions, and if they do not; (c) to identify ways of bridging the gap between the two through persuasion and motivation, community consultation procedures, providing incentives in cash or kind or other methods (Perret and Lethem, 1980:12-13).

The implementation of a participatory development is essential because it:

- (i) strengthens society and the economy by empowering groups, communities and organizations to decide what is best for them and take action and

- (ii) enhances the efficiency, effectiveness and sustainability of development programmes (ODA, 1995 p.95).

Since development environmental management, particularly in developing countries, does not principally depend on technology and investment but is more closely related to human behaviour and institutional capacity as well as support from the people, participatory development through encouraging community participation and local initiatives are deemed as the most suitable strategies (MEIP, 1998:2)

One of the forms of participatory development is a community-based activity. It is defined as a learning process that puts peoples', especially local people, interests first and secures their rights and gains. Further it is more of a self-help activity of development which needs staff/member competence, commitment and continuity in order to ensure the success of the project and achieve the goals people want for their own benefits (Elliot, 1994 p.75). This scheme of development provides a practical dimension to a growing body of (largely theoretical) research which argues that urban regeneration will only come about with greater local self-reliance and more emphasis upon economic development which is sustainable in social and ecological terms. A community-based initiative is a movement towards greater self-reliance and job creation is one of its themes (Davidson, 1988:2-3).

This kind of development initiative has also come from non-governmental organizations (NGO). NGOs form elements of civil society in any region or country. Their importance, in terms of numerical strength, membership, size of operation in relation to the economy as a whole, or to particular sectors, such as health or welfare services, or in acceptance of its way of working, varies enormously from country to country. NGOs can be defined in different ways, they include all non profit, as well as non governmental organizations, including all kinds of clubs, work teams, associations, cooperatives, charities, campaigning groups and so on, but usually exclude informal networks and political movements. In this study NGO is the one

which focuses on other people's benefits and its scope and activity are more at local and regional levels (Wuyts *et.al.*, 1992:122).

In general, NGOs can work with governments in building up peoples' organizations, and their participation in development activities, for it is a common problem: governments have the desire to help but are unable to do so, well. In such cases, if approached diplomatically, government officials can be persuaded of the pragmatic value of involving people, their organizations, participatory modes of planning and all the other activities in which NGOs have a lot of experience (Holloway, 1989:213). In short, NGOs and also support organizations, such as university/education agencies, media, donor agencies and professional organization, are needed as a catalyst to generate community participation.

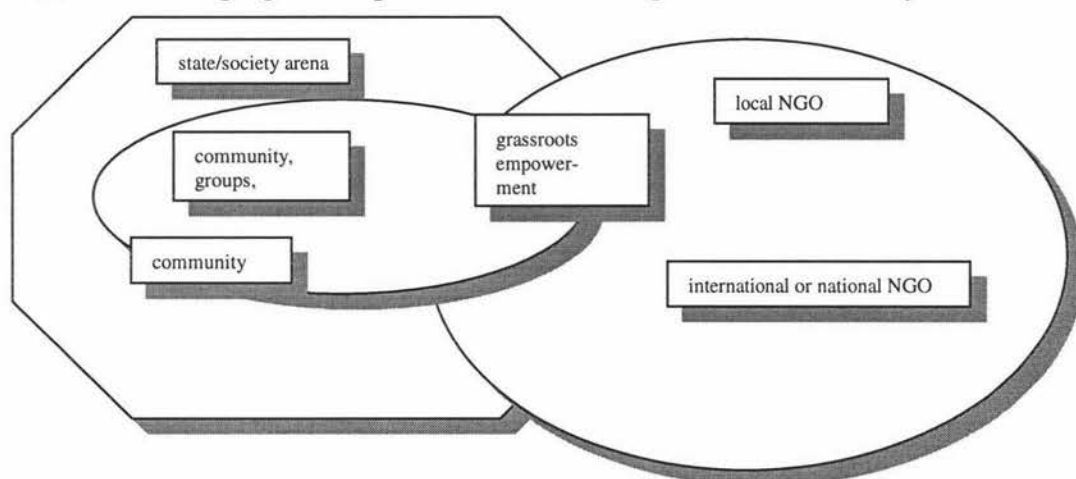
In developing countries, the importance of NGOs is increasing too, particularly those engaged in development activities. Some see them as the promoters of a distinctive form of development that emphasizes 'grassroots development' and 'empowerment'.

Empowerment, at the grassroots, through Non Governmental Organizations (NGOs) should be seen as a process that relates to other wider processes. There are three important general types of process starts from local community-level processes of social differentiation and changing-power relations, and then wider processes relating to that community to the state and society at large, including representation of interests, broader social differentiation and democratization and finally processes occurring within the NGO itself, or between NGOs, relating to the local action to the 'parent' NGO and others including both the mechanism of accountability and the means by which material and staff resources for such local actions are made available and maintained. Figure 2.4. illustrates the process.

Since most of the Third World urban poor are involved in what development specialists call the 'informal sector' –buying, trading and selling the recyclable materials from the waste that flows through the world's cities (where most urban

grassroots economic development efforts are concentrated), their incorporation into the municipal's SWM programmes would not be a problem. The main problems, probably, are the 'education' and continuous support of the municipal government to encourage and ensure their participation.

Figure 2.4. Encouraging Participation Process through the NGO activity



Source: Alan, 1992:122.

Development Analyst Judith Tendler (1987) performed an in-depth review of the economic development initiatives undertaken by independent organizations and found that those most effective at improving the lot of the poor were not the common 'integrated' small projects that include credit, management training, equipment and advice, rather, success seemed to gravitate to those highly specialized groups that began with a detailed understanding of existing conditions in a narrow sector of the economy. Although grassroots oriented, they were centralized enough to target the specific legal and institutional barriers that perpetuate poverty (Durkin, 1989:30-31). Poverty is indirectly related to environmental degradation. It is because poor people are left with little, or no, options at all in order to be able to care for their environment. For them, most of the time, the choice is either survive or not survive.

In a SWM context, municipal governments have a dual role: first, SWM has a responsibility for protecting the public and the environment (Dye, 1998:22-23) and second, SWM is a responsibility for servicing a category of public works infrastructure, such as mass transportation systems (National Council, 1988:33). Governments' past role in managing solid waste is changing from merely taking out the garbage, to invoking, often unwelcome, regulatory policies designed to influence the private decisions and behaviour of millions of individuals and business alike, such as disseminate the importance of reuse and recycle (Heidenheimer et.al, 1990:309). Health, and quality of life, concerns lead to other problems for the government in managing solid waste, namely (a) the current scarcity of disposal sites (including, primarily, modern sanitary landfills) for an ever-increasing level of refuse from the people surrounding the site; (b) the difficulty of siting new facilities in populated areas and (c) competing environmental and political demands that may be paralyzed by budgetary limitations (National Council, 1988:77, 96,98).

Therefore, the involvement of NGOs and other local communities, can shift the role of the municipal government from the sole manager and executor, of the actual process within the solid waste management, to the one that ensures conditions conducive to private sector investment and growth, including small and medium enterprise development and their active participation in the programmes. Thus, it will only act as the supervisor and 'manager' in a SWM by providing legal, regulatory, financial institutional and physical infrastructures that facilitate competition and entrepreneurship and the overall development of the private sector (Cook *et.al.* 1998:5). It, however, has to be borne in mind that although private sector development, including community organizations, is another way to embrace more active participation from communities, it is not in itself a prior goal of solid waste policy. It is rather a means to achieve the general improvement of waste management systems operating, or being planned, in developing countries. Private sector participation in waste management systems should occur when it can

contribute to making those systems more responsive, more efficient, more economical, more equitable or more environmentally responsible (Klundert and Lardinois, 1995:7).

The roles that the government can play is include removing the constraints to private sector development, whether that development is by privatization, public enterprise reform, large-scale foreign and domestic manufacturing enterprise growth or small and medium-scale local enterprise development. This involves selective interventions to correct market failures and imperfections, and also includes support for restructuring at the sectoral and enterprise level, development of technological capacities, human resources and selective institutional support. The development of small and medium sized enterprises (SMEs) owned by indigenous entrepreneurs has been a further means of promoting private sector growth. SMEs are an integral component of the overall economic development strategy and are also recognized as generators of employment and efficient resource utilization (Cook, *et.al.*, 1998:5).

Another consideration for their further involvement is to slightly adapt different approaches of development. Top-down development approaches, as the common practice is in Indonesia, need agents of change in order to make them more effective. In this approach, the initiators usually are the municipal government and international donor agencies. There are common limitations and constraints for these approaches: an inadequate institutional and legislative framework to implement change; lack of political motivation of the government officials; inadequate feasibility studies; built on an existing system that can no longer cope with the new development requirements and little, or no, recognition of the scope and importance of informal sector activities.

Bottom-up approaches are the ones where the local initiative are based on the local needs and employ them as the agent of change. The benefits for the community, if this kind of approach is applied to the local solid waste management system, are the removal of waste; job creation; waste contained at transfer points and

reliable collection services. The limitations and constraints of these approaches include small-scale difficulty in replicating itself without municipal support, and generally limited participation from the local community caused by the lack of incentives, especially financial ones (Ali *et.al.*, 1998:263).

The provision of affordable services to the poor is one of the objectives. It needs both top-down and bottom-up approaches in order to succeed. The agents of change, therefore, have to be comprised of those institutions or organizations or even individuals that are aware of the importance of involving people from the beginning, and have the resources to encourage it. In the case of urban solid waste problems in Indonesia, the principal agents of change are comprised of: Indonesian Government, DKI Jakarta provincial/municipal government, the Sanitation Agency, private entrepreneurs, NGOs, service users and Donor and Loan Agencies, such as, the World Bank and UNDP (Ali *et.al.*, 1998).

Community and neighbourhood-based organizations can help develop strategies for reducing material consumption and generation by sorting recyclable materials and disassembling products for recycling. These, are often labour intensive and would be very expensive in developed countries, but not in developing countries where cheap labour is still considered as an advantage (Gardner and Sampat, 1998:47-48).

2.4. The Answer or Part of the Answer?

A participatory approach is not the one and only answer to ensure the projects' success. It cannot be adopted naively since it is not a well-defined and unproblematic concept that perceives the guarantee of success when an international or national development NGO works with the local community. It should also be borne in mind that it is not clear whether everyone living in a village, or urban location, is included as a community member. On the other hand, those who are included will certainly be living in complex, and unequal, relations with each other.

In practice, some individuals, or groups, are more powerful than others, and cannot represent the interests of the poorest members of the community, or people outside their groups.

Moreover, empowerment as a tool for self-reliance, somewhat gives the term a rather weak meaning in a political sense. As best described by the Shumacher's example (Schumacher, 1973), "showing people how to make their own fishing tackle might increase their capabilities in the technical sense but would do nothing to help them gain access to fishing rights. And if these rights were all held by the state and/or powerful local interests represented in the state, little could be done for the poor and estranged people simply through "gifts of knowledge" (Wuyts et.al, 1992:138-140).

Policies that embrace the poorer people needs, and serves toward the achievement of sustainable livelihood/development, should be formulated and implemented. Within it, there has to be regulations to ensure the incorporation of participatory (as a bottom-up approach) and top-down approaches.

This is because a partnership between grassroots projects and the municipal sector (grassroots initiatives to be integrated into municipal systems) remains a challenge, but still an important aspect for popular participation. It will not occur just because it is a good idea, more than that, people need to recognize that their interests are better served in partnerships than without them (Hamdi and Goethert, 1997:264). Furthermore, the integrated activities may serve as a way to reduce costs to the government, and also provide employment opportunities for the communities. In terms of solid waste management, this partnership would reduce the government's 'burdens' by reducing the cost, provide better service and service coverage, especially in poor areas, and may speed up the achievement of a successful urban agriculture. The next chapter, therefore, would discuss more of sustainable solid waste management programmes, its elements and how composting can be incorporated into it.

Chapter III

Composting Scheme

within the Urban Solid Waste Management Framework

In light of the urbanization trends and resulting problems, particularly in developing countries discussed in the previous chapter, this chapter will focus on solid waste management problems. The following section will discuss composting as one of the solutions in dealing with the increasing amount of solid waste in urban areas. Aspects related to composting, such as the nature of compost and its benefits, how to compost and also the involvement of private and informal sectors within the composting activities will also be discussed.

3.1. Urban Challenge: Solid Waste Management

The term solid waste encompasses a wide range of variety of materials, organic and inorganic (Gottinger, 1991:11), that one may define it as any refuse materials that are not liquid. The US Resource Conservation and Recovery Act (RCRA) has defined solid waste as any garbage, refuse and sludge from a waste treatment plant or air pollution control facility, or other discarded material resulting from industrial, commercial, mining and agricultural operations and community activities (Gottinger, 1991:3). In this thesis, solid waste refers to non-hazardous waste resulting from industrial, commercial and community activities that are not to be treated separately in order to achieve environmentally sound waste management practices (Mayes, 1995:8). Solid waste consists of the solid, post-consumer and post-production residues of households, commercial establishments, industries, institutions, mining operations and agriculture. Throughout this study solid waste will refer only to those solid wastes (a heterogeneous material) produced in urban areas (Sicular, 1992:18).

In this study, waste material is defined as useless remains, refuse, scraps and shreds, an inevitable and inherent product of human social, economic and cultural life (Kharbanda and Stallworthy, 1990:1). Three main sources of waste are domestic refuse, agricultural waste and industrial waste. Domestic waste generation in large cities can be gauged from the volumes disposed of from New York City. This city generates some 30,000 tonnes per day, whereas Jakarta is said to generate a third to half of that amount (Kharbanda and Stallworthy, 1990:5). The type of waste from domestic sources is generally similar, contains not only valuable, and often reusable, materials, such as metal, glass, paper, plastic and food waste with a high-nutrient content, but also an ever-increasing amount of hazardous waste, such as mercury from batteries, cadmium from fluorescent tubes, pesticides, bleaches and a wide range of toxic chemicals, such as occurs in solvents, paints, disinfectants and wood preservatives (Kharbanda and Stallworthy, 1990:5-6). Municipal Solid Waste (MSW) in this study is defined as the waste collected and controlled by the local authority or municipality. MSW is also the most diverse category of waste comprising waste from heterogenous sources including households, commercial and institutional wastes (White *et.al.*, 1995:234).

In developing countries, MSW, due to the lack of a solid waste collection service, is often dumped at sites near cities, sometimes within congested neighbourhoods where it draws rats and other vermin that pose health threats to nearby residents. In industrial countries, the material is dumped in landfill, incinerated or dumped in rivers or the ocean, always with environmental consequences. Landfills often leach acidic substances downward contaminating water supplies, whereas incineration may cause mercury emissions into the air (Gardner and Sampat, 1998:23). The following table illustrates pollution caused by waste from municipal, agriculture, industry and mining sectors.

Further, as a typical city in the developing world with four million inhabitants, is estimated to generate 2,000 metric tonnes of solid waste per day, it is

indeed a problem. At a typical density of 250 kg/cubic metre, it will be equal to 8,000 cubic metres per day, or about three million cubic metres (approximately 730,000 tonnes).

Table 3.1. Solid waste pollution

Waste types	Air	Water	Land
Agriculture	Dust	Run-off	Manure
	open burning		pruning
	odour		harvest residue
Mining	fine dust	mine aids	Tailings
	burning	salts	stripmining
			overburden
Industry	incineration	Coastal/ other water	dumps
	open burning	pollution	junkyards
	odour	landfill pollution	
Municipal	incineration	Incineration	landfills
	open burning	landfills	open dumps
	odour	sea dumps	

Source: www.soc.titech.ac.jp/uem/waste/sw-pollution.html

Those numbers were calculated with regard to households wastes, so when commercial and industries wastes are added, the amounts will increase as well (Sicular, 1992:89, Cointreau, 1982). The following table (table 3.2.) shows the trend in several other big cities in developing countries:

As SWM is one of the growing environmental and financial problems in developing countries, its management, therefore, is also one of the pressing environmental and social problems of our time. In order to dispose of, treat and recycle the ever-accumulating amount of waste in the future, significant changes in

consumption and production patterns of an economy are required. In the meantime, we need to provide efficient and effective management systems for coping with the waste problem on a regional and local level.

Table 3.2. Waste generation trend of several developing countries big cities

City	Population (millions)	Amount of waste generated (tonnes/day)
Manila	12	4000
Jakarta	12	5000
São Paulo	13	10000
Calcutta	10	3000
Dar es Salaam	3	1000

(Deelstra, 1989)

In this endeavour, the site of waste management facilities (treatment and disposal) as well as the consideration of technological options for treatment, and disposal, play a crucial role since by creating cost effective waste management operations contained inside a network of waste disposal and treatment facilities, transportation costs would be minimized and disposal quantities could be reduced by the economic use of advanced technologies for waste treatment (incineration, pyrolysis, composting etc). It also considers the increasing shortage of waste disposal sites (landfills) and heightened public opposition to newly proposed sites (mostly because of the odour and leachate problems), a shift toward handling waste management as a strategy for resource recovery and conservation is needed (Klundert and Lardinois, 1995:3-4).

Despite significant efforts in the last decades, the majority of municipalities in developing countries cannot manage the growing volume of waste produced in

their cities. This inability to manage urban solid waste consists of failures in the following areas: inadequate services; inadequate financing; inadequate environmental controls; poor institutional structure; inadequate understanding of complex systems and inadequate sanitation. The increasing attention to sustainable development also means that sustainable waste management systems will increasingly come to be the goal of a solid waste policy. At the same time, the role of the formal sector, informal private sector and community participants in relation to sustainable solid waste policies are increasing as well (Klundert and Lardinois, 1995). The reason behind this is that the modern, efficient, economically, environmentally and socially sustainable waste management systems are frequently beyond the reach of the developing countries municipal governments. Moreover, even with various actors already playing an extensive role in solid waste management, neither the municipalities nor the formal and informal private sector, nor NGOs, nor the community can solve the waste problems on their own, so far (Klundert and Lardinois, 1995:17).

In general, however, the whole waste management system is still greatly dependent on the role of the municipal government for coordination and responsibility due to the parallel provision of infrastructure and other municipal services, including reliable secondary waste collection services (Klundert and Lardinois, 1995:17). The role of the municipal government in the solid waste management system, therefore, has been shifted from the sole manager and executor to the one who ensures the conditions conducive to private sector investment and growth (including small and medium enterprise) by removing constraints to private and informal sector development. It has to provide the legal regulatory, financial institutional and physical infrastructure, that facilitates competition and entrepreneurship, development of technological capacities and of human resources (Cook *et.al*, 1998:5).

The development of small and medium sized enterprises (SMEs) owned by indigenous entrepreneurs has been a further means of promoting private sector growth. SMEs are an integral component of the overall economic development strategy that is also recognized as generators of employment and efficient resource utilization (Cook, *et.al.*, 1998:5).

In cities, in developing countries, significant quantities of organic waste are generated by the agricultural enterprises of the inhabitants, through general municipal waste, and also vast amounts of water contaminated by organic material from agro-industrial processing or sewage. Waste management in urban areas is a serious issue. It, therefore, must be managed in a more integrated, comprehensive, long term and strategic manner. Rising unemployment (another problem of urbanization) has given extra impetus to resource conservation schemes like waste recycling and composting. These schemes are intended to generate jobs and offer opportunities for training in new skills for people.

3.2. Solid Waste Management Elements and Processes

Solid waste management may be defined as the discipline associated with the control of the generation, storage, collection, transfer and transport, processing, and disposal of solid wastes, in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations, and that is also responsive to public attitudes (Jorgensen, 1997). In its scope, solid waste management includes all administrative, financial, legal, planning, and engineering functions involved in solutions to all problems of solid waste. The solutions may involve complex interdisciplinary relationships among such fields as political science, city and regional planning, geography, economics, public health, sociology, demography, communications, and conservation, as well as engineering and material science.

According to Tchobanoglous (1993), the activities associated with the management of solid wastes, from the point of generation to final disposal, have been grouped into the six functional elements:

1. waste generation
2. waste handling and separation, storage, and processing at the source
3. collection
4. separation and processing and transformation of solid waste
5. transfer and transport
6. disposal

By considering each functional element separately, it is possible to identify the fundamental aspects, and relationships involved in each element, and it is also possible to develop quantifiable relationships for the purposes of making engineering comparisons, analyses, and evaluations. This separation of functional elements is important because it allows the development of a framework within which to evaluate the impact of proposed changes and future technological advances (Tchobanoglous, 1993:10).

Waste generation encompasses activities in which materials are identified as no longer being of value and are either thrown away, or gathered together for disposal. Waste handling and separation involves the activities associated with management of waste until they are placed in storage containers for collection. Handling also encompasses the movement of loaded containers to the point of collection. Separation of waste components is an important step in the handling and storage of solid waste, at source, for example, from the standpoint of materials, the best place to separate waste materials for reuse, and recycling, is at the source of generation (households, markets, industrial areas). Processing at source involves activities such as compaction and yard waste composting (Collins, 1972:38).

The functional elements of collection include, not only the gathering of solid waste and recyclable materials, but also the transport of these materials, after collection, to the location where the collection vehicle is emptied. This location may be a material processing facility, a transfer station or a landfill disposal site. The location of temporary dumping sites have to consider the public health concerns and aesthetic considerations. In small cities, where final disposal sites are nearby, the hauling of waste is not a serious problem. In large cities, however, where the haul distance to the point of disposal is often greater than 25 km (in Jakarta it is more than 40 km) the haul may have significant economic implications (Collins, 1972).

Government authority is, and will remain, responsible for the administration of waste collection removal and disposal, and for the preservation of health standards. However, as the process tends to become less local in character, and as the movement extends in some cases far beyond the municipal boundary, the local government authority finds itself in the transport business, whether it likes it or not. This gives rise to many problems as it requires a large capital outlay, and specialized knowledge and experience, and is a function for which some local authorities are not geared. By delegating some of its operational activities to either private or informal sectors, local government could possibly free its resources to concentrate on its primary task, which is the administration and supervision of the provision of essential services (Collins, 1972:38-39).

The recovery of separated materials, the separation and processing of solid waste components, and transformation of solid waste that occurs primarily in locations away from the source of waste generation are encompassed by this functional element. In developed countries, the type of means and facilities that are now used for the recovery of waste materials, that have been separated at source, include kerbside collection, drop off and buy-back centres. The processing of waste, which has been separated at source, and the separation of waste, usually occurs at a materials recovery facility, transfer stations, combustion facilities and disposal sites.

Processing often includes the separation of bulky items, separation of waste components by size using screens, manual separation of waste components, size reduction by shredding, separation of ferrous metals using magnets, volume reduction by compaction and combustion (Gottinger, 1991).

There are various resource recovery processes that can be categorized into five different groups, an energy recovery process which recovers the energy content of mixed municipal wastes, in the form of either steam, electricity or fuel, a material recovery process that separates and recovers the basic materials from mixed municipal waste, such as paper, metals and glass, a pyrolysis process that thermally decomposes the waste in controlled amounts of oxygen and produces products, such as oil, gas, tar and acetone, a compost process which produces a humus material from the organic portion of the mixed waste and a chemical conversion process that chemically converts the waste into protein and other organic parts (Gottinger, 1991:24).

Transformation processes are used to reduce the volume and weight of waste requiring disposal, and to recover conversion products and energy. The organic fraction of municipal solid waste (MSW) can be transformed by a variety of chemical and biological processes, such as composting and other aerob¹ process or an-aerob treatment process.

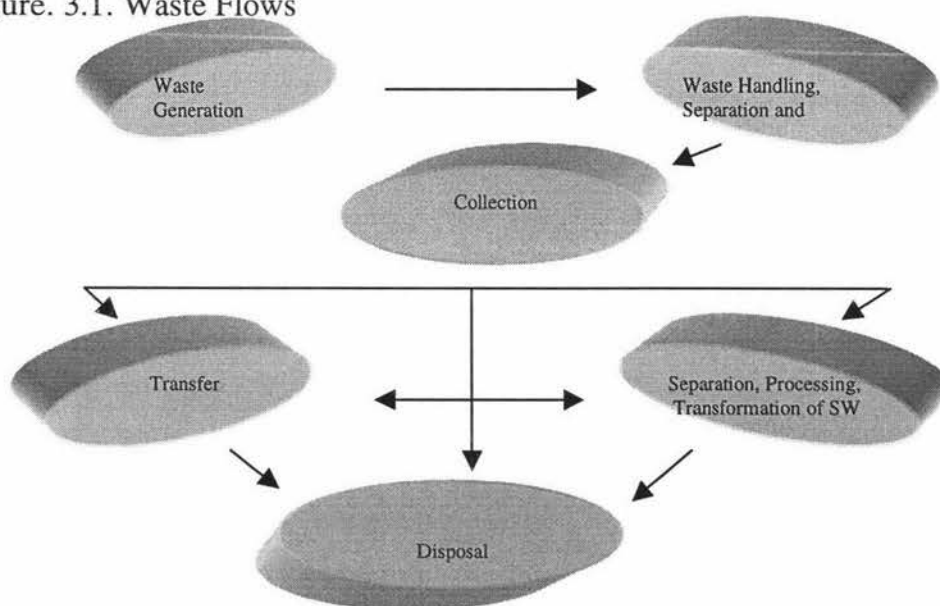
The final functional element in the solid waste management system is disposal. Today, the disposal of waste by landfilling or landspreading is the ultimate fate of all solid wastes, whether it is residential waste collected and transported, by truck or other form of vehicles (including rail cars and barges in some countries), directly to a landfill site, residual materials from materials recovery facilities (MRFs), residue from the combustion of solid waste, compost or other substances from various solid waste-processing facilities. A modern sanitary landfill is not a

¹ aerob means a process that needs air (oxygen) as essential components to keep the process running whereas an-aerob is a non air (oxygen) process, usually happened in a tight man-made container to avoid air from coming in (Rivaie, 1998)

dump, it is an engineered facility used for disposing of solid waste on land, or within the earth's mantle, without creating nuisances or hazards to public health or safety, such as the breeding of rats and insects, and the contamination of groundwater (Tchobanoglous *et.al.*, 1977). Figure 3.1. illustrates the above mentioned processes.

In solid waste disposal management, landfill is still the most common final disposal method used. Currently, it must be the largest repository of both municipal and industrial waste worldwide. Incineration, and waste-for-energy plants, are becoming more popular, especially after most countries realized that they are going to fill up, and exhaust, their landfills in the near future. However, it also has environmental impacts such as, noise produced during processing, the nuisance of dust and odours, the air pollutant emissions, ash generation and effluent discharge (quench and scrubber waters) (ESRG, 1988:28, Chang, 1991:12).

Figure. 3.1. Waste Flows



Source: Shafik, 2000; Tchobanoglous *et.al.*, 1977.

Bearing these options in mind, along with their advantages and disadvantages, an integrated solid waste management system is needed. It is a

"systems" approach to managing all materials that allows for overall improvements in both environment and economic performance, and ensures that problems are not simply moved elsewhere in the system (White, 1995). Further the OECD (1994) stated that an integrated SWM is a system that provides source reduction, waste recycling, waste transformation and disposal. Its purpose, therefore, is to achieve a safe, less toxic, more stable material that can be used, reused, disposed of, or discharged for further treatment. Modelling an integrated solid waste management system comprises four operations that include collection of waste from source, transportation of waste from the source to the facilities (the facilities may be transfer stations, composting plants, or even recycling centres, like in Jakarta), processing waste at these facilities and remove and dispose of the non recyclable and non compostable materials from the facilities to final disposal sites (landfill)² (Gottinger, 1991:6), that can be illustrated in figure 3.2.

3.3. Sustainable Solid Waste Management

Sustainability in the waste management system will only be attained if the current concept of refuse disposal, which imposes great burdens on the environment and resources, is transformed into a closed-cycle system, restoring various natural cycles, thus preventing the loss of raw materials, energy and nutrients (Klundert and Lardinois, 1995:24). In general, this means minimizing resource extraction at the beginning of the production cycle, and final disposal at the end of the cycle. As a consequence, avoidance of waste generation (including waste reduction and minimization) has a higher priority than recovery (including composting) and recovery (preferably including separation at source) has a higher priority than environmentally sound disposal of remaining residues. This concept is generally referred to as the solid waste hierarchy.

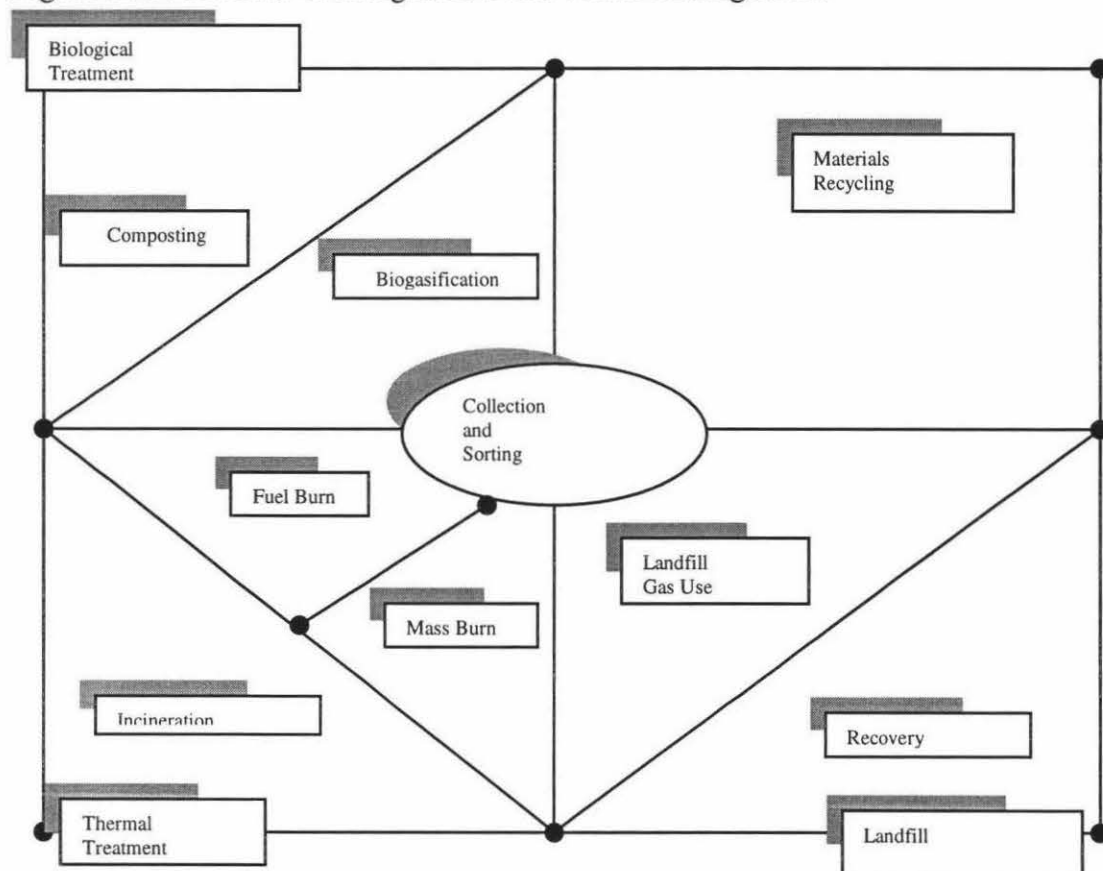
² a landfill here means a specially designed, engineered, operated and maintained disposal site which safely buries wastes in an environmentally responsible way (Napier City Council, Solid Waste Management Plan, 1999).

Further, sustainable waste management calls for the support and promotion of clean technology, together with the prevention, or avoidance, of unnecessary waste production. It also draws on the idea of local self-sufficiency, leading to a preference for processing waste and recyclables as close to the source of generation as possible.

The idea of an urban agriculture (that will be discuss further under 'composting in an urban setting'), therefore, perfectly fits into the framework of sustainable waste management. It has, however, to be borne in mind that in developing countries, there is an inherent conflict between the wish to develop and raise the material standard of living and the priority of waste reduction, since waste generation generally increases with a rise in material living standards (Klundert and Lardinois, 1995).

A sustainable solid waste management system is the aim of solid waste management system development, especially in developing countries. This system can be achieved if there is an inter-sectoral partnership in dealing with the municipal solid waste problem. The municipality should see its solid waste management mandate and responsibilities clearly, and make use of the strengths of the various other actors. These actors include the formal private (commercial) sector, in their role as potential solid waste function contractors, the informal private sector, including individuals, small entrepreneurs and micro-enterprises, already working with waste materials, or having the potential to do so, community-based organizations that are either idealistically motivated, or working for their own welfare and also non-governmental organizations (NGOs), that are usually in pursuit of their own idealistic goals (Klundert and Lardinois, 1995:1).

Figure 3.2. Elements of Integrated Solid Waste Management



Source: White *et.al.*, 1995.

The basic unit of community economic development is often the cooperative (an association of worker-owners who form a business and manage it jointly), unfortunately, the majority of cooperatives survive only a few years. Their members are generally inexperienced in managing capital and equipment, they tend to get locked in a cycle of infighting, and they often face volatile markets, skyrocketing inflation and policies that are not supportive of small producers (Durning, 1989:29). Yet, a more active role for the local community organizations is needed in order to make communities as self-reliant as possible (Jain, 1992).

In a number of cases, partnerships between public, private formal and informal sectors are increasingly significant since the modern, efficient,

economically, environmentally and socially sustainable waste management systems are frequently beyond the reach of developing country municipal governments acting alone. The mixture comes into being, either through evolution, or by deliberate design. Nevertheless, constraints are always lurking ahead. The key constraints to this partnership are firstly is financial constraints, secondly are resistance and territoriality of the various sectors which can take the form of lack of belief in the legitimacy of other partners, or it may have more to do with an expressed, or unexpressed, fear that partnerships may disrupt the status quo, especially, of marginal actors such as informal sector entrepreneurs and thirdly is a barrier to inter-sectoral partnerships resistance to institutionalization on the part of both formal and informal actors may be formed through the recognition and legitimization of the informal sector (Klundert and Lardinois, 1995:2). Further, financial constraints are affecting both municipal government and private sector. For municipal government it is in the form of constraints on the use of taxpayers' money whereas for private sector constraints are on capacity, credibility, resilience and liability. For informal private and community sectors, their constraints are generally because of their marginal access to social institutions, and extremely limited access to financing (general institutional and capacity problems typical of developing countries) (Klundert and Lardinois, 1995).

Decision-making in the small firm, such as the composting enterprises in Jakarta, usually rests with the owner /manager. Therefore the socio-cultural environment is likely to play a significant role both in determining the objectives (the level of income to aim for) as well as the abilities of the individual. The issue of motivation, therefore, is a significant one in developing and further expanding the community-based composting enterprises in various levels and areas (Chell and Haworth, 1991).

Furthermore, it is also important to embrace the informal sectors, such as scavengers or small scale private recycling centres or other non legal-institutional

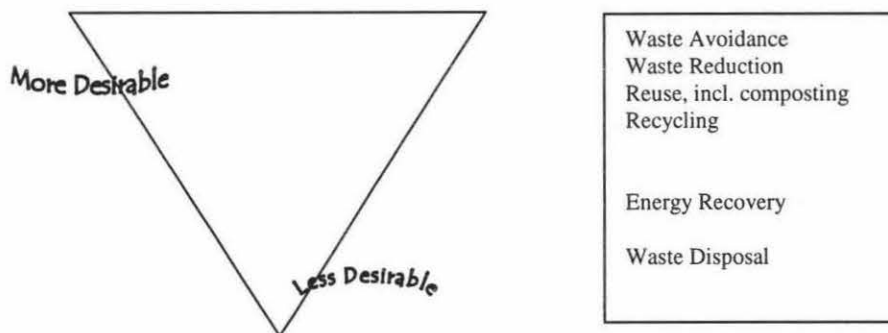
activities, due to their potential to separate recyclable materials, reduce the cost for the municipal government, broaden the service coverage for waste collection and disposal, as well as reduce the amount of waste that has to be landfilled (Klundert and Lardinois, 1995). Moreover, Klundert and Lardinois (1995:9) also note that “there would be a reduction in the amount of waste materials requiring collection and transport, provision of waste removal and sanitary services to otherwise unserved (generally poor) sectors of the city at no-cost to the municipality, the maintenance of a large and available stock of secondary resources to stimulate industrial production and also providing of income-generating activity for a large number of people, many of whom would otherwise be indigent or require financial support from the government.”

As for the private sector, the potential benefits of their involvement in the waste management systems include the greater efficiency and enhanced performance due to leaner private sector organization and more flexible employee compensation procedures and more competitive waste management operations, the creation of a more robust local economy commercial sector, faster response associated with the ability of private business people to raise capital as opposed to the relatively long lead times involved in government decision making and/or the donor grant process or with the government procurement procedures as well as the generation of sustainable employment in the private sector (Klundert and Lardinois, 1995:8).

3.4. Composting as part of the sustainable solid waste management

No waste or waste reduction policy, has become the main issue within waste management, nevertheless, since a large amount of waste was, and continues to be generated, reuse and recycle policies are other popular options. The following figure illustrates the preferable waste treatment method.

Figure 3.3. Waste Minimization Hierarchy



Source: Adapted from Waste Minimization Manual for Local Government, Ministry of Environment, Australia, 1999.

Composting is defined (Finstein 1995) as a microbe-based, aerobic, solid phase matrix, self-heating process. The matrix consists of the organic material that serves as a source of nutrients for microbial growth, a sink for metabolic products, a site for gas exchange and thermal insulation. The microbes responsible for composting are various beneficial bacteria and fungi that are widespread in the environment. These are indigenous to such materials as soil, dust, vegetable matter, and wastes of all sorts. Special organisms are not required (Rodrigues, 1996). Owing to the time/temperature profile of the process the final product (the compost) will be "sanitised", i.e. much reduced levels of human, animal and plant pathogens providing that the original organic waste material was low in contaminants (e.g. heavy metals) and the high temperatures were maintained during the process and that it may be of potential value in agriculture and horticulture (Lopez-Real, 1994). Broadly speaking, composting technology is based around the aerobic nature of the process, and composting configurations reflect variations on a theme of air (oxygen) supply. Though simple stacking of organic wastes (e.g. manure heaps) is sometimes referred to as "passive composting" natural diffusion of air into the matrix cannot replace the demand exerted by the micro flora leading to anaerobic conditions and anaerobic degradation pathways.

Composting activities and all activities that go along with them, will bring social and environmental benefits for the people involved since they can work together, make economic and environmental profit from them and be responsible, and in charge of their own neighbourhood's welfare. Further, compost as a fertilizer is friendlier to the soil since it can reduce soil erosion and improve the topsoil quality. It works as a soil conditioner by increasing soil organic content and maintains and enhances the productivity of agricultural soils. Therefore, in the long run, compost is going to improve soil condition in that it can produce better results (Hoffman, 1997). In general, most researchers publish positive findings in terms of yield levels, moisture retention, organic matter input, improvement in soil physical characteristics etc. Negative findings are usually traceable, or deliberately target poor quality compost as a result of waste stream mismanagement (i.e. failure to separate waste leading to heavy metal and other contamination). It is also in line with the efforts, that have been started in various countries, to reduce the input of nutrients carrying nitrogen and phosphorous which have harmful environmental consequences (Kharbanda and Stallworthy, 1990:9).

Composting can reduce solid waste that is going to be landfilled, therefore minimizing the problems of land availability, waste collection and transport costs. It is also quite an efficient way to reduce, recycle and reuse local solid waste since, by producing compost people can sell the compost, sell the recyclable materials, or reuse them for business purposes and gain financial profit from them. This method utilises a natural process to stabilize high entropy as low entropy, reusable materials (Schoenberg, 1994). The high organic content in the Municipal Solid Waste (MSW) shows strong potential for composting, and can produce good quality compost. Furthermore, the water content and C/N Ratio (35) make municipal waste a good source of material for the composting processes.

Moreover, a composting process uses a socially appropriate technology for the intended beneficiaries who are mostly those who live in slum areas. There are

three steps of choosing a socially appropriate technology. The first is to specify the social, behavioural and resource requirements of the technology, the second is to assess the corresponding characteristics of the project population and its environment and the third is to compare both types of information to verify that the technology and the people are compatible (Perret and Lethem, 1980:15).

Though such materials could be used in rural farming, the economic costs of transportation of such bulky materials is often prohibitive. It, therefore, makes real economic and common sense to collect, process and utilize waste as close to the source as possible. The urban/peri-urban sector is therefore ideal for the utilization of composts, in particular for horticultural crops, that are more amenable to high density planting. The use of composts will undoubtedly have an important effect in terms of water use, since one of the widely recognized benefits of composting is its ability to hold and retain moisture (Parr & Papendick, 1982).

In short, composting is the preferred treatment method for many types of organic waste from both an ecological and economical standpoint. The most common raw materials for composting are municipal solid waste, sewage sludge, waste made up of timber, and from the food processing industries and animal excretions. The main reasons for composting versus other treatment methods are because it is an effective method of drying and reducing the mass, and especially, volume of waste, to be transported to landfills, while minimizing the risks to the environment and that the end product of the process can serve as a soil amendment, having beneficial physical, chemical and biological effects on the soil and on crops. The end product may be used effectively for the reclamation of infertile soils, such as dispersed and impoverished soils (Raviv, 1997: 225).

Further, composting also has other benefits since it complements the existing garbage collection system by processing the waste within the community, it creates jobs within the community, it may enhance a community's greening campaign (with the end product) and promotes awareness of the potential value of garbage, which is

normally perceived as odourous and useless and the last but probably the most important consideration is that it can also generate supplemental income that is needed, especially, for low-income families, as in the case of Indonesia where the official minimum wage is 3,000 to 4,000 Rupiah (US\$1.32 to \$1.76 in 1997) per day (Perla, 1997 p.51).

Thus, composting is considered as the best way to cope with the solid waste problem: it encourages people to participate; cuts costs that have been spent on waste collection (people have to pay more for the services if they want all the waste to be transported to the dumping sites); minimizes the waste transported to the landfill site; the recyclable materials are marketable and it is profitable for the people involved since they can sell the compost to make money, and fund their expenses.

3.4.1. Composting in an Urban Setting

Compost production, and use, in an urban setting has many attractions. As outlined above, it is a process of direct public health importance as it enables potentially polluting, and disease-ridden materials, to be sanitised and stabilised. Such materials (if clean) are of value to crop growing, but of particular value to quick growing, high value horticultural crops. There is less value in using composts, for say, cereals, where the full benefits may not transfer to the grain yield (Rodrigues 1996).

In recent years, there has been a revolution, in terms of the traditional occupations, in both urban and rural environments. Rural areas are increasingly offering non-agricultural jobs in both high income and less developed countries (da Silva, 1997). At the same time, urban areas witness an ever-growing range of opportunities in traditionally rural activities such as, agriculture, horticulture, orchards and animal husbandry. Historically, however, urban agriculture has played

an important role in many civilizations. Throughout the world, there is a long tradition of farming intensively within, and at the edge, of cities (Smith *et al.*, 1996).

Traditionally, urban settlements are importers of natural resources and exporters of pollution from, and to, rural areas (Smith 1998). Thus, the idea of an urban agriculture offers opportunities to some groups in particular and thus has positive impacts on equality. In many cultures and places, urban agriculture is women's agriculture, nature is a low-capital, high-labour industry and attracts low-income entrepreneurs, and also employs part-time and temporary low-skilled workers. It is seen as the largest, and most efficient, tool for transforming urban waste into food and jobs, with by-products of an improved living environment, better public health, energy savings, natural resource savings, land and water savings and urban management cost reductions. It contributes to social sustainability while increasing ecological sustainability. It also provides income to new arrivals in the city, teenagers, retired persons and those caring for children (Smit and Nasr, 1997).

Urban agriculture offers to urban citizens the benefits of an alternative source of income, hunger reduction, nutrition improvement, environment enhancement and sustainable management. It can also contribute to better public health, sustainable waste management, and stimulate new patterns of social organization and community participation. Urban and peri-urban agriculture are an important economic activity, essential to the livelihood of millions of families around the globe and the trend indicates an increase in importance. According to the Smit report (1996), the number of urban farmers producing for the market is expected to double from about 200 million in the early 1990s to 400 million by 2005. Many are examples of successful urban agriculture schemes around the globe.

In addition to the benefits of an increasing food supply and income to urban families, urban agriculture has an important significance to global sustainability. The production of food close to the consuming market reduces the need for transportation, therefore, reducing the consumption of fossil fuels and the associated

emissions of CO₂. There is also a reduction in packaging, refrigeration and the use of preserving additives (Rees, 1997).

Producing food in, or close to, urban settlements allows the utilization of waste as inputs to the process, therefore, recycling the nutrients that would otherwise be discharged into the environment in the form of landfills or surface water. Societal organic waste, municipal solid waste and sewage sludge can be processed into organic fertilizer, returning it to nearby gardens, or farmlands (Smith *et al.*, 1996). It is in the context of urban, and peri-urban, agriculture that composting plays its most important role, producing a rich soil conditioner, while diverting from dumping sites and landfills the organic part of the urban waste.

Current trends in Third World solid waste management are diverse, some use the turnkey and customized projects that continue to impose expensive, usually inappropriate, disposal-based systems, ignore existing structures' strengths and needs, as well as their limitations. On the other hand, some did work within the limitations and potentials that are in line with the local conditions, and forged unique means of handling the city's solid waste in order to achieve a sustainable way to cope with the local problems (Sicular, 1992:112). The efforts to find sustainable ways to deal with the solid waste, especially, in urban areas, have led to the increasing recognition of the potential benefits of scavenging and other forms of recovery, both formal or informal (Sicular, 1992:112). A case study of composting and recycling activities in Olinda, Brazil, can be used as an example on how composting can be incorporated into both government and local people's interest and initiatives to deal with solid waste problem. In the project, which started in 1983, local inhabitants were actively involved since they realized that such project would offer employment for a large number of unskilled labourers. Since the running costs were relatively low due to community's participation in daily activities, the profits they gained, then, could be used to provide service for community and to improve their well beings, such as drainage systems, latrines,

house upgrading and road paving as well as rubbish collection and street cleaning for the community (Cuentro and Gadji, 1990).

The recent support of Community Based Organisations (CBO) has led to the establishment, in many countries, of smaller scale operations of organic waste composting operations suited to the needs of urban horticulturists (Lopez-Real 1995). There is a considerable body of literature concerning the efficacy of compost use in agriculture and horticulture, though it is extremely difficult to analyse such data as there is enormous variation in the studies with respect to quantities used, quality of compost, data on such composting is also often absent, soil types, placement of material, crops used and climate (Rodrigues, 1996). The method used, therefore, is one of the main issue in composting activities in order to ensure the quality of the compost produced.

3.4.2. How To Compost and Its Application into the Case Studies

The most simple and common method of composting is the turned windrow system. It is one that is traditionally, and conventionally, associated with composting, and is widely used in Indonesia. Judging by its simplicity, and the relatively cheap cost, the windrow system is used as the only composting method in this project. Others, such as the vermicomposting method³ recently gained popularity as well, though it is not as popular as the windrow system (Diaz *et.al.*, 1993:122-123).

3 Vermicomposting uses earthworms (*Lumbricus terrestris*, *L.rubellus*, *Eisenia foetida*) in order to promote particle size reduction; remove senescent (overage) bacterial colonies that thereby stimulate the proliferation and growth of new colonies; enrich composting material by way of nitrogenous excretions; increase microbial growth and activity through the minimization of bacteriostasis and mycostasis; add mineral nutrients, and increase the rate and extent of carbon and nutrient exchange because of the interactions between microflora, protozoa and nematodes. The possibility of using vermiculture, as a part of composting, particularly at the household level is worth consideration. Despite its' seeming advantages, it has a disadvantage, as it has to be very carefully controlled, and that the conditions needed may not be universally available (Diaz *et.al.*, 1993:122-123).

In general, the composting process includes three important stages: the preparation of the raw material (pre-processing) which includes the size reduction and sorting; the compost process itself, and the grading and upgrading of the final product (post-processing) (Diaz *et.al.*, 1993:142). The post-processing involves various steps taken to refine the finished compost and meet regulatory and/or market requirements. This may include size reduction, screening, air classification, as well as assured moisture level at below 30% (Diaz *et.al.*, 1993:161).

Further, since composting, in general, is a matter of providing the proper environmental conditions for microbial life, which is aerobic (they cannot do their work unless they are provided with air), the methods include turning (breaking it apart with a spade or garden fork and then piling it back together) in order to get air into it, or thoroughly break up, or mix in, any ingredients that might mat down and exclude air, tearing down and reconstructing piles are activities that are used for aeration. Turning the pile promotes aeration, ensures uniformity of decomposition by exposing, at one time or another, all of the composting material to the active interior zone of a pile and to some extent may also serve to further reduce the particle size of the material (Diaz *et.al.*, 1993:149). It is also important to make sure that the waste to be processed contains all necessary nutrients such as carbon (C), nitrogen (N), phosphorous (P) and potassium (K) (Diaz, *et.al.*, 1993:125).

The pile should also be as moist as a wrung out sponge to fit the needs of microbes and two major kinds of food: browns (dry and dead plant materials such as straw, dry brown weeds, wood chips or sawdust) and greens (fresh plant materials such as green weeds from the garden, vegetable scraps, kitchen fruits and green leaves). Compared to browns, greens have more nitrogen in them. Nitrogen is a critical element of amino acids which is essential to both the plants growth and the soil condition. A good mix of browns and greens is the best nutritional balance for the microbes, together with the aeration and amount of water in the pile (Johnson, 1996:1-2). The loss of water, accelerated by the turning process, can both be an

advantage or a disadvantage in the process. If the moisture level is high it would be an advantage and vice versa. Therefore, it is necessary to add water during the process of turning when the moisture level is low (Diaz *et.al.*, 1993:149).

Ideally, the height of the windrow pile is about 6 ft (1.83 m). In Indonesia, however, where people turn the pile manually, the height should be roughly that of, or even lower, than the average labourer. While the length of the pile is indeterminate, it depends on the space available, the breadth of the pile is determined by convenience and expediency. With manual turning, a width of about one to two metres seems to be most suitable (Diaz *et.al.* 1993:149).

The finished compost is dark in colour and has an earthy smell. It is usually difficult to recognize any of the original ingredients, although some bits of hard-to-decompose materials, such as straw, can sometimes be seen. There is, however, no single point at which compost is finished. In general, finished compost is determined by its colour, the darker the better, and by its particle size, the smaller the particle the better the compost quality (Johnson, 1996:3). In Jakarta, the difference of compost 'quality' differed only by their grains. The bigger is the grain the lesser is its quality (Field Research, March-May, 2000).

This relatively simple way of composting makes it easy for people to do themselves. Further, with the compostable materials still in abundance in the waste stream generated everyday, there will be no difficulties finding resources. Therefore, the composting options within solid waste management is applicable, and deemed sustainable, judging by the waste composition trends, and the fertilizer requirements in the future, especially in an agricultural country such as Indonesia.

All of the above information leads into discussion of a more specific location: Jakarta, Indonesia, which will be discussed in the following chapter. The next two chapters will discuss Indonesia's (in general, and Jakarta's especially) solid waste management problems, and the small-scale composting enterprises schemes that were established as one of the solutions in dealing with MSW.

CHAPTER IV

Composting Schemes in Indonesia: The Jakarta context

This chapter ultimately deals with the analysis of solid waste management problems in Jakarta, and how the small-scale composting enterprise schemes can be fitted into the broader framework, in order to achieve sustainable solid waste management practices.

4.1. General Background

Indonesian Government realizes the importance of sustainable development in the effort to alleviate poverty, enhance the quality of life, and ensure that the economic, environmental and social goals of the nation are integrally linked. Sustainable development is a national goal, with reference to the solid waste problems in Indonesia, it is now recognized that waste must be managed in a more integrated, comprehensive, long term and strategic manner: in line with Agenda 21. Issues of waste production and management are likely to be challenging and potentially intractable, for a nation such as Indonesia, for it is characterized by endemic poverty, rapid and consistent economic growth, increasing industrialization, increasing population density, and inadequate funds for the development of massive public social and technical infrastructures to manage these trends. These trends provide a setting in which increases in both the quantity and toxicity of waste are inevitable, as well as the inadequate management, and in which their impacts on human and wildlife populations are likely to become significant and growing. Progress, to date, on the management of the high and increasing volumes of solid waste has been significant, but is still inadequate compared to the scope and growth of the problems. Action has also been taken to reduce waste. Pilot projects in a variety of Indonesian industries showed a one to five year break even point on capital investments in waste reducing process

improvements. There is at present an 8.1% recycling and composting rate in Indonesia through scavengers, material producers and 'green waste' used in gardens and soils. In REPELITA VI (1991-1995), a commitment was made to extend solid waste service coverage to more than 60% of households in medium sized cities and small towns, and to more than 80% of the population in large cities and metropolitan areas. This programme has been deemed ineffective, largely due to inadequate monitoring and enforcement capabilities in the necessary public agencies (UNCSD, 1997).

The problems, however, are not only the percentage of waste collected, but also the improvement of the solid waste management and finding alternatives in dealing with garbage. For instance, in 1990-1992, Jakarta had a percentage of 79% of waste collected out of 5000 tonnes generated per day (Leitmann, 1993, Oliveira and Leitmaan, 1994) but with the ever increasing number of population and waste generated (especially with the changing of life style), the municipal government has to improve and better their waste collection services in order to cope with the problems more effectively.

4.1.1. Indonesian Context

Indonesia has experienced a period of rapid population growth in urban areas between 1960 and 1990 as shown by the following table:

Table 4.1. Population and urban growth in Indonesia 1960-1990

Year	Total Population (in million)	Urban Population (in million)	Percent of the Total (%)
1961	97.1	16.5	16.9
1971	119.2	20.4	17.1
1980	146.7	32.8	22.3
1990	179.2	55.4	30.9

Source: BPS, 1996; <http://www-scf.usc.edu/~suprayoh/ISI-2html>.

In Jakarta, the capital city of Indonesia, there was a population increase between 1971 and 1990 from 4,743 million to 8,259 million and to nearly ten millions in 1995 (BPS, 1996). If the Greater Jakarta areas' population is counted, the number would be 16,8 million in 1990 (Douglass, 1989). Jakarta's rapid population growth is illustrated in the following table:

Table 4.2. Jakarta's population 1960-1990

Year	World City rank	Population (rounded)	Growth rate
1960	25	2.8 million	4.5%
1970	22	4.5 m	4.9%
1980	21	6.5 m	3.7%
1990	15	8.3 m	2.5%

(Sivarama Khrisnan and Green: 16-18).

A populated city, like Jakarta, is generated tonnes of waste, that as illustrated above, can be very damaging if it is not handled properly, or carefully. With the density of 13,786 per sq km (BPS, 1996), the problems would be bigger, especially, with the very narrow path into the residential areas that makes it difficult for a dump truck to go in. Therefore, despite from adding more personnel and improving the efficiency of the collection, transfer and final disposal, it is vital to develop alternatives and reduce the costs through the promotion of waste reduction, reuse and recycling (MEIP, 1998). Nevertheless, it must be managed in a more integrated, comprehensive, long term and strategic manner to ensure the sustainability of and efficient way to deal with waste management. The integrated approach should reflect the natural processes of breakdown and renewal; life-cycle approaches which consider all aspects of resource use, waste generation, storage, transport, treatment and disposal; waste management strategies that work towards longer-term goals rather than simply addressing the immediate needs (Centre for Advanced Engineering, 1992:6).

In the pursuit of sustainable waste management, one view is that the ultimate goal should be total waste prevention, even though that goal may be unattainable, preventive options should always be the first priority, since the long-term storage of waste is becoming more expensive, and difficult, with increasingly more stringent treatment requirements. Waste minimization practices are one of the preventive steps toward the disposal of waste. This can be achieved through implementation of the three Rs: Reduce, Reuse and Recycle. This method can be in the form of the reduction of waste at source, especially during production, or can focus on a broader view that would encompass the whole life-cycle of products and the many opportunities for waste minimization that arise at various stages of product life.

Nevertheless, there will always be a continuing need to dispose of some waste, while still recognizing that the amount of waste produced can be minimized. The intent and effort must then be to treat waste and dispose of residues in such ways that any risks to the environment are within acceptable limits (Center for Advanced Engineering, 1992:6-7). Waste management decisions, especially solid waste, therefore, are about which waste treatment system is most suitable in terms of space, alternative uses, availability of capital and expertise as well as environmentally acceptable impacts (Jorgensen, 1997:135). In developing countries, there is, however, some inherent conflict between the wish to develop and raise the material standard of living and the priority of waste reduction, since waste generation generally increases with a rise in material living standards (Klundert and Lardinois, 1995:24).

In the case of Indonesia, in 1993, only 40% of the urban population had their solid waste collected, and formal waste collection systems are almost unknown in rural areas. Uncollected solid waste is typically either burned, or disposed of in streams or in open land. Given the demographic trends already discussed, growth in the production of solid waste is projected to increase dramatically. This will pose serious environmental and social challenges given the already low collection and management rate. Solid waste

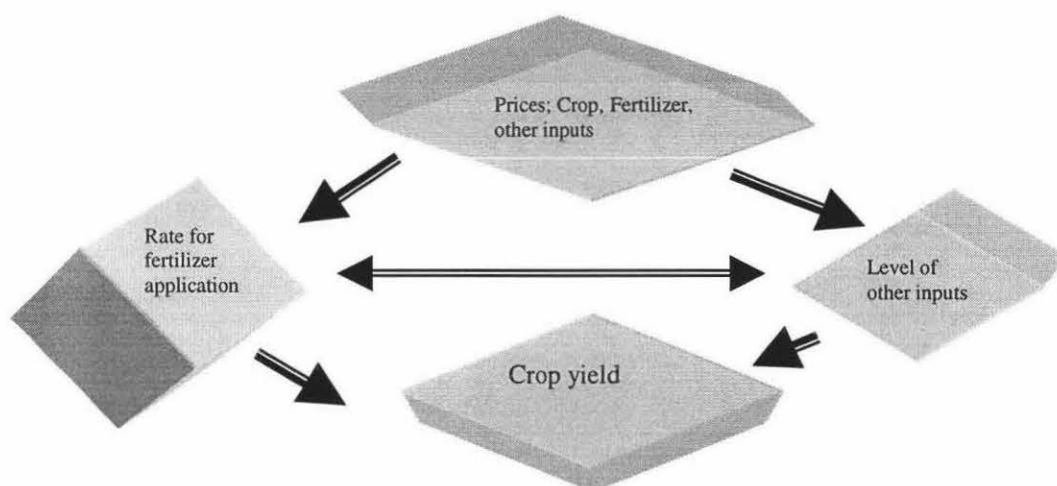
production is projected to increase 500% by 2020 for the domestic sector, and 1000% for the manufacturing sector. The resulting pollution of watercourses and aqueducts in centres of high population densities is projected to increase 800% during the same time period (UNSDC, 1997). The solid waste 'informal' disposal can lead to a deterioration of water quality that in turn will increase health problems, particularly for the urban poor. Even the solid waste that is collected poses significant environmental challenges. There are only six sanitary landfill sites in Indonesia at present, while there are more than 380 formal open dumps, that can themselves be significant sources of groundwater leachate, methane gas, smoke and vermin/pests (UNSDC, 1997).

Specifically, Indonesian MSW problems sprang from basic urban social, spatial and economic structures that lead to the failure of planners and managers. Its characteristics, such as labourers and limited land availability, leads to a needs of a system that carefully builds on these indigenous strengths and avoids expensive, inappropriate as well as imported ideas and technologies that are not in line with the basic social characteristics¹ (Sicular, 1992:118). Other aspects that hinder the effectiveness of the solid waste management programme in Indonesia include the subsidized price of fertilizer. This has been an integral part of the Indonesian government's policy: to boost crop production. This policy, along with government-sponsored rural credit schemes, extension programmes and the introduction of improved crop varieties and infrastructure development, have all constituted to the significant increases in food crop production, as well as significant effects on rural income levels in Indonesia. Further, it has made the nation self-sufficient in rice and major food crops, like maize and cassava) in the eighties (O'Brien, 1989:42).

Increased fertilizer consumption is seen as a means to achieving the primary objective of increased crop production as can be illustrated in the following figure:

¹ Western paradigms for SMW usually involve a high capital cost based on disposal. But locating and purchasing land for transfer depots is difficult and expensive to apply in

Figure 4.1. Fertilizer and Crop Yield



Source: O'Brien, 1989:42.

The price of the fertilizer subsidy is aimed at achieving rice self-sufficiency, since rice is the most important staple food for most Indonesians. It has two common features: (i) the fertilizer's price is guaranteed throughout the country, regardless of the level of development or economic condition of the areas and (ii) similar prices for fertilizer on a per kg basis for all types distributed by the government (Rasahan and Kasryno, 1989:30-31). The fertilizer distributed, however, was mostly a chemical one, therefore, the subsidy money went to both fertilizer importers and foreign chemical companies from which the Indonesian-based fertilizer companies bought the materials and substances needed for the production. The poor farmers, although they do not have to pay handsomely for fertilizers, may have to pay for the soil degradation and destruction in the end.

Compost, therefore, is seen as an option, both the garden and manure types, especially, when, even in a remote area compost can be produced. Moreover, since it does not need a large space to process the waste, city inhabitants, even in densely populated urban areas, can also make their own compost. Small-scale composting enterprises, that include informal sectors like scavenger practices and community-based waste collection, therefore,

Indonesia due to the density and scarcity of land available (Sicular, 1992:18).

were thought of as the best solution for urban solid waste management problems.

Another consideration for composting is because it is one of the methods of waste treatment widely used in Indonesia beside the material recovery and pyrolysis (using an incinerator) process. Pyrolysis is applied only in some big cities, like Jakarta and Surabaya, due to budgetary limitations. Further, composting is the preferred treatment method for many types of organic waste, from both ecological and economical standpoints. The most common raw materials for composting are municipal solid waste, sewage sludge, waste from timber and food processing industries and animal excretion (Raviv, 1997:225).

4.1.2. Solid Waste Management Issues in Jakarta

Via the Urban Development Programmes, the Indonesian government has tried to enforce the delivery of basic urban services. Urban development programmes have been applied in most of the growing cities, and Jakarta was the first on the list. The municipality of Jakarta, like the others in Indonesia, managed urban solid waste under a special institution, the Sanitation Agency. The efforts so far have been relatively limited to disposal of solid waste by the use of sanitary landfill. Incineration has been applied, as an alternative solution, in some areas. The cost of this method, however, is huge compared to sanitary landfill thus making it a non-practical solution.

Waste collection in Jakarta is mostly based on door-to-door collection. As mentioned above, this is not adequate in terms of the collection coverage and transportation process to a final disposal site. The lower income community areas are usually not provided with the same level of services as those who live in the middle to high-income community areas. The reason is mostly because the municipal government does have budgetary limitations to spend on solid waste management, therefore, they cannot cover every area. The service is usually more directed to those who pay their waste retribution, which in most cases, are those who are relatively wealthy. Further the service

delivery if any, may be hampered by the relative inaccessibility of many homes due to poor roads and narrow pedestrian paths in poorer areas (Sicular, 1992).

In general, the levels of basic urban services, including solid waste management, in Indonesia are very low and Jakarta is no exception. Its municipal solid waste production is growing and the municipal capacity is very limited. In 1978, only 34% of Kotamadya/wilayah residents, and 15% of non Kotamadya urban residents, received formal solid waste management services and this number did not significantly increase with time (World Bank, 1984:vol.1:table2.12). On the other hand, the amount of solid waste that never (or slowly and irregularly) leaves the LPS (only about one third of solid waste collected each day) has been increased (JICA, 1987:32f). Only about 80 % of total solid waste production (24,000 m³ or around 6000 tonnes per day) was handled and around 4,000-5,000 m³ (1000-1250 tonnes) of it is thrown in the river (Shafik, 2000). Further, in neighbourhoods that are composed almost entirely of poor residents, very little waste fee revenue can be collected, and the level of service particularly bad. Not only is this inequitable, but it exacerbates the health problems that are most worrisome in just these highly congested areas. Moreover, the situation becomes unstable as the quality of the solid waste collection deteriorates due to the less and less payment collected (Porter, 1996).

The Dinas Kebersihan (DK, the Municipal Sanitation Department), like the other cities, has a responsibility to keep the city clean. This includes, the management of street sweeping, waste collection and transfer. Transferring here means movement of solid waste from the small LPS to the landfill site. Much of the cost for this transfer activity is covered by solid waste fees paid at local level. Nevertheless, very little (around 1%) of these fees, reaches the municipal agency, or is actually used to fund these activities. When the waste is collected by the community itself, fees are low and 'little reaches city coffers' (Watt et.al.1991:8) whereas, when the waste, and the fees, are collected by the DK, its door-to-door collection technique suffers

serious shortcomings: they only have a few part-time collectors who lack incentives, and the fact that the money they collect has to pass through the hands of at least six agencies and the DK does not automatically retain the revenues (Cervero, 1991:1 and JICA, 1987:55). As a result, waste disposal at this stage is paid for from the City's general fund (Porter, 1996:72-73). This also means that the DK (as the one and only authorized agency in Jakarta's Municipal system to deal with the solid waste management, especially the waste transfer responsibility) is not well funded. Some areas especially the squatters' areas, as a consequence, do not receive adequate service from the agency and must deal with their daily production of solid waste themselves.

For those areas not fully covered by municipal services, the typical system applied is one of division of responsibility among the municipality, the neighbourhood associations –the Rukun Warga (RW) and Rukun Tetangga (RT)² and the householder (Sicular, 1992:114). The householders are responsible for placing their waste in containers (that they provide themselves) while the RT/RW is responsible for collection of household waste and transfers it to the LPS. The Sanitation Department is then responsible for collecting solid waste from commercial districts, such as markets, industrial areas and temporary dumping sites, and from here haul them to the final disposal site (Sicular, 1992:114-115). “This system, in general, is labour intensive, decentralized and wholly inadequate to cope with the removal, and the amount of, refuse that is generated everyday. It does, however, have advantages in its flexibility, and the relatively inexpensive cost to the municipality since it does not have to deal with residential collection, which is the most labour intensive and costly phase of solid waste management. Moreover, this system employs large numbers of workers and encourages scavengers' activities in the process” (Sicular, 1992:115).

Another problem associated with the MSW management is that too many ministries and institutions are involved under the current system. As

² RW (harmonious citizenry) and RT (harmonious neighbourhood) are the lowest level administrative units in Indonesian cities

mentioned above, the municipal sanitation agency receives funding from central government, which has also set national goals and policies in place, but no single ministry or institution is actually charged with the SWM goals and policy development and implementation (Sicular,1992:116). Policy development is divided among several ministries, such as Home Affairs Ministry, which has responsibility for management aspects, the agency for the Study and Application of Technology, which is responsible for research and development, policy recommendations, as well as support pilot projects together with the Ministry of Population and Environment (World Bank, 1984, vol2: Table III: 1-3).

In short, there are three main issues related to solid waste handling in Jakarta.

Firstly, the level of handled solid waste is relatively low, more specific and the main problem is at the household/neighbourhood level. According to Porter (1996), the policy of making the first stage of solid waste collection a neighbourhood responsibility makes very good economic sense because it is better to treat solid waste when it is closer to the household as they benefit greatly from having their own waste removed from their immediate vicinity provided that they are willing to pay for this removal, otherwise the service is readily terminated if they do not. The other reason is because of the heterogeneous income levels of Jakarta's residents no one is better situated to find the proper level of solid waste fees than the local community and its leader.

Secondly, the capacity of landfill is constrained and there is a serious problem of sanitary landfill situated close to settlements. The existing landfill is also about to reach its maximum capacity in the near future (Field Research, May 2000, Jakarta).

Thirdly, There are problems related to financial constraints. Up until now, the government subsidy on solid waste handling has exceeded the existing user fees. Facing financial constraints, the pricing of solid waste disposal should be studied further.

Concerning the basic problems, there are three main objectives in term of improving solid waste management in Jakarta, including the improvement of solid waste coverage, reducing dependence on landfill and reducing government subsidy and increasing fees collected from households (Porter, 1996).

As the problems do not occur separately, for example, the need for new sanitary landfill is closely related to the management of solid waste production, and the solid waste coverage may still not be applied in poorer areas whose inhabitants cannot really afford to pay. If an improvement in handling solid waste can reduce dependence on landfill, which means it will help extend the lifetime of the landfill, then this will help reduce the government expense since landfill provision is still one of the most expensive components in solid waste handling in Jakarta besides the solid waste transfers (Porter, 1996). Moreover, since lack of funding is one of the many problems, the inclusion of informal sectors, as well as private enterprises, could be significant, for they can collect solid waste from their own neighbourhoods, and send it to the TPS. Further, they can contribute more to the solid waste recycling and reuse process in the form of waste screening, reusing activities and composting.

4.2. The Composting Schemes Potentials for SWM in Jakarta

Many Indonesian municipalities, including Jakarta, have attempted to reform their solid waste management systems, through several different types of collection, transfer as well as haul and disposal method experiments using a variety of funding and planning strategies (Sicular, 1992:113). Yet, these did not help them to find an effective long-term solution to their garbage crises.

One of the biggest problems created by the growing population in Jakarta is the collection and disposal of waste. In 1995, there were 25,715 cubic metres of waste per day that contained 73.92% organic material and 26.08% of non-organic materials but Dinas Kebersihan (the Municipal

Sanitation Agency), had only managed to collect 21 m³ of waste or roughly 34% of total waste produced everyday (Dinas Kebersihan, 1996:1).

Other aspects also essential to the service provision effectiveness, such as budgetary limitations on solid waste management, lack of awareness of the importance of dealing properly with waste, including separation and other temporary waste processing, such as recycling, composting and reuse.

To address the waste problem, government agencies, international development organizations and some NGOs (especially CPIS) have also been involved in raising awareness and advocacy of the benefits people can get from composting the process. They also acted as intermediaries between the grassroots initiatives like 'recycling centres' and municipal governments. Simultaneously, it served the ideological, political or altruistic interests of international organizations, as these donors have been looking at composting projects as one of the ways to minimize and reuse the solid waste in big cities, especially Jakarta. Composting was seen as likely to play a critical role in achieving the 40-60% waste reduction goals (Perla, 1997), mostly because there should not be any problems with organic waste as the resources since the organic component of municipal solid waste in Jakarta is estimated to be as high as 75 percent. Other favourable reasons to opt for compost are that it is a relatively easy method to apply, its end product can serve as a soil amendment, having beneficial physical, chemical and biological effects on the soil and on crops and it may be used effectively for the reclamation of infertile soils such as calcareous, dispersed and impoverished soils (Raviv, 1997:225).

Composting is not something new to the Indonesian community since during the pre-industrial period, composting was an informal community level method of disposing and reusing organic waste. It was, however, abandoned in the wake of development and economic growth that began in the 1960s and the use of a locally-produced compost was replaced by chemical fertilizers. The increasing use of compost would provide more benefits to the soils, farmers and the government in the end. Nevertheless, the combination of

compost with sufficient fertilizers will have more benefits towards crop yields since fertilizers can provide other essential minerals, such as Kalium and Sulphur which compost has in relatively small percentage (Sikora and Enkiri, 2000).

Some Indonesian researchers have also been studying the use of composting techniques in solid waste management. In Yogyakarta (Central Java), composting research is using microbes to decay the organic waste. From an area of 850 m², production of compost reached 1,75 tonnes per day. The compost was sold to farmers, individuals as well as government agencies, and the profits from this were 100 % higher than operating costs. This technology is easy and suitable for development all over Indonesia (Shafik, 2000).

Further, composting has other benefits as follows:

- (i) complement the existing garbage collection system by processing the waste within the community;
- (ii) create jobs within the community;
- (iii) enhance a community's greening campaign in promoting recycling and reuse of waste;
- (iv) composting activity can also generate a supplemental income that is needed especially for low-income families in Indonesia, where the official minimum wage is 3,000 to 4,000 Rupiah (US\$1.32 to \$1.76 in 1996/1997) per day (Perla, 1997 p.51).

The benefits of composting make it increasingly popular as one of the ways to cope with solid waste problems. Mostly it is because the methods used in composting are relatively easy and inexpensive that people can do composting themselves. Moreover it does not need much space that it can be done by households in relatively dense areas.

4.3. Composting Trends in Jakarta

Indonesian municipal, and agro-industrial, waste streams are high in organic content. In Jakarta, and other major cities such as Bandung and Surabaya, the average organic fraction of MSW was 72% in 1995 (Wahyono and Sahwandeli, 1998:64). In these cities MSW is generally handled through transfer stations on its way to the final disposal sites, however, the growing population in these cities has created more problems for municipal governments, such as how to dispose of waste and decrease, or even eliminate, problems created by it. The SA, in its report, however, noted only the Jakarta trend of solid waste composition as shown on table 3.2. below:

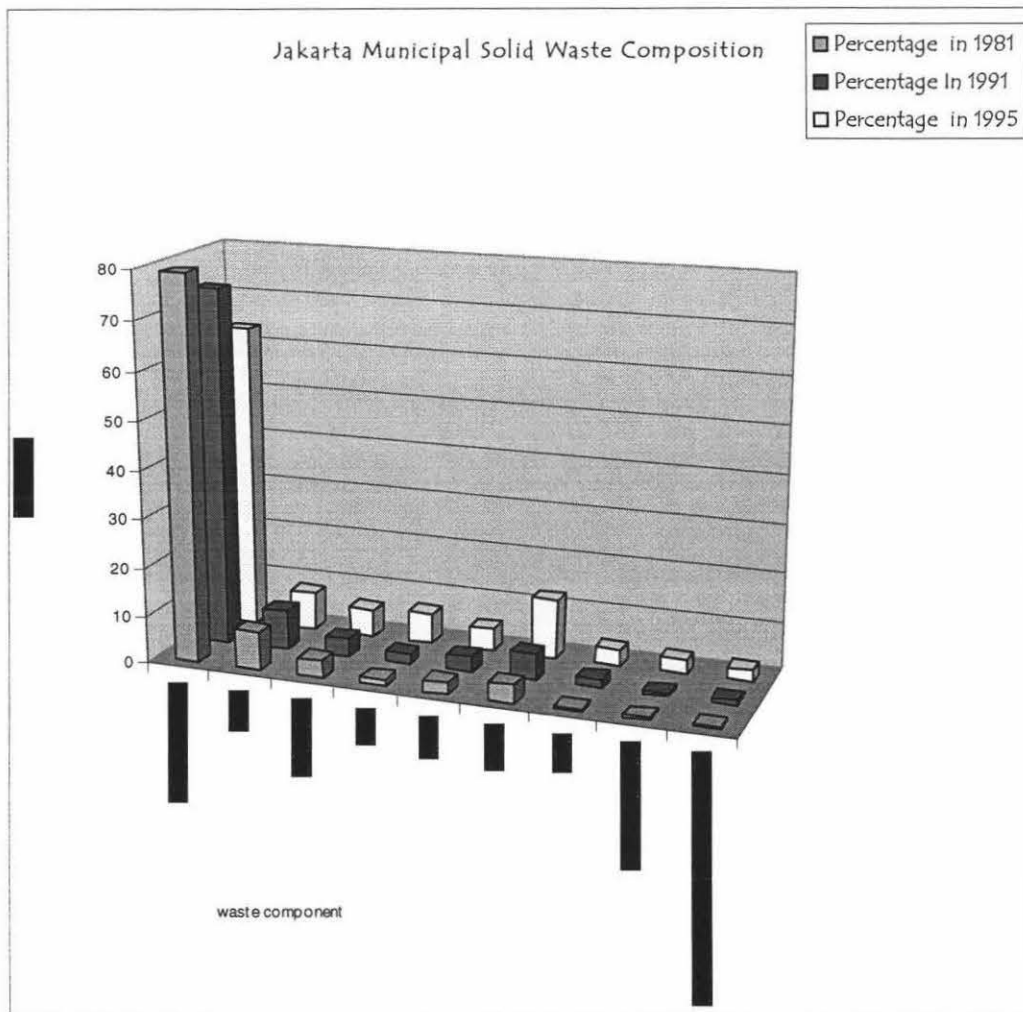
Table 4.3. Jakarta Municipal Solid Waste Composition

No.	Waste component	Percentage in 1981	Percentage In 1991	Percentage in 1995
1	organic materials	79.49	73.99	63.479
2	paper	7.97	8.28	7.83
3	wood/yard	3.65	3.77	5.776
4	metal	1.37	2.08	6.39
5	textile	2.4	3.16	4.79
6	Plastic	3.67	5.44	12.335
7	Glass	0.5	1.77	3.45
8	rubber and leather	0.47	0.56	2.90
9	others (stone, soil, sand, bones etc)	0.48	0.95	2.35
	Total	100	100	100

(Source: Dinas Kebersihan, Laporan Tahunan 1997).

Simultaneously, the Jakarta municipal solid waste component trend comparison is illustrated by figure 4.2. below:

Figure. 4.2. Comparison of the Jakarta Municipal Solid Waste Composition



Source: Dinas Kebersihan, 1997

From the table and figure above, we can see that there is a changing in people's consumption patterns. The organic waste slightly decreased as more plastic, glass, metal, rubber and leather were thrown into waste stream. This might relate to the demand of a more 'modern' Indonesians' lifestyles that includes the consumption of disposable goods and/or other convenient non recyclable materials, such as plastic-based goods.

In 1993, as noted by the sanitation agency, Jakarta's households generated about 5,000 tons of solid waste per day and the number increases every year. In 1997 it produced 14,000 m³ (5,600 tonnes) per day (Mockler, 1998:6).

Generally, the waste follows two primary pathways:

1. A formal system under which garbage is either hauled directly to landfills (about 40 km from the city centre), or is first collected at intermediate transfer points in the city (LPS) and transported later to landfills;
2. An informal system: recycling process by wastepickers/scavengers who collect metal, paper, plastic etc at LPS, households or markets and at the landfill (CPIS vol1, 1993:5).

As mentioned above, all activities related to waste management (that have or will be done), should be in favour of the creation of sustainable livelihoods that are based on a web of functional interrelationships in which every member of the system is needed and is able to participate. Further, it should also utilize appropriate technology that is ecologically fitting, socially just and humane, and that will enhance rather than displace community knowledge and skills. The concept of a livelihood here is defined as a means of living, or supporting life, and meeting individual and community needs (NARCSL, 1995:1).

These principles are part of a holistic set of values that are: non-exploitative, promote participation in decision making, emphasize the quality and creative nature of work, place needs over wants and foster healthy, mutually beneficial relationships amongst people, and between people and their environment. Therefore, waste minimisation, through recycling and composting activities, offers an obvious answer to the escalating expenses associated with disposal of waste in modern landfills (Warmer, 1994).

As the sanitary landfills require maintenance, proper planning, design and operation in order to avoid the unexpected that may mean a high cost to the municipal government (Warmer, 1995), and the waste reduction is most effective when it is done at the source, and is supported by consumers either by purchasing products that do not contribute to solid waste problems (pre-cycling) or by choosing waste minimisation services or products (Powelson

and Powelson, 1992), composting has been seen as one of the ways to solve the municipal waste problem. It is viewed as an environmentally sound method which is supportive of the sustainable livelihood concept when it is applied together with the waste reduction, recycling and reuse schemes. Moreover, it can also lower reliance on incineration that can produce smoke and other gases that can be dangerous to human health (CPIS-vol.1. 1993:19-20). Recycling-composting schemes, however, are also prone to problems as they can be expensive and that some waste cannot be recycled because separating useful material from waste is relatively difficult and time consuming (<http://www.soc.titech.ac.jp/uem/waste/disposal.html>). Further, there is also an extra cost for eliminating contaminants that could reduce the quality of finished compost, such as metals and plastic-based materials. Attempts to initiate a source separation programme have been unsuccessful because of the both households and industries' reluctance to separate recyclable materials as well as limited vehicle capacity for transporting the materials (Wahyono and Sahwandeli, 1998:64).

Even with all these difficulties, composting facilities are expanding and more waste management officials are seeing composting as an integral part of their overall waste management strategy. The production of compost from municipal solid waste is an excellent environmental and economic response to increasing waste management problems.

From an agricultural perspective, it is indeed a highly desirable aspect since compost can provide nutrients and organic matters for the soil and reduce soil erosion³. Other beneficial uses of compost include urban parks and gardens, golf courses, horticultural, landscaping, shrimp farming, rehabilitation of poor soils and even for export. Therefore it is important to produce high quality compost and not create any other environmental problems, especially because the 'know-how' exists and high quality compost

³ Java alone loses over 7 million tons of topsoil every year with an associated cost of US\$ 400 million (Margrath and Arens, 1989).

production would not increase costs in general (Urban Development Sector Unit, 1997:1).

In the late 1980s, the CPIS has conducted research on composting and developed a model for community-based composting, which was then implemented in Jakarta in the early 1990s in cooperation with the Municipal Sanitation Agency and the World Bank.

This small-scale composting enterprises scheme had its own benefits: it is a relatively low cost project that involves the local communities, especially those of a lower level income group who live in poor, densely populated areas and further encourages them to gain profits by running these enterprises and marketing the product themselves. This scheme also lowers the cost that has to be borne by the municipal government in terms of collecting and transferring waste costs. This scheme was considered as one of the best ways to cope with solid waste problems since it allows people to participate, it cuts the costs on waste collection (people have to pay more for the services if they want more waste to be transported to the dumping sites), it minimizes the waste transported to the landfill site, it produces recycled materials that are marketable and it is financially benefits the people involved.

In most cases, members of local communities have been asked to run a composting enterprise in their neighbourhoods, given the initial funding and assisted in marketing their product. Being aware that waste was one of their biggest problems, and the fact that they need family income, they have agreed to do it. They created their own scheme for collection of solid waste in their areas; scavengers do the first screening of the waste by separating the recyclable materials from the compostable ones; the local community, or small private efforts, utilized to transfer the remaining non-compostable waste to the LPS before it is picked up by the municipal servicemen to be landfilled (Mockler, 1998). Education and training have also been conducted simultaneously: training in separating recyclables (paper, plastic and aluminum) and in setting up household backyard worm and bin composting as well as how to promote recycling and composting within the community

Furthermore, the sustainability of composting (as a soil conservation) and its efficiency (as optimally only 10-20% of input will be rejected), would make it worthwhile for municipalities to find solutions to the minor impediments of composting in order to make it more efficient and applicable to local communities. (Perla, 1997).

Further, this scheme has also allowed more private and community sector participation in waste management, although their involvement is not in itself a prior goal of solid waste policy. It is rather a means of achieving the general improvement of waste management systems operating, or being planned, in developing countries. Private and informal sector participation in waste management systems has contributed to making the system more responsive, more efficient, more economical, more equitable or more environmentally responsible even (Klundert and Lardinois, 1995:7).

In Jakarta itself, the benefits of the informal sector is approximately US\$48.5 million per year from the solid waste recycling programme, compared with the US\$ 0.5 million paid in garbage collection fees. In 1988, daily waste production was more than 21,000 m³, 25% of which was recovered by an estimated 37,000 scavengers. These activities save the city US\$270,000-US\$ 300,000 per month from the collection and separation costs (Oepen, 1993). In 1995, at least 78 factories used material that had been recovered from waste in their plastic, paper, glass and metal production processes. The recycling rates for glass and paper are as high as 60-80%. The waste paper collected by scavengers comprises 90% of the secondary raw material in this sector. In delivering 378,000 tonnes of waste paper per year to paper factories for recycling they save six million trees from being cut down (Oepen, 1993).

Given the importance of the informal sectors' activities within the Jakarta solid waste management, the composting schemes, therefore, involved their active participation in the process. But, first we are going to look further of what are and how scavengers conduct their activities.

4.4. Scavenging as an integral part of the project

"Scavenging is the basis of recycling in the Third World" (Goff, 1995:213). The word 'scavenger' has several contemporary meanings, it refers to garbage collectors, junkmen, chemical agents that neutralize or remove undesired substances and habitual consumers of refuse or carrion (Sicular, 1992:16). In this study, the term is used to mean garbage collectors or junkmen.

In Indonesia, the practice of scavenging exists due to three conditions: a market for secondary materials recovered from refuse; the existence of wastes of sufficient quantity and quality to meet industrial demand; and the presence of people who are willing or compelled to do work that is poorly paid, hazardous and low status (Sicular, 1992:43). The first condition has been boosted by the industrial growth, the profusion of small-scale manufacturing enterprises utilizing recovered materials and by the government-allocated monopolies that made the price of basic virgin materials artificially high (Sicular, 1992:43). The second one has been met by the consumption habits of the urban middle and upper classes that more and more resembles those in the developed world. This has led to an increasing quantity and variety of paper, metals, plastics, glass and post consumer goods in the waste stream (Sicular, 1992:43-44). As for the third condition, the rapid social change caused by economic development has displaced a pool of people, especially those associated with agriculture. Most of them ended up in cities, willing to do any kind of work that they can find to be able to support themselves (Sicular, 1992:44).

Jakarta, in general, has an extensive recycling system, due to the scavengers' existence. No sooner has solid waste left the household than it begins to be pored over by scavengers, seeking a living through collection of discarded items that have a value in recycling or re-use. There are some 10.000-40.000 scavengers in Jakarta (CPIS, 1988:V-4). The range in estimates is large because of the nature of the occupation and also because scavengers are considered urban undesirables and are continually subject to

police harassment, as well as liable to compulsory job retraining, exile from the city or transmigration (Porter, 1996:70).

In general, these scavengers constitute poor and vulnerable segments of the population who face multiple problems. Due to their daily contact with garbage, they are usually associated with dirt, disease and squalor, and are perceived as a nuisance, a symbol of backwardness or even as criminals. They are subject to a scavenging elimination policies through bans enacted by the local municipalities. These were supposed to 'force' the scavengers to find alternate employment. It was not until 1987 that they were freed from official impediments to their work (Porter, 1996:70) when the government finally conducted a comparison of costs and benefits of waste pickers, and because there is an increasing demand for recyclable materials in Indonesia, especially in Jakarta, by industry, as a result of the increasingly popular, environmentally sound economic and industrial code of conducts. Industries that consume recyclables encourage, and support, the existence of middlemen or waste dealers ("Lapaks" and "Bandars" in Indonesia⁴) and not from individual scavengers, in order to assure an adequate volume and quality of the materials (Medina, 1998:70-71).

Scavengers have fairly good incomes for their skill levels, US \$25-125 per month in 1988 (or US\$ 5-25 at present), this typically exceeds the average wages of unskilled workers in Jakarta such as, the street sweepers or even janitors (US\$ 15-25 in 1988) (Sicular, 1992)

With them in the waste management system, 7-20% of Jakarta's solid waste can be removed from the stream, and put back into the private, profitable productive process. Currently, there are a dozen factories in the Jakarta area recycling some 200,000 tonnes of waste paper per year; another half-dozen factories processing some 500,000 tonnes of scrap iron per year; and various processors of non-iron metals, plastics, glass, rubber and textiles. Not all inputs come from Jakarta, which adds a final layer of complexity to

⁴ The 'lapaks' usually sell their different streams of recyclables to brokers or specialized middlemen known as 'bandars' who purchase particular materials from the lapaks and

the recycling story. Some of the recyclable solid waste is imported. Some imports of solid waste materials are banned, but others enter with a modest 10% duty (Porter, 1996:71). Thus, it is significant to include them in the municipal solid waste management scheme.

4.5. Jakarta's Composting Scheme

As the result of this new interest in composting, some projects were already up and running, started in the early 1990s. Most of them were community-based activities, part of the projects initiated by the World Bank and the Jakarta Municipal Sanitation Agency (Dinas Kebersihan -DK) together with the Centre of Policy Implementation Studies (CPIS).

The Jakarta's context of small-scale composting enterprise schemes shows that solid waste management is closely related to other aspects of its residents' lives, such as their living standards and their education. The municipal government's budget constraint is also one of the reasons why solid waste is increasingly become problematic and therefore, why composting is such an important alternative to improve the provision of solid waste services.

In the composting project that has been studied, the municipal government of Jakarta, along with the World Bank and the CPIS were willing to engage in a partnership and implement it. Their partnership was structured to ensure that important participants and aspects of existing solid waste management systems are not ignored in the planning process. The CPIS and the World Bank played a significant role during the planning and initial stage implementation. They helped involve the local community, in various areas, to work together on the project, and provided the training for them in order to arm them with the skills they needed to run small-scale composting enterprises on their own. The following chapter will discuss more of these initiatives.

transport and resell them to factories where they are recycled (Simpson, 1993:78).

CHAPTER V

The Enterprises for Recycling and Compost Production Initiatives In Jakarta

5.1. Background

In the 1992/1993 fiscal year, the Municipal Sanitation Agency, together with the Centre for Policy Implementation Studies (an NGO based in Jakarta) and supported by the World Bank, initiated a community-based composting project in various parts of Jakarta. Initially, an advisory team from Harvard University's Institute for International Development (HIID), and research staff from Indonesia's Centre for Policy and Implementation Studies (CPIS) explored the technical and economic viability of small-scale operations for the composting of municipal solid waste. This research involved the cooperative efforts of experts in solid waste management, social anthropology and urban planning. In this manner, improved methods for the recycling and processing of MSW, introduced into Jakarta. The first phase of this project was to develop an urban composting process that had rapid output and could fit on a constrained site. It had to utilize indigenous materials, was labour intensive, could operate in a densely, urbanized environment with a minimum of nuisance conditions, such as bad odour or not un-aesthetic view of the site and would result in a high quality soil amendment product. An experimental station was established in November, 1989. The process applied in the station, not only had to work technically, but also economically, since this project was seen to be able to:

- (1) develop a composting technique best suited to Jakarta's conditions (in terms of its waste streams, climate and labour surplus economy);
- (2) study the cost of producing compost with the technique developed;

- (3) develop a training methodology for future compost workers and managers;
- (4) investigate the economic uses of compost and the nature and potential size of the compost market (Simpson, 1993:78-79).

By late 1990's, the preliminary technical and financial results emerging from the experimental station were sufficiently encouraging to justify the establishment of the Unit Daur Ulang Produksi Kompos (UDPK), or Enterprises for Recycling and Compost Production (ERCPs), operated by private entrepreneurs (existing *lapak* - 'recycling centres' operations). The preparation phase then began.

5.2. Enterprises for Recycling and Compost Production: the preparation phases

ERCPs were seen as being well-suited to Jakarta's waste stream, climate and economic conditions (CPIS –vol.1,1993:25) since they were designed to be an economically efficient and environmentally beneficial component of an urban waste management system. Further, they serve two functions as as a recycling and sale centre of economically valuable waste materials (metal, paper, plastic, glass etc) and as a centre for production and sale of compost made from the non-recyclable organic component of municipal solid waste (CPIS –vol.1,1993:2).

In short, the ERCPs establishment was deemed as advantageous as it captures value from waste (recyclables to be resold and compostables to be composted) and serves as an example of appropriate technology for labour surplus economies. Its establishment also provides environmental benefits¹,

¹ both through the use of the method for environmentally sound waste management and by encouraging the use of compost, which provides a variety of benefits to the soil (CPIS vol1, 1993:3)

reduces the need for synthetic/chemical fertilizer, as well as helps to ease the municipal government's burden through avoided waste disposal costs (CPIS - vol.1, 1993:3). In addition, the compost production would provide another revenue for the poor, and employ additional informal sectors. According to the preliminary reports, the project demonstrated that high quality compost could be positively produced by private enterprises at a relatively low cost (Simpson, 1993:79).

In the first phase of the establishment, the CPIS conducted a workshop and training for the potential composting entrepreneurs. The course provided the various materials necessary to make compost both theoretically and in practice. It also helped with the understanding of the problems, and how to solve them, which may occur during compost production. In short it covered subjects related to how to run an ERCP and how to understand compost marketing's strategies (CPIS, 1990:1). The compost marketing component covered wide range of issues, including the benefits of compost, current markets for organic fertilizer in Jakarta and the Greater Jakarta, market characteristics and needs, the right type of promotion, the role of distribution and product development, and also constraints and opportunities for compost marketing (CPIS, 1991:6). The workshop was conducted over 14 days, and each participant had to pay for a vaccination, and for composting equipment such as a mask, boots, plastic gloves and a 'werkpak' (work suits) they needed for the workshop. The cost to all participants was approximately IDR.70,000. Other expenses, such as transportation to and from the workshop location, room rental and meals were borne by the World Bank along with the Municipal Government.

This course facilitated participant knowledge to develop the skills to compost, and be able to apply it, to their own enterprises. By applying these skills they could create jobs for other people, help the municipal government to deal with the urban solid waste problems and to create a better and healthier neighbourhood as well.

As for the ERCPs location, the CPIS and the World Bank used some criteria such as, not choose a site located on the edge of wetland or flood plains, choose an area where sufficient and regular deliveries of fresh wastes can be made at low cost (it means routes for delivery of garbage and pickup of the residual to be well maintained and easily accessible throughout the year) and also to avoid densely populated neighbourhoods and areas where adjacent land users may find ERCPs inappropriate -hospitals, religious building or schools (CPIS, vol.1, 1993:28).

Some enterprises were located in already established lapak sites. It was because the lapak site owners or managers were already seasoned entrepreneurs who relatively had successfully managed their employees and business, therefore, it would not be a problem for them to manage composting activities. In addition, these individuals were well acquainted with handling the waste stream, and knew what it took to successfully market materials, since they already collected, and resold recyclable materials themselves (CPIS, 1993:25). Nevertheless, the more important reason, probably, is because the owner is usually own the land, that therefore, would make it easier and cheaper for the ERCPs' establishment (CPIS, 1994:44). Another 'perfect' sites for the ERCP are the temporary dumping sites and even the final disposal site (CPIS, 1994:12). An ERCP situated in a temporary dumping site would experience a relatively easier and relatively less expensive operation in collecting solid waste to be composted.

The size of ERCPs depends on land availability, on the supplies of labour and waste, and the demand for compost. The ERCPs system is specifically designed to be flexible, in the sense that arrangements for waste delivery and site location could be made either with the local government or privately, as appropriate to the particular circumstances. ERCPs are also easily movable from one site to another and also to be complementary to other systems of waste management (Simpson, 1993:80).

Another significant point of this phase was the appointment of an administrator for the enterprises. There were three types of workers: a manager who was responsible for financial management, employees and marketing and who also had the responsibility of maintaining relations with governmental agencies, and other potential buyers, a site manager who was responsible for the composting process in order to achieve the initial production target, and also to train new workers, and composting workers who were responsible for each of the composting stages every day (CPIS, 1994:65).

A requirement for the manager was, amongst others, a high school degree or other similar level of education, managerial skills, leadership capability and entrepreneur skills. The site manager position required similar qualifications plus the age criteria of 18-45 years old, whereas for composting workers, there was no particular academic background requirement, only the willingness to work hard and that they were in relatively good health (CPIS, 1994:67-68).

During the second phase of the research, the development of pilot projects was assisted by the CPIS through the provision of partial start-up grants, technical assistance, worker training and a purchase arrangement for the compost produced: by creating a link with municipal departments. The Jakarta municipal government had also assisted the pilot projects by securing access to suitable land, and by arranging for the daily delivery of fresh garbage to the ERCPs, and the removal of non-compostable residuals and hazardous materials afterwards (Simpson, 1993:79-80). Each pilot project processed roughly three tons of raw waste per day, from which about 0.75 to 1.25 tons of compost could be produced. Between 400 and 700 square metres of land was needed for the composting process. Active composting required about 40 days, with an additional 14 days for maturing the compost. The composting technique used was simple and used relatively inexpensive materials in combination with the informal sector – scavengers, in order to make it an easily replicable process (CPIS- vol.1, 1993:3). The ERCPs composting process was started from the waste collection/reception

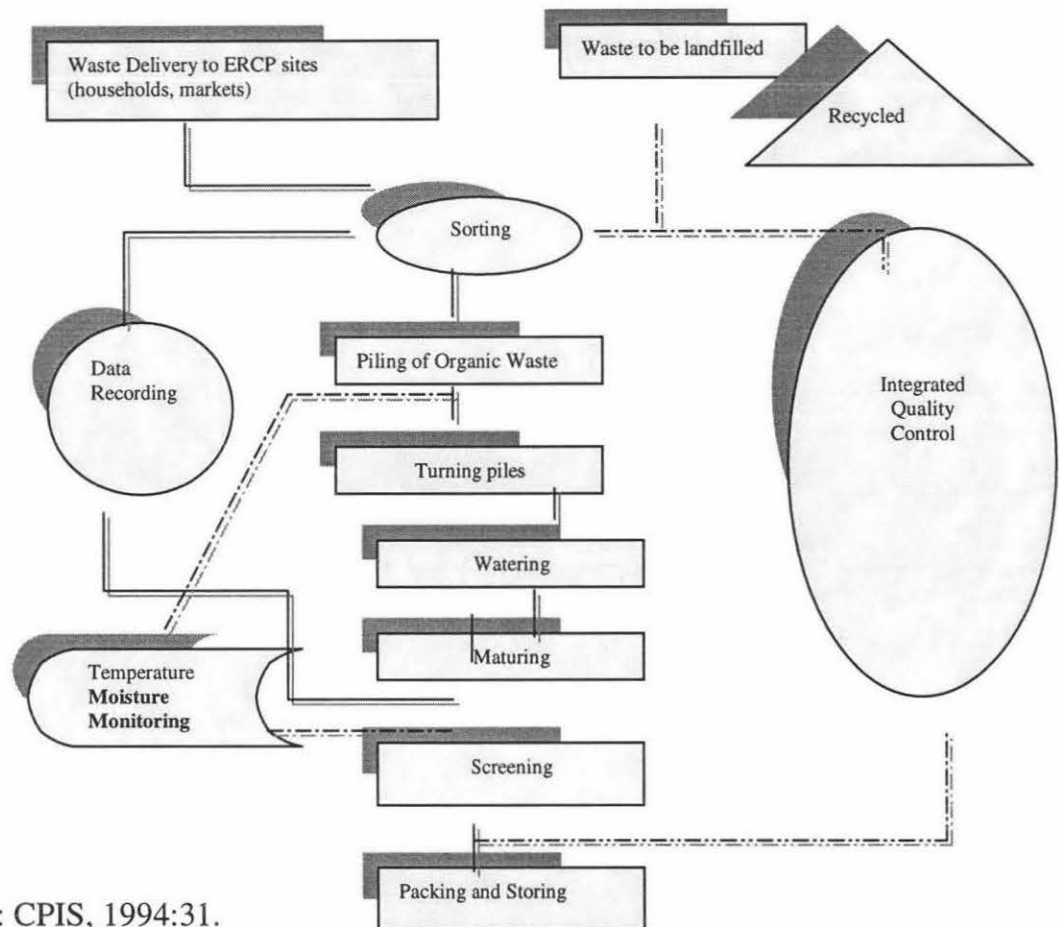
from the waste source, such as households and markets, until the packing and storing of the ready to market compost. Figure 5.1. illustrates the process.

This project involved waste pickers, often called scavengers, to help the composting process by screening out the recyclable materials from the waste collected. They collected and delivered glass, paper, cardboard, metals and wood, all the materials that they could sell. The involvement of this informal system is quite significant as it may capture anywhere from 88-98 percent of these higher valued materials, and leave primarily organic material to be composted. The challenge lies in how to adapt an approach to the constraints of a relatively capital-poor, but labour-rich country, like Indonesia, where available space in cities was already quite restrained (Simpson, 1993:78).

There were 13 small composting enterprises (Unit Daur Ulang Kompos - UDPK) in this scheme. They were spread throughout various areas of Jakarta. Three of them were studied, the UDPK in Petamburan, Central Jakarta, Cipinang Besar in East Jakarta and Kebon Melati in Central Jakarta. In addition, one privately owned (but closely linked to CPIS and the Sanitation Agency's project in terms of employees' training) composting plant in Bumi Serpong Damai Real Estate, Tangerang, Greater Jakarta was observed.

This composting scheme, however, was not intended to solve entire urban waste problems in large cities. A typical ERCP, in Jakarta, processes about three tons of raw waste per day, although larger amounts of waste can also be processed in some larger ERCPS. Further, "if Jakarta's 260 officially designated local municipal units (kelurahan) had an average of one ERCP, they could handle about 10% of the city's solid waste; if there were an average of three, then 30% of the solid waste could be handled in this way" (Simpson, 1993:80; CPIS, 1993:2).

Figure 5.1. The ERCPs Composting Process



Source: CPIS, 1994:31.

Further, some of the ERCPs were located at temporary dumping sites which means that it was incorporated into the operation of the formal solid waste management system. This arrangement might lead to public sector efficiencies, avoid transportation and landfilling costs, better operation of over-utilized temporary dumping sites and mitigation of local environmental and health problems, and by diverting wastes from final disposal sites, landfill life can be extended. The landfill life extension is, in itself, has a higher value since available land for a new landfill is a scarcity in a densely populated Jakarta (CPIS, vol.1,1993:54).

5.3. Municipal Government's Role

Initial results pointed to the fact that ERCPs could be profitable, and that government interventions could be limited, among others onto research, training, help in dissemination of the idea, in ensuring that ERCPs get their service of waste delivery and its collection afterwards and assistance in arrangement of any required permits or other legal requirements (CPIS vol.1, 1993: 3; CPIS, 1992:13). The ERCPs system was flexible in the sense that arrangements for waste delivery, and site location, could be made either with the local government or privately, as appropriate to the particular circumstances and supposed to be easily movable from one site to another (Simpson, 1993:80). This role, however, was not really limited, as the site caretakers tended to depend on the municipal government for assistance. Since the responsibility of this project was formally under Jakarta's Municipal Sanitation Agency, the municipal government's role grew bigger, especially when the CPIS and the World Bank discontinued their assistance due to the their own project time limit (Field Research, Jakarta, March-May, 2000).

5.4. ERCP's managing characteristics

The characteristics of the ERCP's approach in managing MSW were as follows:

- a) The approach was labour intensive. It relied on the informal sector workers and requires relatively little capital (the capital requirements of the ERCPs vary from about IDR. 10-20 million, depending upon the size of the enterprise)
- b) The ERCP's composting process was efficient, with continuous sale of the compost being produced from raw waste in about 52-54 days;
- c) The ERCP's applied composting technique should produce relatively high quality compost;

- d) Financial analyses prepared before the launching of the pilot project indicated that the ERCPs would be commercially profitable without government subsidy (CPIS-vol.1, 1993:26).

Further, if the demand for compost grew substantially (provided that scientific and economic information on its benefits is generated and disseminated), ERCPs could spread throughout Jakarta, and other Indonesian cities, and become an important private component of the overall system of urban waste management.

5.5. ERCPs Economic Benefits

The economic benefits from the ERCPs project can be broken down and illustrated by table 5.1.

Other benefits from the ERCPs schemes are ecological and social. Ecological benefits include the reduction of pollution due to the waste piling, thus creating a cleaner and healthier environment/neighbourhood. In addition composting preserves natural sources, such as water, soil and humus, also maintains the recycling system and makes it more effective. Furthermore, the use of compost could reduce the use of herbicides and pesticides and increase the efficiency of chemical fertilizers, it reduces water use; 'heal' the soil so that it can be productive again and increase the agricultural and shrimp/fish farming production. The social benefits included the employment opportunities and the "corporate image" for private companies that were willing to establish their own composting and recycling plants (CPIS –vol.1, 1993:6).

Table 5.1. Waste processing cost per m³

Municipal government	Large scale ERCPs
Transporting cost : IDR.7,607	With 935 kg compost production and 50 kg <i>lapak</i> materials = IDR. 8,000 (capacity of around 300 m ³ per month)
Cost of Landfill usage : IDR. 1,200	
Landfill capacity/day : 12,727 m ³ (3,500 tonnes). per m ² capacity : 12,727 (m ³) x 11 (years) x 350 (workdays) divided by 98,000 m ² (effective area) = 49 m ³ or 0.02 m ² area for per m ³ waste Cost per m ³ per day : IDR.60,000 x 0.02 m ² = IDR. 1,200 assumptions: average waste density : 275 kg/m ³ work days/year : 350 days land price per m ² : IDR. 60,000 (in 1994)	
Operational landfill cost : IDR. 4,467	
Total = IDR. 13,274	Total = IDR. 8,000

Source: CPIS, 1994:4-5.

From the table above, it shows that the landfill costs is quite high. The cost would decrease if less solid waste could be achieved due to the cost per m² of the use of the landfill area. Land availability, as well as the highly expensive price for every m² of land if the present landfill could no longer be utilized. One composting site, was projected as able to reduce the amount of waste to be landfilled by 300 m³ per month and reduce costs up to IDR. 39,555,000 per month (approximately US\$. 20,000 in 1994).

5.6. Factors Affecting the Sustainability of the ERCPs

5.6.1. General factors

Generally, the factors reported as affecting the sustainability of ERCPs can be grouped into those external to the UDPK and those internal to the organization and management of ERCPs themselves. The list below clarifies this approach.

Table 5.2. Factors affecting the ERCPs' sustainability

External Factors	Internal Factors
Sources of capital costs and waste	Management ability
Land status	Financial accountability
Interaction with community	Availability of operational funds
Support and Training	Compost quality
Interaction with Dinas Kebersihan	Work efficiency and Productivity
Market demand and competition	Marketing Efforts

Source: Mockler, 1998:19.

From the field observations for this study, the major reason for such termination was inadequate market development that has depleted UDPK operational funds and put them out of business. Other reasons for their closure were their low understanding of financial management and the non standardized compost quality that they produced (Mockler, 1998:19-20; Field Research, Jakarta, April 2000).

All these factors related to the management. When the management of the UDPK is not optimal, this affects work efficiency, which in turn affects the quality of compost, and the timing of the expected production volume. If they are late in completing a batch of compost they may run out of operational money and

have to lay off workers before they can sell their product. Additionally, payment for compost delivered is not always paid for in cash by the distributor, which makes the solvency of the UDPK understandably threatened (Mockler, 1998:20).

5.6.2. Capital Investment Costs

Capital start funds are fairly significant for a commercial UDPK unit. The financial Model used for the buildings of the ERCPs was designed for the small-scale and the large-scale enterprises, a scale defined by the waste that can be processed daily. The 1994 CPIS guidelines, estimated Rp.11.6 million for a small-scale unit and Rp.16.2 million for a large scale one. This mostly spent only for the capital costs such as building shelters, storage room and also to build the wall surrounding the site. (CPIS, 1994:27-31). Nowadays, this amount can be quadrupled due to the economic crisis in Indonesia, especially the Indonesian rupiah depreciation against the US dollar. The financial model for ERCPs is shown by figure 5.3.

5.6.3. Compost quality standard

Indonesia, according to the World Bank report (UDSU, 1997:11), can, and was, producing compost from municipal solid waste that is among the highest quality compost in the world. The metal concentration of the MSW composition was considered normal, and mostly way below the proposed United States sludge/compost standard. Further, since the outlook for composting in Indonesia is excellent, it should continue to pursue composting as a key component of an integrated waste management strategy due to its potential to address much of the growing waste management crises. A good quality compost will have other parallel benefits: by removing organic wastes from the waste stream it will allow more paper, plastic, metal and glass to be recycled and lends itself to the development of refuse derived fuel for incineration (Urban Development Sector Unit, East Asia and Pacific Region, 1997:10-11).

Table 5.3. Financial Model for Small and Large Scale ERCPs

Items	Production scale alternative	
	SMALL	LARGE
1. Total Area needed composting area	450 m ² 240 m ²	670 m ² 360 m ²
2. input of waste daily	14 m ³	20 m ³
3. number of workers (on average)	Up to 8	12
4. total production/daily - fine - grain	620 kg 227 kg 393 kg	935 kg 343 kg 592 kg
5. initial funding	IDR 19 million	IDR 25 million
6. monthly operational- funding	1.2 million	1.8 million
7. production cost (IDR/kg)	126-200	113-119

Source: CPIS, 1994:24; Mockler, 1998:9.

Good compost quality standards are of importance as well for ERCPs to be able to develop large scale markets, and to boost exports. Traditionally, compost in Indonesia is a product made from organic waste, the most commonly used method is the windrow system. However, in more recent years, microbacterial composting methods and vermiculture have also been gaining in popularity at community level. From the results it would appear that vermiculture has been a more accepted option by community groups since this method produces compost faster, and generates a viable income. The two methods involved in microbacterial composting tend to take much longer to produce

compost and this compost is mostly used for household purposes only. Although piloting of these methods has been limited, it appears from existing reports that of the three options, vermiculture has the greatest sustainability due to its income potential (Mockler, 1998:22). Nevertheless, the green waste composting using a windrow system is still popular, and has been utilized in all of the composting enterprises.

Table 5.4. Proposed standards for heavy metals in MSW derived compost in Indonesia and concentration of metals in the solid waste compost in Jakarta

Metal	Mg/kg dried matter	Average solid waste compost metal concentration	US sludge/compost standard
Arsenic (As)	10	4.5	100
Cadmium (Cd)	3	10	18
Chromium (Cr)	50	77	2000
Copper (Cu)	150	305	1200
Lead (Pb)	150	401	300
Mercury (Hg)	1	3.8	15
Zinc (Zn)	400	1013	2700

(Urban Development Sector Unit, East Asia and Pacific Region, 1997:10 and CPIS, vol1, 1993:39).

5.6.4. Compost Marketability

The marketability of compost is influenced by the chemical and physical composition of the compost, which varies considerably depending on the waste source, and whether the separation of the organics from the inorganics has been timely enough to reduce contamination. It therefore follows that compost will be of a higher quality if composted as close as possible to the source of garbage, such as the LPS (temporary dumping sites) as opposed to the LPA (final disposal site). Also, it is possible to produce at least three grades of compost that are differentiated only by the size of the particles, from super fine to medium with a comparable retail pricing structure from approximately IDR.250/kg to IDR.400/kg -IDR.190-300/kg (in 1988) from the compost producers (Mockler, 1998).

The composting project that was organized in collaboration with the CPIS had, in the mid-1990s, found a variety of solutions for the marketing of compost. The Municipal Sanitation Agency had developed collaborative agreements with other government agencies such as Dinas Pertamanan (Municipal Landscape/Parks Agency) and Dinas Pertanian (Municipal Agriculture Agency) to buy ERCPs compost, and considerable research into agricultural use was aimed at contributing to its marketability. Such interdepartmental cooperation was strengthened further by including written agreements containing a commitment to purchase specified volumes from specific ERCPs, however, it was reported that even though the commitments were formalized, they were not always fulfilled due to prior arrangements with private contractors. One report cited complaints by the Landscape Agency about the poor quality grade that sometimes did not meet the users requirements (for instance for gold courses and shrimp ponds), and high price, of ERCPs compost as possible reasons for unfulfilled quotas (Mockler, 1998).

A 1995 evaluation report stated that marketing was the most serious constraint to UDPK viability (MEIP, 1995:II-3). In 1992, CPIS developed a

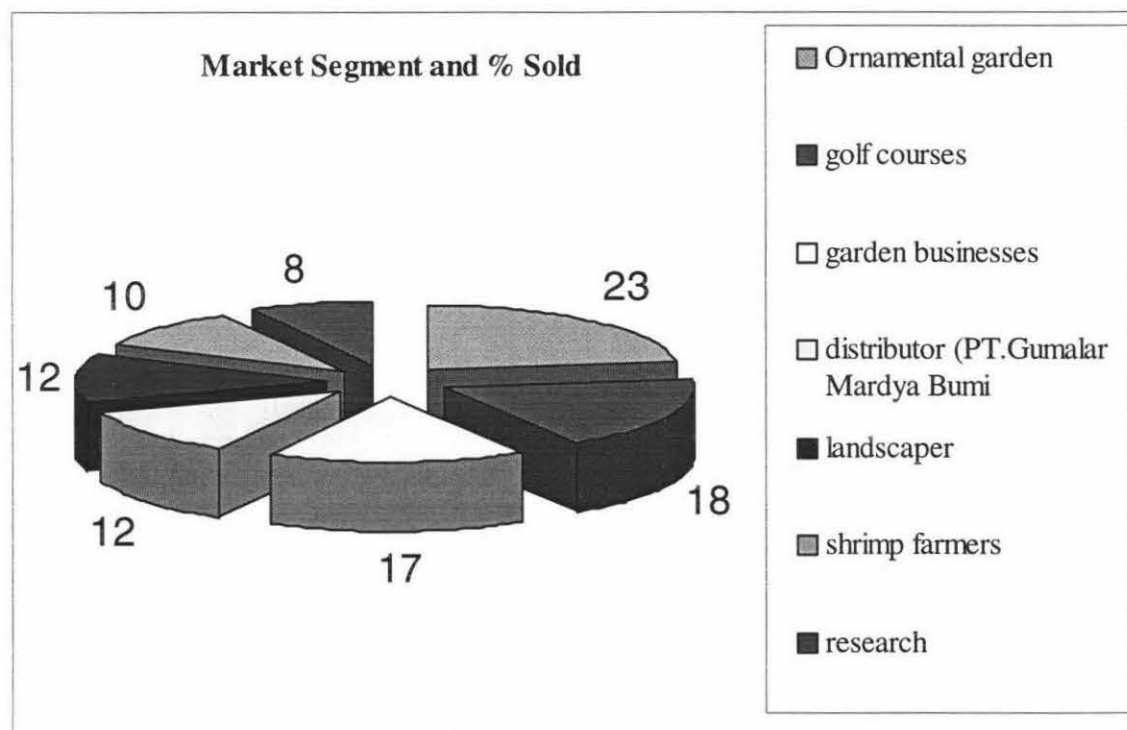
partnership between the UDPK supervisors and a distributor, PT. Gumalar Mardya Bumi. This partnership, however, was not enough. Compost was still less popular than chemical fertilizers. This, combined with low awareness of its uses and benefits, suspicions about its quality and its comparatively expensive price, provided further disincentives to purchasing compost. According to the report, the involvement of stakeholder agencies and institutions in recycling and composting was essential (Mockler, 1998:22). Through this distribution system, 80% of compost produced (Lestari Brand) could have been sold to ornamental gardens, golf courses and garden businesses. This 80%, however, was just 12% of the overall market.

This means that the compost produced by the ERCPs was not enough to fill the market, borrowing the number in 1993 as shown by the figure 5.2.

Another factor to consider is that these markets fluctuate and require constant attention to keep the amount sold constant, and its use consistent, with the users' requirements, such as golf courses and shrimp ponds. Further, the sole distributor has not been as active and supportive as was hoped and it has specified if not limited collaboration time with all the enterprises (Mockler, 1998, annex2:9).

A market segmentation analysis was conducted by the CPIS in 1993, in order to know where the compost would be marketed. It is shown in the following figure:

Figure.5.2. Market Segment for Compost in 1993



Source: Dwijayanti, Darwina, 1993.

In addition to the segments discussed above, market segments can be individual and government agencies that deal with parks and gardens, recreation and sport centres, critical area revival programmes as well as tree re-planting programmes/projects (CPIS, vol.1, 1993:76-77).

Moreover, since 40-50% of Jakarta's solid waste stream appears to be readily compostable, the growth of ERCPs might lead to a substantial reduction in the costs of collection, transfer and landfilling of the city's MSW (CPIS, vol.1, 1993:54).

The ERCP initiatives have certainly considered several options before they started. The criteria for the location, employees, compost standard quality (although it is relatively simple), employees' training and also external support in marketing the product. The failure of the initiative could be a mixture between the external, such as support from the municipal government and market

fluctuation, and internal factors, such as management capability and marketing efforts of the employees.

The following chapter, therefore, will discuss the four case studies, in a more detail, explanation, and analysis, in order to understand why the small-scale composting enterprises project failed and how they could be made to work better in the future within the broader framework of Jakarta's integrated solid waste management.

CHAPTER VI

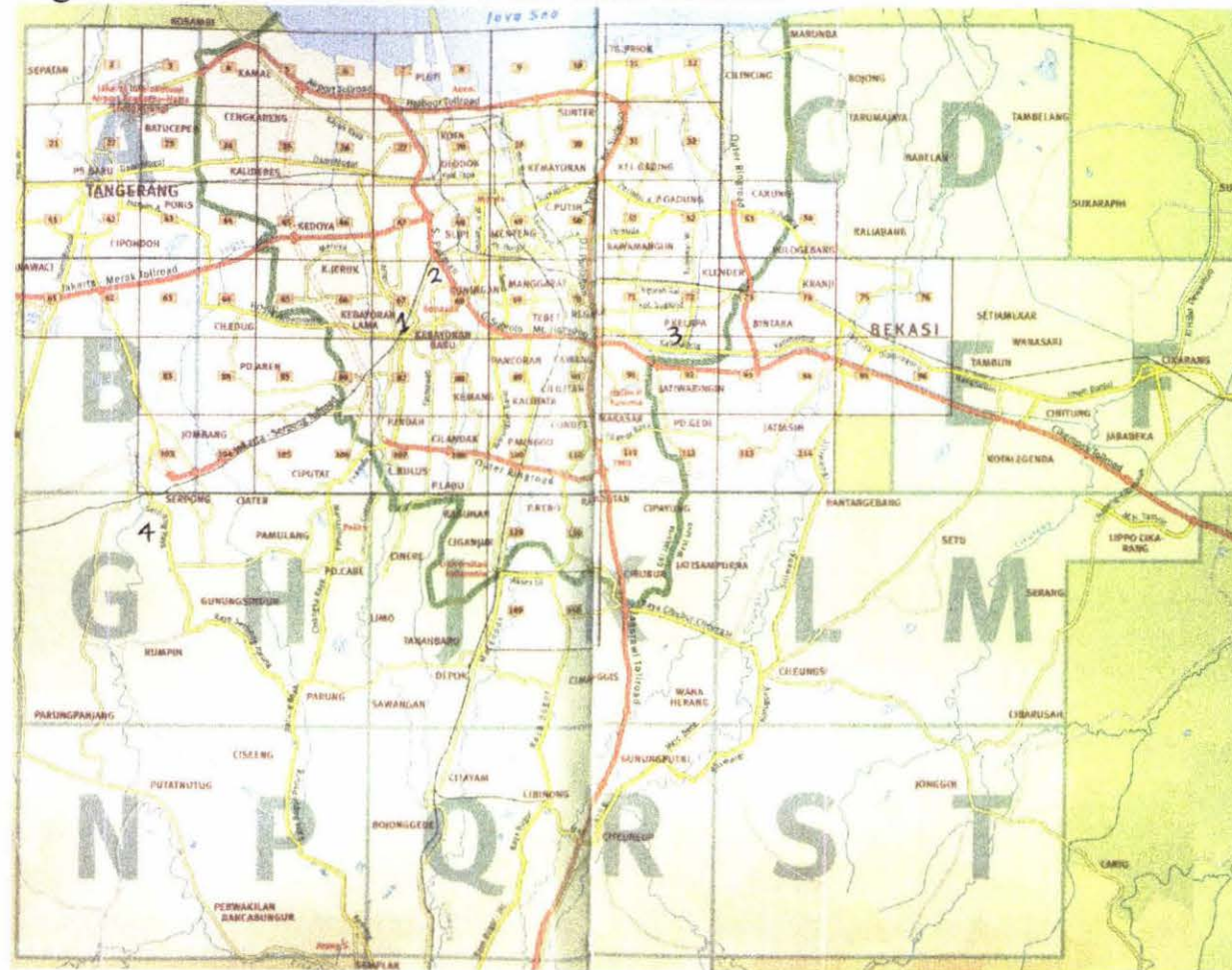
Case studies

This chapter discusses the four case studies involving small-scale composting enterprises schemes in Jakarta. In the first part, the three failed enterprises will be discussed, covering various aspects related to their composting activities in the past and also problems that led to their closure. One case study, the one that is still actively producing compost, is discussed in the second part.

This study included three different locations within the Greater Jakarta area: Central Jakarta (two projects), East Jakarta (one project) and Serpong, Greater Jakarta (one project)¹. One project in Central Jakarta (Kebon Melati) failed as a composting enterprise, but still survives as an informal recycling centre. It collects and buys recyclable materials from local areas and sells them to the lapaks of a higher hierarchy (bandars), whereas the Petamburan site still survives as the temporary dumping site for its area.

¹ Central Jakarta as stated by Sicular (1992), Central Jakarta has become a more 'industrialized' area than the other four, in terms of the type of solid waste it generates. This area generates more paper and plastic than organic waste owing to the growing development of offices and government institutions in the area. This central office development is caused by the growing desire to locate offices near the presidential palace, and other key governmental departments that are located mostly in the Central Jakarta area. This area, however, still has a relatively high organic material percentage in its waste composition. The high percentage of papers and other recyclable materials, make it more attractive for people to create small private recycling centres.

Figure 6.1 Location Of The Four Case Studies²



1. Kebon Melati 2. Petamburan 3. Cipinang Besar Utara 4. BSD

6.1 The Four Case Studies

6.1.1. The Kebon Melati, Petamburan and Cipinang Besar Utara Compost and Recycling Enterprises

These three enterprises used to be quite successful in producing relatively good quality compost. However, all three failed to survive. Despite the shortage of funding from the CPIS/World Bank and the Municipal Government, the constrained marketing research as well as promotional activities, most of the enterprises could carry on with their collecting, composting and recycling activities. The collection was carried out by local enterprises focussing on collecting household waste. The scavengers contributed to the recycling and the first waste screening activities of the composting process. These combined activities formulated a very efficient team of waste management, supported (then) by the Municipal Government and the CPIS in the marketing process. The CPIS helped them sell the compost through the one and only compost distributor, PT. Gumelar Mardya Bumi, while the Municipal Government helped them by forming an alliance with the landscape, parks and agricultural municipal agencies, to which the product was sold.

We need to examine, then, why these enterprises failed despite these forms of assistance and their high apparent potentials.

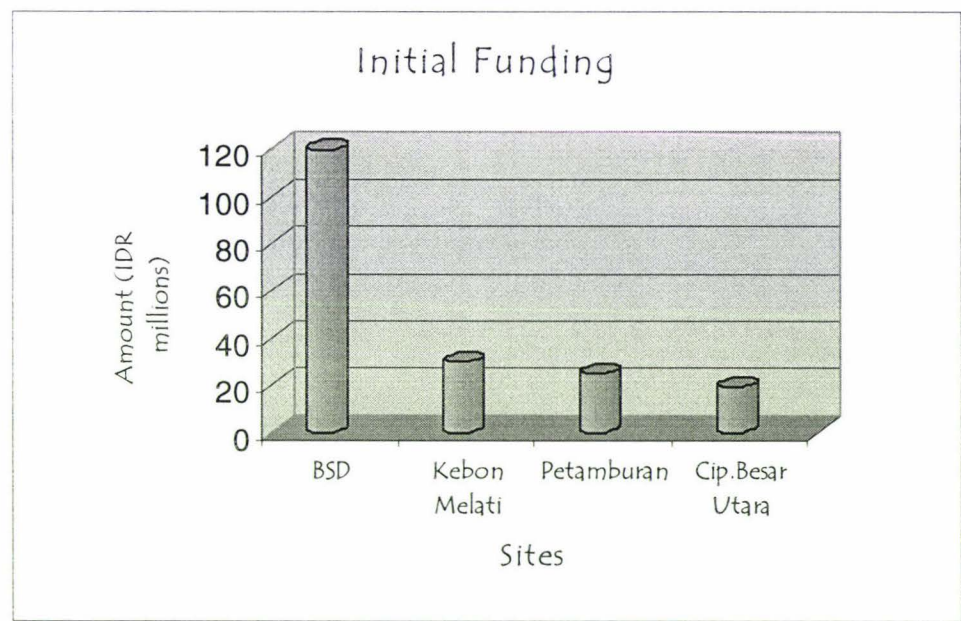
6.1.1.1. Funding

Each of the composting plants received approximately IDR.19-25 million (US\$ 2,000-2,500 in 2000), depending on their size, as their initial fund in 1993/1994. In addition to this initial funding, the Kebon Melati site also borrowed IDR.5 million from the bank, which made their initial fund approximately IDR. 30 million. This additional fund was used to build permanent buildings on the site, to purchase more waste carts as well as enabling them to pay their workers more. This additional funding is most probably the reason this

site survived as a recycling centre in the area. The recycling activities are still conducted by scavengers, and local neighbourhoods are actively involved. Scavengers screen the waste whereas local neighbourhoods screen, and sell, the recyclable materials to the 'centre' (Field Research, Jakarta, March-May 2000).

The Cipinang Besar Utara site received approximately IDR. 19 million whereas the Petamburan site got approximately IDR. 25 million. These plants spent most of their funds paying for their expenses, especially to build the composting roofed site, their workers composting gear and on all materials purchased to build the composting equipment (Field Research, Jakarta, March-May 2000).

Figure 6.2. Initial Funding Comparison



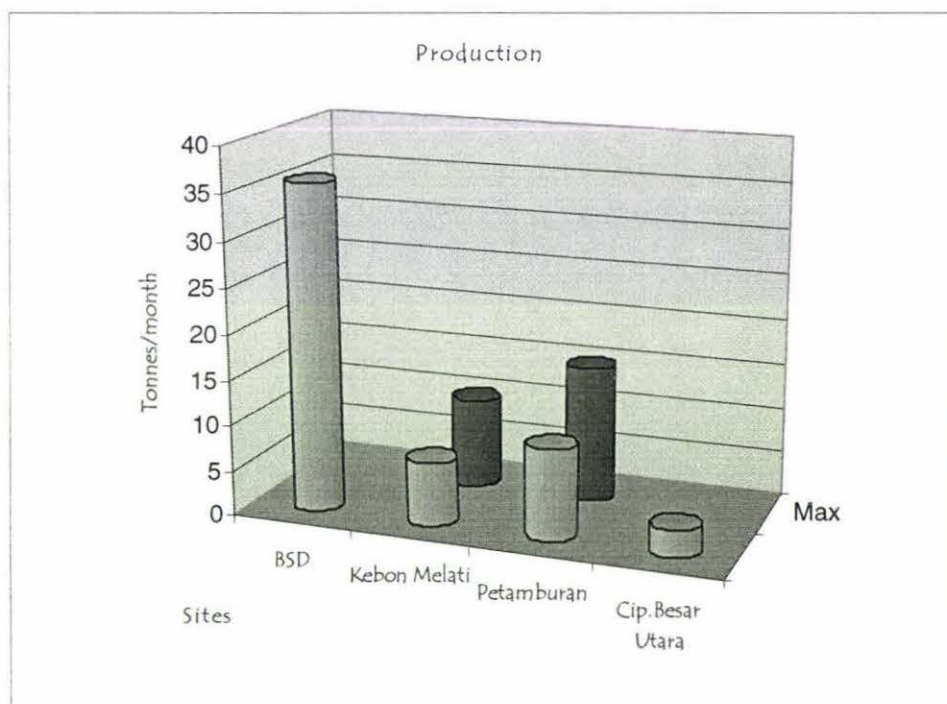
6.1.1.2. Waste Sources and Collection

Household waste is collected by local private enterprises and some money is received from the waste collector (approximately IDR.100.000/month). The scavengers (who are usually local people) screened the waste and collected all the

recyclable material that could be sold, such as paper, glass, metal, aluminum and cans, either at source (households), or at the composting sites. Their activities reduced the workload for the composting workers thus saving them the screening time.

Other waste sources for these plants were the local market and factories, such as the local bread factory for Petamburan and Kebon Melati Site. The Cipinang Besar used to accept 4-7 trucks of waste/day; the Petamburan site 15-20 trucks/day; and the Kebon Melati 8-12 trucks/day. The Petamburan site used to produce 10-15 tonnes compost/month and the Cipinang Besar 3 tonnes/month, whereas the Kebon Melati produced 7-10 tonnes/month.

Figure. 6.3. The amount of compost produced (tonnes/month)



6.1.1.3. Composting: The Process and The Sites

A modification of the windrow method was applied in all these sites. This process took four to six weeks with turning the piles and maintaining the

temperature at approximately 50 degrees celcius (no less than 45, and no more than 65 degrees celcius) were the most important activities².

Cipinang Besar Utara had an open sided roofed building for the waste receiving and separation process, as well as to store the materials to be landfilled, while the composting process took place in an adjacent open area. As it is no longer active, the site at present is used as a parking lot. The Petamburan and Kebon Melati sites had an open sided roofed building for the composting process. The recyclable materials were put in the open areas outside the roofed building (see figure 6.4. and 6.5.).

Figure 6.4. Open sided Roofed Building for Composting process in Petamburan



Figure 6.5. Open area to store the recyclable materials



² In a windrow method, the temperature is usually three degrees higher than other methods (interview).

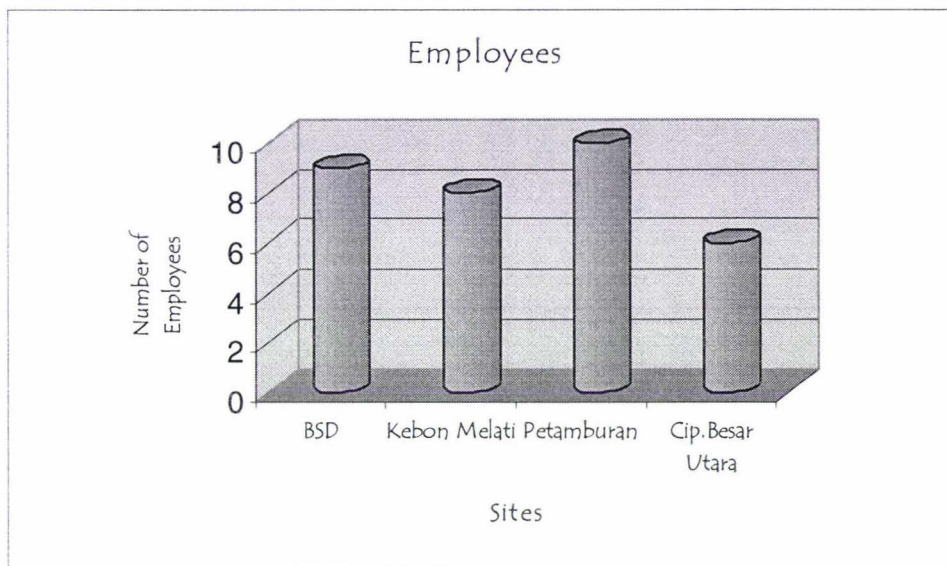
6.1.1.4. Production and Product Price

Each of the three enterprises sold their products at prices ranging from IDR.190-300/kg, depending on the compost quality. They sold the super quality compost at Rp. 12,000/40kg, the middle quality at Rp.9,000/40kg and the 'standard' one at Rp. 7,000/40kg. The three different compost qualities were only differentiated by the compost grains, the smoother the grain the better the quality. They also had three different compost bags sizes: 3kg, 5kg and mainly 40kg. The smaller bags were labelled 'Lestari' and sold through retail stores and kiosk outlets with the help from the sole distributor at that time (PT. GMB). The larger bags were sold primarily to the bulk end-users, such as golf courses, shrimp ponds/farming, municipal parks' agencies or pot-plant entrepreneurs (CPIS, vol.1, 1993:36).

6.1.1.5. Workers

The UDPK in Petamburan, Central Jakarta used to have ten permanent workers who each earned IDR. 3,500-5,500/day). The Cipinang Besar Enterprise, East Jakarta used to have six permanent workers (each earned IDR. 4,500/day) and Kebon Melati, Central Jakarta had eight permanent workers (each earned 4,500-5,500/day).

Figure 6.6. Number of Employees



6.1.1.6. Problems

In the DK report (1995/1996) on the ERCPs' project, the site inspection conducted showed that most of the compost produced was just stored in piles and could not be sold. The report noted it that most golf courses could not use most of the compost produced due to its poor quality (DK, 1996:6), and lack of marketing campaign efforts just made sales more difficult. The sole distributor, even with its success in exporting compost and selling it to bulk users, such as shrimp ponds owners and municipal parks, also had problems with the non-standardized compost produced, a reason why they stopped buying compost from ERCPs but not necessarily poor quality (Mockler, 1998).

These three sites had similar problems. They produced relatively good quality compost but then they could not sell it. The suspicion that spread, that ERCPs' compost was not good quality, also impeded the marketing efforts. Other problems that can be identified were lack of management skills that led to an inefficiency and ineffectiveness of the ERCPs' activities. No targets were applied, both for production and marketing, and this indicated a lack of

management skills. They had financial difficulties, especially for the site maintenance and for daily activities funding. Some of the ERCs were located in an area that sometimes is flooded especially in the rainy season³. The Petamburan site was one of them. The Cipinang Besar Utara site, although never experienced flooding in the site, the neighbourhoods surroundings were sometimes did. Thus, made it difficult for the waste truck to reach the site to deliver the waste supply and for enterprise to sell the end product.

6.1.2. Bumi Serpong Damai Composting Project (BSD)

BSD is a real estate development enterprise in Tangerang, Greater Jakarta. It established its composting plant in late 1989, and started its production in the early 1990s, a collaboration of PT. BSD Real Estate, CPIS and the World Bank. It was mainly based on the estate's need to deal with the waste it generated everyday. Moreover, the estate management saw the opportunity to make money through the process, instead of just spending it on waste collection and transfer to the LPA. It is because as a real estate company, PT. BSD focuses also on park/garden development and maintenance in order to make its housing areas greener, more aesthetic and healthier to live in. They required fertilizer for this maintenance. Further, lots of golf courses in the Greater Jakarta area, and also adjacent to the housing complex, mean that the demand for fertilizer was high.

The BSD management, then, came up with the idea to have a composting plant of its own. Significantly, it was a decision based on economics. With the composting plant, they could both deal with their waste problems, and make money out of it (Interview, Field Notes, Jakarta April-May, 2000).

³ Flood in Jakarta is sometimes unpredictable. Some areas that has never experienced flood for years could get flooded once or even twice in couple of years (Field Research, March-May, 2000).

6.1.2.1. Funding

The CPIS and the World Bank provided the training materials and the project scheme, whereas the BSD Real Estate Company Limited provided the initial fund, approximately IDR 370 million (approximately US\$ 40,000 in 2000). This fund included land purchasing, to build infrastructure for the site (including the road leads to the site and the water pipe), buildings (composting site and the store rooms), as well as other equipment purchased (such as an incinerator – approximately IDR.170 million and waste screener, waste grinder and workers' gear). This left the composting itself, apart from the road development and incinerator fund) initially funded with approximately IDR.120 million (approximately USD. 12,000).

The amount of money needed for the plant's monthly operation is approximately IDR 3,750.000 in order to pay for all the expenses including workers wages, workers' welfare, compost sacks, transport and compost delivery cost and equipment maintenance.

Further, the company would also pay restitution to the sanitation agency for all the non-recyclable, and refuse materials, to be landfilled. The refuse materials to be disposed of are normally between eight to eleven trucks/day. The transfer process from the composting site to the LPA, cost IDR 45,000/return trip and normally they would need to make four round trips per day. This makes the additional waste-related costs, borne by the company, approximately IDR. 3,600.000.

6.1.2.2. Waste collection

Waste collection is conducted by two small private enterprises run by the local people's enterprises. The collection process uses two slightly different systems: individual/door-to-door with pick-up vehicle (capacity of 4m³); and individual/door-to-door using a dump truck (capacity of 8m³) (BSD, 1995:IV-2).

The two enterprises collect household waste (BSD has around 10,000 units) for IDR 5,000/month/house. They can earn approximately IDR 20 million/month gross. Each enterprise has 30 waste collectors who earn approx IDR 200-300 000/month and 11 vehicles (both pick-ups and trucks).

In 1995, the amount of waste generated each day was 159 m³/day (around 40,000 tonnes). From this, 16 m³/day went to the composting plant, 6 m³/day went to the incinerator and 16 m³/day were recycled (see table 5.1.). The numbers, for recycling and composting, are expected to increase with time and the actual amount of waste, to be landfilled, would decrease. With only one real estate area, the amount of waste composted, and recycled, is not high enough to have a striking impact on landfill use. Had there been composting plants in all real estate areas in Jakarta, the number would have been greater.

The community, in the real estate area, has also contributed to the collection process by separating their household waste. The company has provided them with two different waste bins, green for organic and yellow for inorganic waste. Thus, the process involves householders from the beginning and helps reduce the composting workers' workload. Household, and green, waste collected each day can be as much as 60 trucks per day during the rainy season, and 45-50 trucks per day in the dry season⁴. (Field Research, Jakarta, March-May 2000).

⁴ source; interview with the site manager and the head of environment and landscape division of the BSD.

Figure 6.7. Amount of Waste Received In Each Sites

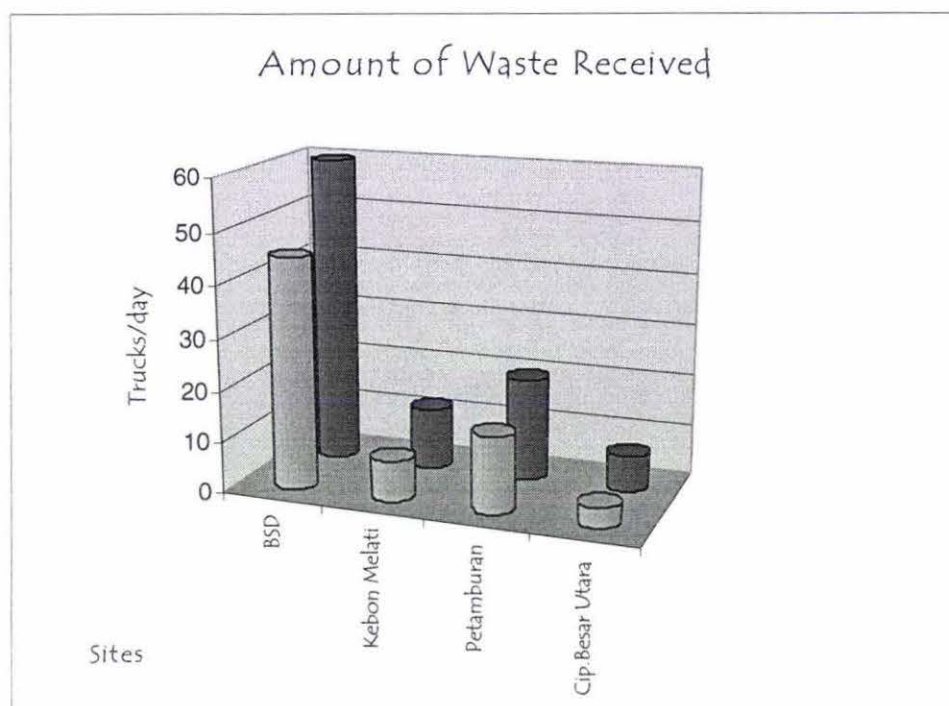


Table 6.1. BSD's waste projection for compost, recycling and incinerators

No.	Year	Recycling volume (m3/day)	Compost volume (m3/day)	Incinerator volume (m3/day)	Total (m3/day) to be processed	total waste volume (m3/day)
1	1995	16	16	6	38	159
2	1997	32	19	6	57	318
3	1999	59	22	6	87	588
4	2000	75	24	6	105	779
5	2001	97	26	6	129	969
6	2003	135	30	6	171	1349
7	2005	173	35	6	214	1730

Source: BSD, 1995: IV.6-9.

6.1.2.3. Composting Process

Once the waste collectors arrive, the composting workers help them unload. Kitchen and green waste are composted in an open sided roofed building, while the rest is sited in the open area adjacent to the plant in order to enable scavengers to pore over them and take recyclable materials (see figure 5.7. and 5.8.). The remaining waste after some has been composted and recycled is then transferred to the landfill. The method applied is a modification of a windrow system, the same piling and turning method, but without the windrow itself. The mixture of kitchen and green waste is piled in a trapezoidal form: up to 2 metres wide, 6 metres long and 1 metre high. The pile is turned manually every three days, and watered everyday as long as is needed for four to six weeks. In the seventh week, the finished compost is screened and packed in a bag, and is ready to be sold through the BSD cooperative.

Figure 6.8. The Composting area



Figure 6.8.1. Scavenging area



6.1.2.4. Production

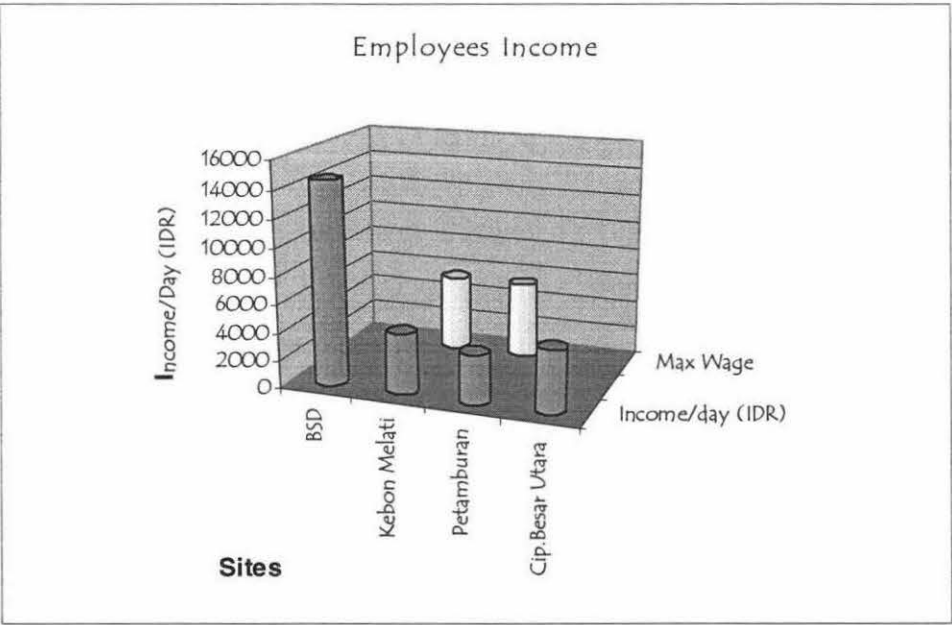
The composting plant can produce around 36 tonnes of compost monthly (900/sacks weighing 40kgs/sack) or around 25 sacks per day. Some is used privately, within the real estate area for park maintenance totalling between 20-100 tonnes/ha annually (BSD, 1995:IV-8). The rest is sold for IDR.8,500/sack to the local cooperative who then resell it at the price of IDR.10,000/sack. Most of

the compost is sold to larger farms, shrimp farms or to vegetable/fruit producers in the area, as well as to the golf courses in the surrounding areas.

6.1.2.5. Workers

At the composting plant there are eight permanent workers and one site manager. They earn approx IDR 350,000/month. Every day they are provided with two glasses of milk and are vaccinated every month in order to protect them from intestinal or other (pathogen-caused) diseases. Additionally, they are given fringe benefits which includes health, housing and transportation. There are also nine casual workers who earn IDR.15,000/day, plus a daily glass of milk and vaccination. The casual workers work whenever they are needed, mostly during the rainy season when the waste collected is more than within the dry season. They also help with the waste collection in common areas of real estate.

Figure 6.9. Workers’ daily earnings in comparison



6.2. Summary of Main Data Collected

The main findings above are summarized in the following table.

Table 6.2. Comparison of data summary

	BSD	Kebon Melati	Petamburan	Cipinang Besar Utara
Employees	9	8	10	6
Initial Funding	IDR. 120 millions	IDR. 30 millions	IDR. 25 millions	IDR. 19 millions
Monthly Funding	IDR. 3750.000	Depended on the sale	Depended on the sale	Depended on the sale
Source of Waste	Real estate's houses; local market	Local markets, Local neighborhood	Local neighborhood; local markets; bread factory	Local neighborhood; central market
Waste received	45-60 trucks/day	8-12 trucks/day	15-20 trucks/day	4-7 trucks/day
Production	36 tonnes	7-10 tonnes	10-15 tonnes	3 tonnes
Buyers	-Golf courses -Larger farm owners (shrimps and vegetables or fruits) -Individual	-Individual -Municipal landscaping agency -Potplant entrepreneurs -PT. GMB, -shrimp farmers -small farmers	-Individual -Potplant entrepreneurs -Small farmers -Shrimp farmers -PT.GMB -Municipal landscaping agency	-Individual -Municipal landscaping agency -PT. GMB -Shrimp farmers -Small Farmers -potplant entrepreneurs
Employees income	IDR. 350 000 monthly (14600/day)	IDR. 4400-5500 /day	IDR. 3500-5500 /day	IDR. 4500/day
Compost price	IDR. 10000 (250/kg)	IDR. 190-300/kg	IDR. 190-300/kg	IDR. 10000 (250/kg)

6.3. Analysis

6.3.1. Elements of Survival

In the three UDPKs that are no longer functional, respondents mentioned three major barriers preventing their enterprises continuous running:

- a) compost marketing;
- b) funding availability;
- c) lack of external support.

These three are intertwined, although the marketing failure aspect played the greater role. This is because, if the marketing aspects had been successful, the enterprises may have been able to fund daily activities and expenses. External support from the Municipal Government and the NGO is needed, especially in developing the compost market and helping them to get their small business licences or other waste collection and removal arrangements from the nearby LPS to the LPA.

Failure in marketing the compost is probably the main reason for the closures. Most of the workers admitted that they did not know how to address the issue of marketing. Within the management line, responsibility of workers was for the waste screening and the composting process only. The site manager usually conducted the marketing by creating alliances with municipal park/gardening agencies, and other governmental departments, in order to sell their product. They also cooperated with NGOs with a focus on a environment and development to promote the use of compost to the local people and especially with PT.GMB as a sole distributor for ERCPs' compost. The distributor company, however, was dissolved in the mid 1990s due to some internal problems and left ERCPs to market their product on an individual basis (MEIP, 1998:16). The marketing problems were mounted as economic crisis hit in mid-1997.

Although the economic crisis was not the main reason for the closure, it had an important role. The crisis led to high inflation that made the prices of goods and food rocket. Thus, people could not afford to buy the material that they need for the plant and nor could they afford to buy compost. Some operations had closed down, even before that, due to the above mentioned reasons, but most of them were terminated not long after the economic crisis started.

Closely related to marketing is the compost price. The price for one kilogram of compost was, and is, about the same as for one kilogram of chemical fertilizer. Those who want to use compost, however, need to buy more compost if they want to have similar amounts of, for example phosphate and potassium levels. This meant that they had to spend more money, and more effort, into utilizing the compost, afterwards. The three failed composting enterprises had also paid attention to the quality of the compost they had produced so that it had, on average, various nutrients needed by the soil at the highest level. Since they could not afford to send their compost samples to be examined in a laboratory, maintaining, and ensuring the quality of their product was done by a thorough screening of the waste, turning up the piles more often and making sure that the temperature was just at the right level. Some of the small composting enterprises used to sell the top quality compost at IDR. 200/kg to make their product more competitive. This, however, could not really cover their expenses for the workers or their daily activities. They needed approximately IDR 1.5 to three million per month for their activities.

Farmers in general, as one of the primary compost buyers, continue to prefer chemical fertilizers. This was due to the fact that the Indonesian government, for almost thirty years, has said that chemical fertilizers were the best choice and that they boost production which allows farmers to earn more money. The fact that (in the long run) these chemical elements may eventually destroy the soil has been concealed. Up until recently, the highest priority was

how to boost agricultural production and earn more money. Therefore, marketing failures, for these small composting enterprises, is somewhat connected to this frame of thinking of people in general, or farmers in particular, as their intended market.

As for the BSD plant, the reason for its survival is probably the real need for its existence. The company actually makes money from selling the compost, instead of just spending money on waste collection, and waste transfer to the TPA. Although the financial profits they have gained is not huge and compost, so far, is not really in great demand, it is considerably enough to enable them provide better services to their residential areas. Such service includes a provision of separate waste bins for the organic and inorganic materials for all households in their housing complex.

Moreover, the company has enough financial resources to ensure they are able to fund the plant's activities, even in a depressed financial environment. The benefits of composting accrue to the management companies through avoidance of waste disposal costs, and reduced chemical fertilizer use in their landscape and park maintenance.

Further, there is also an additional benefits as the composting plant has given them the 'corporate image' that the company really cares about the environment, and has done something concrete about it. This 'green' image may attract more people to buy a house from, or do business with the company.

The differences between the two enterprises (i.e. the community-based and the privately owned) were probably concerns the need, and the awareness, to deal with waste problems, human resources, especially in marketing the product, and funding availability. In the BSD real estate area, most people live there are of middle level to high-income group. Therefore, spending some money, and their time, in separating their own waste is not really a big problem as most of their basic needs have been covered by their income. With low-income people, the

waste collection fee is only one of their problems. Often, they continue to dispose of their waste by throwing it on the riverbank, or wherever there is an empty land spot, because it is free. In some areas, 'private' waste collectors do collect waste in these neighbourhoods, with relatively low fees, but these waste collectors have mostly thrown the waste collected into the same illegal spots: so the households have received no value for their money, indeed they are better off by disposing of their own waste, wherever they can (Hardoy and Satterthwaite, 1989).

6.3.2. Identifying the Impacts

The small-scale composting enterprises scheme had both direct and indirect impacts on the community, and the government. The direct impact compasses an increase in community skills in order to deal with their MSW problems, especially in waste collection, recycling and composting activities. Although the training did not cover all inhabitants in the composting project areas, this project has certainly helped the community, in terms of refuse collection and removal from their neighbourhood. Further, it helped create employment opportunities, especially for those with no, or little, formal education: waste collectors, recyclers, composters or even the compost sales. This has also opened opportunities to build businesses related to waste, such as pot planting and shrimp farming.

There are also indirect impacts, such as environmental savings due to less waste generated and longer use of the landfill. There was an increase in community productivity which has led to an increase of income (this especially from the scavenging activities that allowed people to gain profits from free recyclable materials from households, and other sources of waste) and saving government expenditure on SWM due to the longer landfill use period, less materials/waste to be landfilled and less cost for waste collection and its disposal. The relatively cleaner neighbourhoods were expected to reduce mortality rates

because of intestinal or other pathogen diseases, especially in children and infants (Field Notes, Jakarta, March-May 2000).

6.4. Underlying Factors

In the field research, there was only one case study (Cipinang Besar Utara) that people did not know much about it. Even when being asked for it and the direction to get there, most people did not know. The other three, even people from different village knew about them and could point out the direction. This small fact might be an indicator of how successful was the dissemination of the small-scale composting enterprises' implementation. Further, the Petamburan site was in a worse condition than the other three in terms of the road and the site condition. It is probably because of the nature of the location (right on the river bank) and the fact that it functions as a temporary dumping site for the local neighbourhood with only one caretaker who does not have other job than taking care of the waste and the site.

Education and the socialization of compost and other activities related to it, such as waste separation and recycle some of the materials, are essential in order to create conducive environment for a more integrated and sustainability solid waste management. These case studies show their importance and also pointed out the weaknesses of the schemes' implementation, such as, small, mostly neglected, aspects such as the site location and the maintenance of the site as mentioned above.

Closely related to the problems, the impacts and the underlying factors, the following chapter, therefore, would discuss more on the factors that contribute to the failures or might contribute to the success of such schemes, with the three major barriers above as the underlying factors.

Chapter VII

Final Discussion and Conclusion

This chapter focuses on the strengths and weaknesses of the composting scheme, regarding the four case studies. The causes of their closing down as well as the other project success are also explained. Entailed are some of the suggestions on how to improve the scheme in order to make it fit better within the SWM programmes in Jakarta in the future and also on future research areas that can be obtained from this study.

7.1. Obstacles to the small-scale composting enterprise projects

The following is the key constraints that faced the projects and ultimately forced most of them to close down. Six main factors can be identified as follows:

Firstly: The marketing of compost is the most serious constraints to enterprises' viability. Based on a marketing study conducted in 1993, ERCPs' compost were not in great demand. Several marketing efforts were applied but could not help expanding the compost market. Some of the reasons were mentioned, such as ERCPs' unreliable and insufficient production capacity to meet the demand and also the price of the compost that was considered as 'too high' compare to the price of chemical fertilizer. This aspect would be further discussed later.

For the privately owned composting enterprise, marketing the compost is not really a problem, because the company owns (or has a good relationship with) some of the golf courses in the surrounding area, and has a marketing team who have managed to form good relationships with potential customers, buyers or clients of the company, including local farmers (with large farms) who then became compost customers (interview: Jakarta, March-May, 2000). The

composting plant also sell the end product to a local cooperative, which is run by the local community, who then sell it on to the previously identified customers.

Secondly: a major problem is the 'belief' that chemical fertilizers are the best choice for agricultural practices. Such a belief makes farmers (as the traditional primary users of fertilizer), as well as other fertilizer users, such as households or pot plant entrepreneurs, prefer a chemical fertilizer. Marketing failures, for most of the small-scale composting enterprises, is somewhat connected to this frame of thinking.

Thirdly: There is no price advantage for compost for the price of one kilogram of compost is about the same as of one kilogram of chemical fertilizer (IDR. 348/kg) (Rosegrant and Kasryno, 1990). However, customers need to use more compost if they want to have similar amount of, for example, potassium or phosphate levels in their compost. More compost means more money, and also more effort is needed to utilize it.

Fourthly: Lack of interest in alternative methods. The Municipal Government, particularly the Sanitation Agency, was partly responsible for the project's failure. They have the authority to manage all the municipal wastes in Jakarta, yet they put most of their efforts and money, into the sanitary landfill process and do not really consider any alternatives. They have spent between IDR. 30 to 70 millions per village district per month, mostly on the waste collection and its transfer to the landfill site (interview, Jakarta, 2000). With 206 village districts in Jakarta, that amounts to from IDR. 6,180 billion to 14,420 billion per month for the waste collection and transfer process alone.

From 1992/1993, however, the Sanitation Agency, at last, turned its attention to the composting process as a way to minimize the waste that has to be transported to the landfill site. Nevertheless, they have never really been serious about implementing this process in all village districts of Jakarta. This is shown by the amount of money they have spent on the programme (only IDR. 300

million for one year¹) and lack of effort they have put into it, including the familiarization of the use of compost, and the importance of separating organic and inorganic waste. In general, government expenditure on solid waste management does not cover all the expenses and cannot provide the wide coverage service as expected (Mockler, 1998:5). For example, over the period 1979-1983, total government expenditure on solid waste management throughout the country was, only, approximately IDR. 480 per urban resident. With generation rates at around 5 kg/ person/day, only 25% of the solid waste produced was collected or properly disposed of (World Bank, 1984, vol.1;60-62; Sicular, 1992:116). This amount has actually increased over the years, as in 1993/94 the total estimated garbage collected was 70%. The total government expenditure of about IDR. 525 billions in 1995, however, is not going to be enough in the next 25 years with the waste volume is estimated to increase four times (Mockler, 1998:5-6).

In terms of solid waste service provision, the densely populated areas scattered throughout Jakarta that usually accompany by inadequate and very narrow path to and inside the areas have made it difficult to DK to collect waste. Lack of budget has aggravated the service and made it worse since most of the time DK has to provide better service to those who has paid the fees and tend to neglect the poorer areas, which most of the time do not pay for the solid waste retribution. The lack of discipline and incentives for the DK's employees have also contributed to the standard of service that they provide. Thus, poor human resources, lack of new initiatives, corruption and collusion practices within the agency itself and further complicated by weak control by, and on, the government are part of the DK's problems (source: Interview, May 2000).

From customers point of view, as long as they do not receive the best service, while still having to pay waste collection fees, they would still rather be

¹ source: interview with the official of the Municipal Sanitation Agency

disinclined to separate and recycle. After all, they receive no financial gain from it, and economic benefits are important as an incentive for people to participate, especially in poor areas. Another benefits or incentives that probably would make people more in favour of separating and recycling their own garbage is the lower fee regulation applied attached to these activities.

It requires long-term commitment, investment in skill development and guidance to assure real improvements in especially poorer people's socio-economic welfare (Mockler, 1998:28). After all, for low-income people wherein the enterprises were built, buying food is their main focus for spending the little money they have. This makes it more difficult for them to stick with a cash-strapped project, such as a waste separation programmes, composting their own household waste, or joining the community-based composting programmes, since they do not receive any financial incentives at all from these and do not or cannot see (due to their immediate needs) any social or even environmental incentives coming out from such activities.

Fifthly: The economic crisis that started in mid-1997, more or less contributed toward the project failures. Most of the enterprises had to close down their activities after they started due partly to scarce funding availability, and the increasing expense of daily needs that 'forced' them to increase their workers' wages. The rise in process and scarcity of raw materials and production inputs during the crisis was worsened by the weakened consumer's purchasing power that both directly and indirectly decrease the demand for compost (The Asia Foundation and AKATIGA, 1999:1).

Sixth: These case studies showed that the participatory method is not the one and only answer for every development problem that occurs. Leaving it to 'the people' only through, among others, participation, is not necessary the answer in ensuring project's success, given limitation of time, money and other resources, including the lack of skills of the participants. This kind of project still needs support from the government, NGOs and other community organizations,

to ensure the sustainability of the project's implementation. The support may be less and less in time, but it would still be needed if the objective is to 'educate' people on the importance of the use of compost to larger audiences. As in this study, this composting project's implementation, although having covered most aspects needed for broader community participation, still failed. No continuous monitoring and evaluation conducted in order to identify problems and solve them, were the big part of the flaws. After the initial stage, all the enterprises were neglected these stages, given little or no support at all. The Municipal Government, and the Sanitation Agency, did not keep up with the development of the enterprises. In fact, neither the sanitation agency, nor even the NGOs visited the sites on more than rare occasions. Or even when they did, they did not really deliver what they promised², therefore, the composting plants basically had to try to survive by themselves.

This is due to the realization that grassroots activities do not grow by themselves. The biggest challenge, in reversing global environmental deterioration, including the mounting solid waste problems, is to forge an alliance between local groups and national governments. Governments have the resources, and authority, to create the conditions required for full-scale grassroots mobilization. In short, grassroots development and community action for sustainability, need to be cultivated on a wider scale by just policies and government agencies that perform their duties in a competent manner (Durning, 1989:51). For small-scale enterprises, support from the government, in terms of removing unnecessary obstacles, such as reducing or even removing unnecessary costs and levies, makes licensing/permit process easier and also ensure the availability of raw materials for their production would help them overcome problems (Asia Foundation and AKATIGA, 1999).

² source: Interview, Jakarta, April 2000

7.2. Identify the Solutions

With the above mentioned problems facing the scheme, there are still strong arguments for 'reviving' the failed projects in the near future. Some of the underlying reasons being that this scheme can be operated and managed by relatively unskilled labourers; It provides employment opportunities because it is a labour intensive operation, and also it can be further improved toward the realization of urban agriculture.

To improve the integrated municipal solid waste and the small community-based, composting programmes, the following points have to be included, and fully considered:

Firstly, Educational campaigns on the importance of compost, and the recycling process should be promoted to deal with solid waste problems. This would establish a receptive environment by convincing the public of the value of using compost. The promotion of home composting can also be one of the options to deal with compostables that are unsuitable for commercial composting. This campaign should be carried out by government agencies, and NGOs, via presentations in the media (written publications, radio and television) that may include the advantages and disadvantages of compost utilization, methods of producing compost, information on obtaining compost and the proper utilization of compost (Diaz et.al, 1993:196). Once this is done, and people know the importance of separation, recycling or composting their household waste, there should also be compliance incentives and penalties included in the municipal regulations.

Secondly, The stimulation of the compost market, in order to create demand, on a national scale would be significant as well. The setting of an Indonesian quality standard for compost would assist in consolidating market demand. If composting is to become an economically viable alternative, compost has to find suitable markets, and for this end its quality must be consistent and satisfactory. The proposed compost quality standard submitted by the World

Bank, can be used as the guidelines for compost production in the future. Thus, all enterprises have to apply the same standards in order to produce the same standard of quality. In 1997, export markets have been identified by PT.GMB in Singapore, Australia and the United States and this demand could be fulfilled with more serious involvement of all participants (Mockler, 1998). If the market can be stimulated, even at a national level, the demand for compost would be quite large then waste would no longer be a huge problem. Thus, substantial government support, and private sector involvement, would be required to establish an adequate market demand, both nationally and internationally. Nationally, establishing a mechanism of cooperation between the urban and the agricultural sectors of the society would expand the compost market. It is due to the characteristics of the raw materials (which for MSW means source separation), although this initiative cannot be accomplished without an active participation of all parts of society (Raviv, 1997:227).

Thirdly, Community-based activities should not be left unattended for long periods of time, and should be reviewed and monitored. A project can be successful if all the parties involved put their best efforts in it, including continuous monitoring and evaluation in order to improve performance. Evaluations should be conducted in order to assess the progress and development of the project, and should be participative through the entire process of monitoring and evaluation in order to allow people to voice their interests and idea as well as difficulties they meet (Oakley, 1990:32). Knowledge, or wherewithal, is essential in order to continue these projects, and support from the government and NGOs can make things easier for the community. In the case of the composting scheme, external support is needed to start it up, and to be successful, such as in the form of land provision to store and sort the recyclable materials (temporary disposal sites which can be used by composting enterprises), or even the socialization of compost use ([www.unep.or.jp / ietc / ESTdir / pub / MSW / SP/Sp2/SP2_4.html](http://www.unep.or.jp/ietc/ESTdir/pub/MSW/SP/Sp2/SP2_4.html)).

Fourthly, The recent economic crisis has placed small and medium enterprises (SMEs), including these small-scale composting enterprises, in a rather difficult situation. The collapse of the banking sector has created problems for most commercial activities, especially those involving SMEs. Although preliminary studies show that SMEs have a tendency to be most adaptable to changing economic circumstances, but it is more than likely that they will also be affected by the shrinking domestic market as well, therefore, empowerment of the small enterprises, including composting enterprises, should be premised on market principles and the outcome of the empowerment should not be the sacrifice of economic efficiency (Indrawati, 1999:18). It is common knowledge, in Indonesia, SMEs still suffer from structural weaknesses. There are internal characteristics and problems faced by SMEs: problems related to human resource quality (including the low education level of both owners and the employees) and their limited access to improvement skills training programmes. Production problems include the high price of machinery, lack of access to technology and experts, and difficulty securing production inputs because of distance, uncertain supply and high prices.

Furthermore, government support cannot be separated from macroeconomic policies and the institutional setting (in which the role of government institutions and officials have to be taken into account) (Indrawati, 1999:19). The government should also be focused on the use of market-based initiatives, along with foster father schemes, forced partnerships and subsidized credit schemes in order to help those in need of support. There are some pre requisites for genuine empowerment including a competitive environment, access to financing, technical and managerial competence and a supportive legal framework (Indrawati, 1999:18-19).

Fifthly, Training for workers should cover marketing processes, and skills in order to allow them to sell their product for themselves, without being so dependent on middlemen to sell it for them. The Sanitation Agency could help by

arranging sales through City-Greening Programmes and local government departments, such as Municipal Parks, and the Department of Agriculture. Therefore, amended regulations for cooperatives, loans to small-scale businesses and low-rent space for stockpiling depots are important issues. A local cooperative can be one of the ways of dealing with compost marketing. This allows more local people to become involved with the projects indirectly, which means that their scope for marketing will expand, resulting in more sales people. It is not that these policies have not really been implemented, they have! Simply, they did not fail due to the lack of managerial and marketing skills only, but also due to external constraints, such as the economic crisis and the ineffectiveness of such policies implementation.

Sixth, A successful composting programme in Jakarta, therefore, is greatly dependent on the larger policy framework of the municipal governments, and the wider economic aspects as well. Economic crisis or not, if the larger policy framework can accommodate people's needs and allow their potential to expand, then the chances for success are increased. This means that nothing cannot be done to change policy (Wuyts, et.al., 1992:284), and a good policy may initiated change in people's behaviour, especially toward the recycling and composting activities.

One of the most practical possibilities for change is probably the pricing structure: to lower, or even eliminate, the disposal charges for those who separate their household waste into organic and inorganic, while at the same time charge, or raise the charge, for those who do not do the separation. Further, the implementation of policies that aim for the encouragement, and assistance, of greater separation of green wastes within the community is significant.

For solid waste management, the municipal government, as the one with the authority to execute the solid waste programme, can promote and recommend the use of compost and also change people's perspective about it. Further, it may stress the importance of recycling and reuse of materials and the benefits of

composting enterprises and enhance the people's awareness of the importance of dealing with their own waste problems, starting from the source -their own home. In short, more efforts and financial budget should be put into integrated waste management programmes, instead of just focussing on landfill use.

Education is another aspect that should be geared towards helping people become capable of dealing with the problems of excessive population densities, including environment, at a local level. NGOs, and the communities themselves, can be part of the programme, and be the government's equal partners in the programme's implementation. This cannot work in a day, changing people's perspectives and behaviours might take a long time, nevertheless, this has to be started at some point and the fact that the composting project has been started, although it has failed, is a good sign for the government, and shows the people's willingness and enthusiasm to deal more seriously with their own solid waste problems. People's readiness to change, after all, is one of the indicators of their involvement (Finger and Kilcoyne, 1995:253).

Given the problems that lie ahead, including government and community structural weaknesses, policies to encourage participation need to be comprehensive, and longer trial periods are needed before results will be seen. Popular participation is not something that can easily be switched on or off. It is a protracted process of social developments which progressively build up or destroy a capacity of public action (Wuyts *et.al.*, 1992:280). Public participation and action is not a simple addition of state action and of other forms of non-governmental public action, it can be constrained, twisted or enhanced by state action and often, also, by the actions of better funded NGOs. Therefore, a positive support by the state and local government, as well as the willingness of resource-rich, or better off people, to participate in the programme may increase the success probability for any development project, especially a small-scale and relatively small funded project such as the small-scale composting enterprises scheme (Wuyts *et.al.*, 1992).

Seventh, The idea of urban agriculture (Smit and Nasr, 1997) may be applicable in dealing with both solid waste and social problems, such as lack of space as well as the need to increase income. Urban agriculture, with home composting, and the use of compost, may provide people with additional income, or even just enable them to save some money that is usually used to buy food. The city's open spaces, like river banks, ponds or even walking paths can be used to start a programme. Vegetables or herbs can be planted, and can be sold to earn some extra money, or if it is a programme managed by the municipal government they can be sent to public hospitals, or nursing homes, or even just given out to the needy. Ideally, a realization of the idea of urban agriculture is needed in order to create a city that can recycle its own organic waste and reuse it again as an input for a new production cycle (Smit and Nasr, 1997). This idea needs composting as the essential link in the process, so it can be further promoted as an integral part of another composting enterprises scheme in the future;

Finally it is necessary to develop simple credit facilities for the composting and recycling entrepreneurs, (in terms of a loan or a subsidy). This scheme can help them maintain the quality of their compost, and also sustain the availability of their product: i.e. enough compost to produce and guarantee compost's availability consistently (Diaz *et.al.*, 1993:198). According to a more recent study (Budi, 1997) and from a macro economic level, the DK is in a position to subsidize UDPKs based on the cost savings they enjoy from avoided waste transportation, disposal and land acquisition costs as shown in the following table:

Table 7.1: Municipal Governments' cost-savings in three big cities in Indonesia

City	Operational costs	Inorganic waste produced/month (m ³)	Reduction in waste by waste pickers (m ³ / % of total)	Money saved/month (in IDR)
Bandung	3,630 million	55,061	10,661 or 19%	29,178,000
Semarang	2,940 billion	30,729	500 or 2%	1,375,000
Surabaya	11,200 billion	41,459	12,666 or 31%	34,830,000

(Dinas Kebersihan Bandung, Semarang and Surabaya, 1998).

The ERCPs financial feasibility should include all expected costs including land rent (which should be leased for at least five years to ensure the break event point for the business), electricity, employees' wages and waste collection and marketing costs. From the table above, it is possible for the Municipal Sanitation Agency to help composting financially and create a relatively simple credit scheme in order to encourage people to be involved in the activities. More support and help, in terms of lower the waste collection fee and free delivery of solid waste, could be applied as an incentive to improve ERCP's development and expansion in the future.

7.3. Conclusion

All in all, the small-scale composting enterprises projects are clearly an innovative, environmentally friendly and very promising economic approach to managing MSW in Jakarta. Moreover, they are an integral part of the waste management system, designed to involve local community participation, as well

as encourage the small, or large-scale, private businesses in the waste processing related field. The Municipal, as well as the national, government has to create necessary conditions for the local communities to be able to fully participate in their own development process, namely waste management through the small-scale enterprises implementation (Carmen, 1996:87-88).

Assistance to small enterprises and informal workers in waste recovery, trading, and recycling can enhance waste reduction for a whole city. It may also improve working conditions in small undertakings and reduce adverse environmental impacts. The kind of assistance required is not costly compared to the benefits that the city will get in the end (UNEP-IETC, 2000).

Nevertheless, the small-scale composting enterprises programmes are not designed as a panacea for the problems of managing MSW, although they can be an important component of an overall plan for the management of urban waste (CPIS, vol.1, 1993:81). We have seen that such project can fail and there is no guarantee of success. Therefore, other components of the integrated system should also be implemented in order to ensure success.

7.4. Areas for Further Research

This study has identified only four composting enterprises in Jakarta under the Municipal Sanitation Agency, the World Bank and CPIS project. Further study, which includes similar enterprises, such as those enterprises that compost manure, or use worms in the process, or other initiatives, may be worth examining. Other cities may be able to contribute a success story concerning a similar scheme.

Further study on other practical and 'user friendly' composting methods applied, such as vermicomposting, or those that use and process manure, may be beneficial in strengthening the arguments of how composting can be of use in creating a sustainable solid waste management

Privatization of and involvement of informal sectors with solid waste management programmes in Jakarta, with regards to urban agriculture approaches/programmes, may also be studied to determine the impact, or contribution, toward the improvement of service provision and the creation of urban sustainable livelihoods.

Finally, this present thesis has given a descriptive, qualitative analysis on the implementation of small-scale composting enterprise schemes in Jakarta. Further study, utilizing more quantitative analysis, could be undertaken to present the impact and effectiveness of such scheme, using this thesis to stress the importance of this scheme as a means of income and helping maintain a sustainable livelihoods.

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Appendix : Interviews

A series of interviews were conducted in Jakarta, Indonesia with interviewees as follows:

- (i) Anwar Sanusi, Head of the Center for Automatisatation, Agency for Public Administration, May 2000;
- (ii) Bambang Sudiyono, Head of Section, Planning and Development Division, The Municipal Cleanliness Agency, April-May 2000;
- (iii) Dondi S., Agency for Technology Application, April 2000;
- (iv) ex CPIS staff, April-May-2000;
- (v) ex Petamburan worker (caretaker for the existing waste disposal), April-May 2000;
- (vi) ex worker of the Cipinang Besar Utara composting plant, March, 2000;
- (vii) ex worker of the Cipinang Besar Utara site, April, 2000
- (viii) Firman Sahwan, Agency for Technology Application, April-May 2000;
- (ix) H. Mumun, ex Kebon Melati worker (caretaker for the existing recycling center), April-May 2000;
- (x) Head of Social Affairs, Cipinang Besar Utara Village District Official, March-April 2000;
- (xi) Ina Belinda Claire, Head of Landscape Division PT. BSD., April-May 2000;
- (xii) Isono Sadoko, World Bank Official, April 2000;
- (xiii) Marzuki, site Manager of the BSD Composting Plant, April-May 2000;
- (xiv) PT. BSD Staff, May 2000;
- (xv) Suhadi Hadiwinoto, World Bank Official, April 2000;
- (xvi) Three workers of the BSD plant.