

MUNICIPAL SOLID WASTE MANAGEMENT IN INDONESIA: STATUS AND THE STRATEGIC ACTIONS

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(Received November 30, 2006)

In Indonesia, municipal solid waste (MSW) is becoming increasing complex due to variety of reasons like the increasing quantity of MSW, rising public awareness and municipal administration policies in different cities and surrounding regencies. After the landslide accident at Bandung city disposal site, most of related agencies are trying their level best to improve the situation. Against this backdrop, this paper attempts to analyze the present system of MSW addressing variety of aspects such as quantity and composition of MSW being generated, operational management, legal system as well as financial aspect. The systematic assessment has revealed the problem like lack of legal framework, low coverage, improper waste storage, less encouragement for composting, and lack of proper disposal practices. Finally, an action plan is presenting suggestion for immediate and future addressing the issues like the operational management, institutional, financial aspect, public participation & environmental education.

Key words: municipal solid waste, strategic actions, Indonesia

1 INTRODUCTION

During February 2005, landslide disaster at Bandung disposal site killing 140 persons, has brought the issue MSW management to national floor and, probably could be considered as "wake up call" for switching on the rapid awareness towards improvement in waste management. Various stakeholders including public and private agencies are trying their level best for improved course of actions not only to avoid the accidents like at Bandung disposal site but also systematize the situation to provide better services in a cost-effective manner.

On an average, every Indonesian generates 0.76 kg/day of solid waste. Thus, with total population 246,533,673 Indonesia would generate 187,366 ton/day of MSW in a total area of 1,890,000 km² which is administratively distributed into 33 provinces. There are 91 major cities and semi-urban areas termed as regencies either encircling the major city or exist independently in different parts of the country. The problem is more acute as considering Indonesia is the world's largest archipelago which is composed of nearly 17,504 islands.

This paper presents the situation analysis of prevailing MSWM in Indonesia addressing mainly the operational, financial and legal aspects for storage, collection, transportation, treatment and disposal systems. Accordingly, the shortcomings have been identified and a strategic action plan for short and long term is suggested.

2 INSTITUTIONAL ARRANGEMENT FOR PUBLIC SERVICES

Initially, most of the public services were managed by the national government. However, since 2001, there has been decentralization of power and responsibility to the provincial and local governments. Presently, most of the public services like public works, health, education, agriculture, communications and environment are managed by municipalities. In most cases, the city and its encircling regency are independently managed by different municipalities. For example, Bandung city with total population of 2.5 million is managed by Kota Bandung municipality, while Bandung regency with total population of 3.5 million is managed by Kabupaten Bandung municipality. Presently, there are 450 municipalities catering to cities and regencies. Institutionally, the basic services for water supply, sewerage, drainage, and MSW management are a joint responsibility among national, provincial, municipal and private sector (Table 1). The proportion of responsibility in the installation, operation and maintenance varies significantly from city to city. Municipal administration is mainly responsible for operation and maintenance while national and provincial governments share the burdens of installation and capital investment.

As far as MSW is concerned, big cities may form local enterprise to widen their activities so as to get some additional revenue. While, other cities may establish only cleansing unit in their municipal organization. There is no responsibility for the unit to get profit for the municipality. However, both local enterprise and cleansing unit should report to the municipality every year.

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Table 1 Responsibilities of the different level of government for public services

Type of activity	Installation				O & M			
	N	P	M	Pr	N	P	M	Pr
Water supply	√		√	√			√	√
Sewerage	√						√	
Drainage	√	√			√	√	√	
MSW transportation and management	√		√				√	√

O & M = Operational and Maintenance; N = National; P = Province; M = Municipal; Pr = Private sector; √ = indicate the responsibility

3 MSW MANAGEMENT SYSTEM

MSW generation from variety of sources in municipal area is temporarily stored at convenient locations within a city area. Further, this is transported by municipal agency to processing and final disposal site (Fig.1). Normally, the organic matter consist of kitchen, yard wastes, etc is composted while rest of the material is disposed by landfilling. The overall system consists of waste storage, collection system, transfer station, transportation and final disposal (Fig.2). Each stage of the management system is described below.

3.1 Quantity and Composition of MSW

The MSW generation is directly related to the contributing population. Table 2 presents the waste generation in the major cities in Indonesia. In a study carried out by the World Bank about the percentage of population provided with MSW management services and its relative position with respect to other Asian countries is presented in Fig.3.

Major sources for MSW are residential localities, small-scale industries, commercial areas, markets, and other public facilities such as hospitals, schools, etc. Fig.4 represents the distribution of MSW generators in Indonesia. The composition of MSW is a mirror of consumption patterns, eating habits, social structure, etc of the society generating the waste. Fig.5 presents the typical physical composition of MSW in Indonesia.

3.2 Storage at Generation Points, Collection and Transportation Systems

Residential area (households): In residential areas, each individual equips the house with a household storage in the form of plastic or metal bin or the fixed brick-box in front of the house. Most of the fixed brick-box is open system with varying capacity from 70 to 120 liters. In every community, there is an organization termed as "community neighborhood unit" which is responsible for waste collection from individual house through hired labors. Workers use bamboo basket and take out the waste from the storage and take it to a transfer station with the help of handcart. In higher-income localities, they use metal bin or brick box as waste storage. In these localities, the municipality normally provides a daily door-to-door collection system using a truck. Instead of

putting the waste at transfer station, the municipality transports them along with other wastes generated from streets, commercial area, etc directly to final disposal site. The waste pickers are often looking for recyclable materials from the wastes deposited in the household storages and transfer stations.

Commercial, industrial and institutional areas:

The generators should be responsible and collect the wastes by using their own handcart and take it to a transfer station. In larger commercial and industrial areas, some generators provide the trucks to transport the waste to transfer station or directly to final disposal sites. Other generators rent a container from municipality with capacity of 6 or 10 m³ to be placed near their areas. Due to the limitation of municipality in providing the containers and trucks, in certain areas, the generators are engaged private agencies on contract basis for waste collection and transportation.

The street: Each household is responsible for the removal of waste in front of his house. Wastes from main roads are swept by the municipal employees. For commercial areas, street sweepers are responsible for keeping public streets and facilities clean, including city yards, terminals, etc. Street sweeping is carried out both manually (with brooms) and mechanically. Mechanical sweeping vehicles usually clean only the main streets in large urban centers. Although street waste constitutes a very small fraction of the overall waste stream, a significant portion of the work force for the waste management is allocated for the street cleanliness.

Retail market area: There are two types of retail markets: permanent and temporary. Since most of the permanent markets are adjacent to the roads and accessible by the trucks, the municipality may provide a truck to transport the wastes directly to final disposal site. For the temporary market, municipality provides handcarts to collect wastes from each shop to transfer station.

3.3 Transfer Station

Transfer station is introduced for the sake of convenience and to reduce the hauling distances for collection trucks, thus lowering transportation costs. Some of the transfer stations are relatively modern; provided with attendants and equipped with mechanical transfers and waste compaction, whereas others are simply a large steel container, concrete bin, and/or open space. Some special handling system may apply at a modern transfer station like in Jakarta city. Each of two larger transfer stations in Jakarta has a waste compaction system with a capacity of 1,600 m³/day of transferring the wastes to the vehicles. The bin transfer stations are made of brick or concrete with 6-12 m³, located mostly in residential and small commercial area. The steel containers with 6-10 m³ capacity are located mostly in larger commercial areas. The transfer station may consist of one or two containers and depends on the area served by the transfer station. Generally, the transfer station is overloaded and it is difficult to maintain the cleanliness.

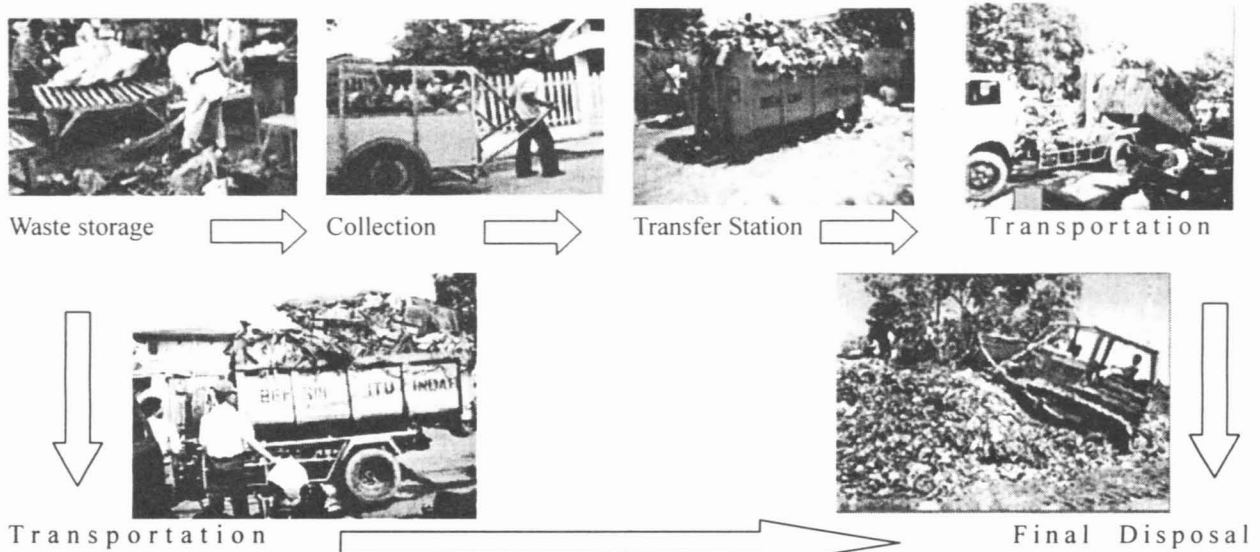


Fig.1 MSW flows in Indonesia

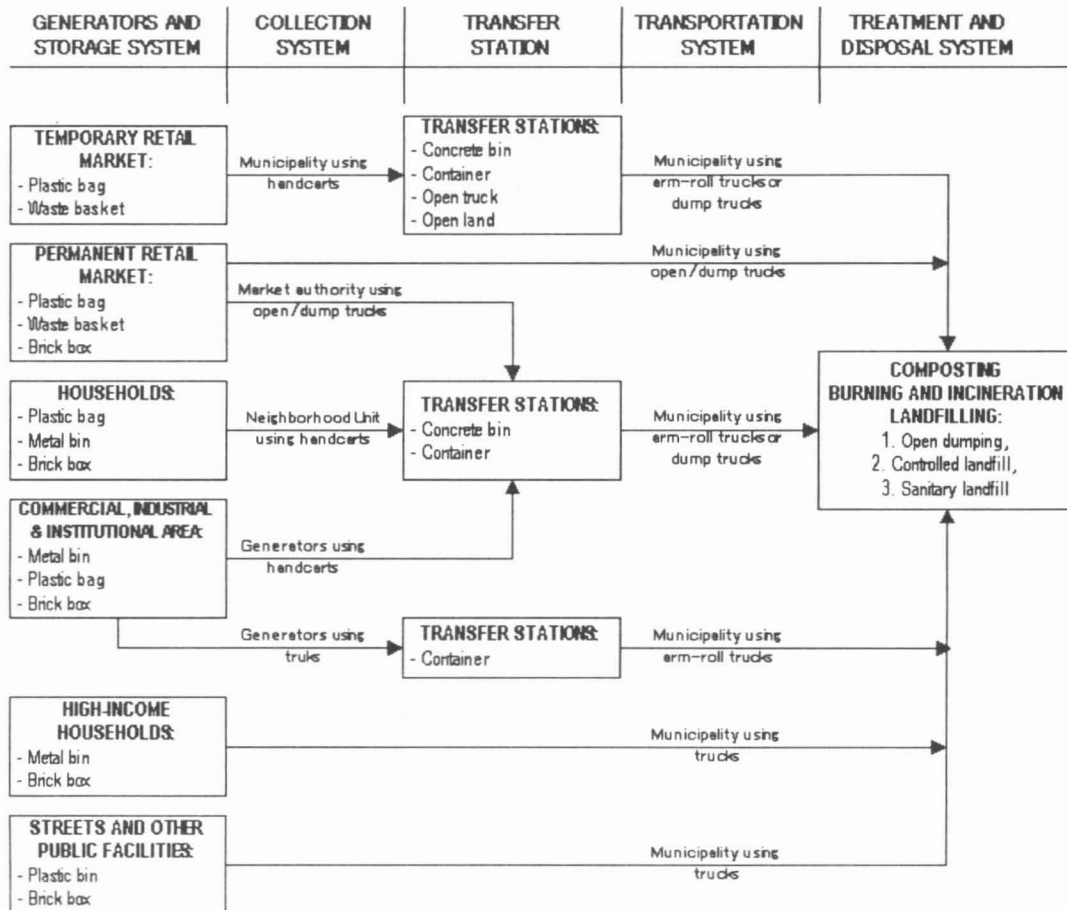


Fig.2 Schematic diagram of waste management system in Indonesia

3.4 Transportation System

Municipality is responsible for the haulage of wastes to the final disposal facilities. Transportation system uses arm-roller trucks or general-purposes trucks in various capacities. The arm-roller trucks equipped with lifting mechanism load the container on it and empty it at the

disposal site. The general-purposes trucks are used for the waste transportation from bin transfer station. Due to the scarcity of land, most of the cities, the disposal sites are usually located outside of the city. In big cities, since the traffic is very heavy, travel time to the disposal site is too long. Thus, daily average number of roundtrips made by vehicle is only two or three.

3.5 Treatment and Disposal System

Composting: Indonesian communities have traditionally used composting to dispose of their organic waste. Composting is the decomposition of organic wastes under controlled conditions to produce soil conditioner, compost, or organic fertilizers. Over the past 20 years, the practice of composting has been decreasing due to the increased use of chemical fertilizers. However, since the beginning of the 1990s, several municipalities and communities have initiated various composting technologies (World Bank, 2003).

In densely populated area of Jakarta, a community consists of 60 low-income families demonstrated a successful vermicomposting project. They could sell the vermicompost for IDR 5,000 to IDR 10,000 (about US\$ 0.52 – US\$ 1.1) per kg. Recently, an open windrow composting is adopted by several communities such as in Cipinang Besar-Jakarta, Cibangkong-Bandung, etc. Individual households in Jatihandap-Bandung utilize a box composting to treat their kitchen and yard wastes. Fig.6 shows composting technologies applied in Indonesia.

Burning and incineration: Burning of waste is practiced in urban and rural areas to get rid of the household waste. Accidental fires are often started at dumpsites caused spontaneously igniting methane gas produced during the decomposition of organic matter. Incinerators are not commonly used by the municipalities. Only Surabaya, Bogor and Padang cities used an incinerator to treat MSW. An incinerator in Surabaya was developed through public-private partnership in 1989. The 200-tons/day incineration facility became operational in 1991. The low calorific value of the waste (between 900-1,200 kcal/kg) caused start-up problems, and fuel had to be added constantly to maintain the combustion process. The plant incinerates only 170 tons per day due to the spatial requirements for the air drying system (Silas, 2002).

Landfilling: A municipality in Indonesia may have more than one disposal sites. Table 3 presents the information about types of disposal practices adopted by different categories of municipal agencies. "Controlled landfill" term is used for the improved open dumping site like the use of soil cover after one or two weeks. There is only one landfill owned by Jakarta municipality: the Bantar Gebang Sanitary Landfill System, which became operational in 1989. Located 40 km from the city, the site is equipped by three compactors. Approximately 5,500 tons of MSW are delivered daily by nearly 1,500 trucks. Sanitary landfill practices are not being followed consistently; for example, soil cover may be applied once every three weeks. Around 640 waste pickers are registered to work at and/or adjacent to the landfill. The operational record of the Bantar Gebang landfill is poor, mostly due to lack of financial resources, properly trained and skilled staff (JICA, 2003).

A decade before, MSW generated in Bandung city was disposed of at several dumpsites. However, due to the land scarcity, recently, the municipality disposed most of their waste at Leuwigajah dumpsite. Leuwigajah was operated by three different authorities, the City and

the Regency of Bandung, as well as the City of Cimahi. The landslide disaster at the Leuwigajah occurred in February 2005, which buried alive at least 140 people, and the site was prohibited for its use. Thus, all old dumpsites like Jelekong, Cicabe, Pasir Impun are forced to receive MSW collected from the contributing city. However, the use of dumpsites could not be extended for long time due to the opposition from the local residents. Now, after rigorous negotiations with the local residents, Bandung city is having a new dumpsite at Sarimukti, Regency of Bandung. The method applied for the final disposal site in Bandung is limited to open dumping.

3.6 Informal Recycling System

Recycling is done mainly by the informal private sector (e.g. waste pickers, garbage truck helpers, etc), and occurs at three points: the generation point, curbside collection point and at dumpsite. They collect various materials including cardboard, plastics, glass bottles, scrap paper, scrap metals, etc. In 1996, the Indonesian Scavengers Association revealed that in Jakarta there are more than 150 facilities that process recyclable material for different industries. The recyclables, mostly paper, glass, metal and plastic are sold to the distributors. The distributor clean, sort, package the recyclable material, and preliminary process it before reselling. However, such kind of recycling reduces the quantity of wastes significantly for transportation to final disposal (Table 4).

3.7 Legal System

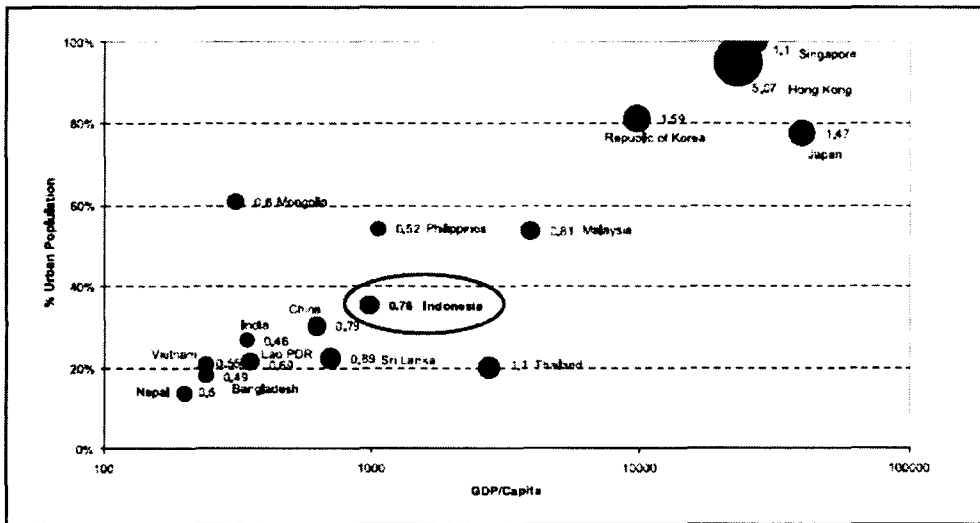
According to Law No. 23/1997 on Environmental Management, waste is defined as the residue of a business and/or activity. The law does not mention about MSW. In 2003, Ministry of Environment supported by JICA issued an academic draft on Waste Management Law. The draft is being discussed in the Indonesian parliament. In the draft, waste is defined as an invaluable organic and/or inorganic solid or semi-solid residue from a business and/or other activities. Regarding with MSW management the Public Work Department has issued: 1. National Standards for estimation of waste generation in small & medium cities and waste generation & composition sampling; 2. Technical guidelines for urban waste management and final disposal site selection.

3.8 Financial Aspect

Financially, MSW management in Indonesia is a municipal responsibility. MSW collection system is carried out by community neighborhood and charging their members a fee. For practical reason, the fee for MSW collection is combined with other community fees which may be for the security and environment improvement. So, the community only pays a single bill for all services in their residential area. The community fee varies from IDR 10,000 to IDR 30,000 (about US\$ 1.1 – US\$ 3.2) monthly per household. The amount of community fee depends on the living condition of the residential area. The amount of community fee is decided amongst community members.

Table 2 Waste generated and collected in major cities in Indonesia (Helmy et al., 2006)

City	Population	Waste generated		Waste collected	
		kg/cap/day	ton/day	%	ton/day
Jakarta	8,792,000 (2004)	0.66	5,802	90.1	5,228
Surabaya	2,599,796 (2000)	0.65	1,689	92.1	1,556
Bandung	2,510,982 (2004)	0.70	1,757	90.8	1,596
Medan	2,036,018 (2005)	0.68	1,384	87.1	1,205
Semarang	1,393,000 (2003)	0.69	961	87.9	844
Makassar	1,130,384 (2000)	0.86	972	94.5	918
Padang	787,740 (2004)	0.90	709	92.5	655
Yogyakarta	511,744 (2004)	0.78	399	93.3	372
Total	19,754,640		13,676		12,378



Note: Size of circles is proportional to unit waste generation
 Source: "What a Waste: Solid Waste Management in Asia," Urban Development Sector Unit, East Asia and Pacific Region, World Bank, May 1999.

Fig.3 Waste generation rate in Indonesia in the context of Asian countries (World Bank, 1999); GDP/capita in US\$

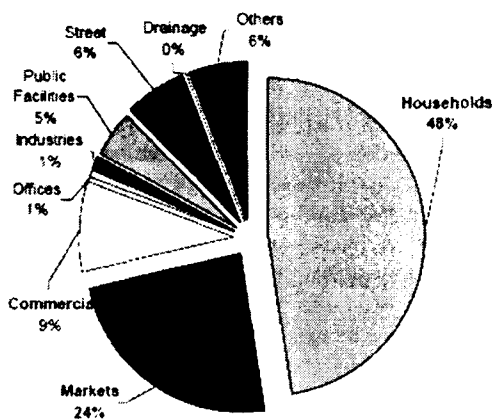


Fig.4 MSW Generators in Indonesia (Helmy et al., 2006)

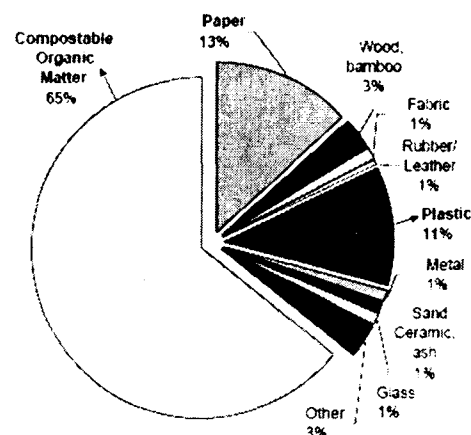


Fig.5 MSW composition in Indonesia (Helmy et al., 2006)

Table 3 Disposal systems in Indonesian cities (MoE, 1997)

Category of municipality	Number	Disposal system		
		Sanitary landfill	Controlled landfill	Open dumping
Metropolitan	6	5	1	-
Big	5	1	3	1
Medium	40	-	19	21
Small	399	-	34	365
Total	450	6	57	387

Table 4 Role of waste pickers in MSW reduction (Listyawan, 1997)

City	Inorganic wastes (m3)	Reduction by waste pickers (m3)
Bandung	55,060	10,610 (19%)
Semarang	30,729	500 (2%)
Surabaya	41,458	12,665 (31%)

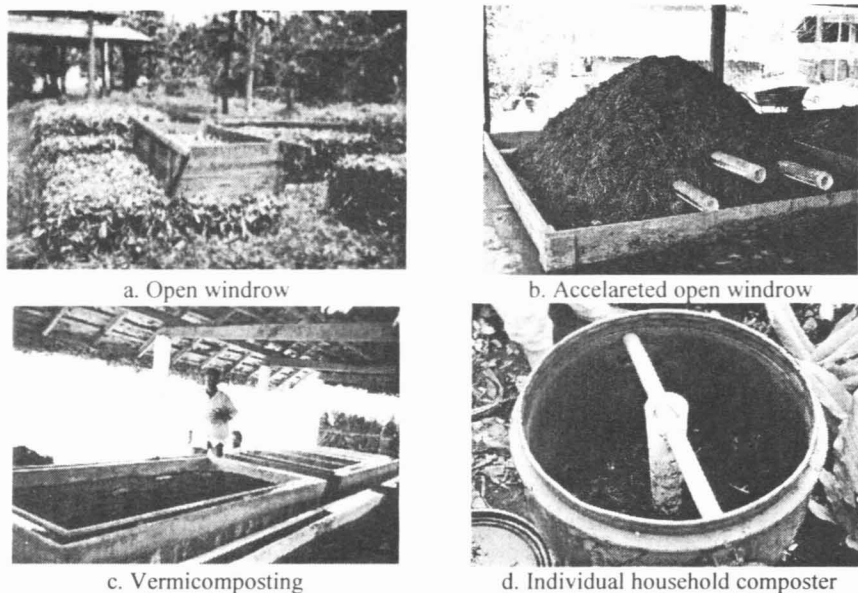


Fig.6 Various composting technologies applied in Indonesia

In addition to collection fee, the citizens have to pay transportation and disposal cost. The monthly fee for transportation and disposal is paid along with water supply (or electricity) bill. The fee may vary from city to city. Every local enterprise has to submit their annual budget for transportation and disposal of MSW. Subsequently, at the end of year, they have to submit their actual expenditure and return the excess amount to the municipality. The fee in Bandung city depends on the power of electricity used, kind of collection system, and the purpose of buildings (Table 5). A budget for MSW management may vary among Indonesian cities. The local enterprise responsible for transportation and disposal of MSW have estimated about US\$ 2.24 million for Bandung city having total population of 2.5 million (Table 6). In case of Surabaya city, the expenditure made by the local enterprise for the year of 2002 was IDR 60 billion (US\$ 6.6 million), which proved to be substantially less to their annual income IDR 15 billion (US\$ 1.6 million). Therefore the balance was provided by the municipality in the form of subsidy.

4 ASSESSMENT OF PREVAILING SITUATION AND PROBLEM IDENTIFICATION

MSW management in Indonesia is becoming more complex everyday due to variety of reasons. The quantity of solid waste is expected to rise substantially due to rising population and increasing waste generation rate. However, the local governments are not equipped adequately to provide the proper service due to lack of the managerial capacity and resources required to shoulder the increasing responsibility. In Indonesia, various levels of government have a stake in SW management. However, that is without clear definition of their responsibility. Moreover, many of municipalities do not have their own landfill and thus have to depend on their smaller neighborhood again without clear understanding. This creates confusion during operation and results in mal-efficiency for the system. This may

give rise to serious accidents like the one at Bandung city final disposal site located in Cimahi city, when hundreds of people have lost their lives. In many such situations, the concerned agencies are always trying to avoid their responsibility and blame others for the miss happening. Thus, the governments in Indonesia face a big challenge to deal with MSW management. The stage wise problems could be identified in the following manner.

Table 5 The collection and transportation fee in Bandung city (US\$/month) (Silas, 2003)

Class	Power (Watt)	Indirect collection	Direct collection	Public facility
I	>6,600	0.78	2.08	0.78
II	>3,600-6,600	0.63	1.83	0.63
III	>2,200-3,600	0.52	1.56	0.52
IV	>1,300-2,200	0.42	1.04	0.42
V	>900-1,300	0.32	0.78	0.32
VI	450-900	0.21	0.52	0.21

Lack of national policy and legal framework for MSW management: A first step to improving the situation is to work out a phased technical and legal framework for waste management. Apart from the adoption of a waste policy, a legal framework is required that enables setting of objectives and targets. A well-elaborated legal framework can assist in effective implementation. The legal framework should also include an effective enforcement system.

Low coverage service for the waste transportation: In general, coverage service provided by Indonesian municipalities is not sufficiently carried out, especially in low income and/or slum areas where the road is too narrow or in the isolated sub-urban area. It has been observed that general purpose trucks are less efficient when compared with the arm roll vehicles as far as the time required for loading and unloading and the quantity of SW being transported. Moreover, waste transportation at rush hours lowers the efficiency of trucks.

Table 6 MSW management cost in Bandung city (Sundana, 2004)

Purposes	Collection	Transportation	Disposal	Overhead	Total
Management cost (thousands US\$)	606 (27%)	807 (36%)	123 (5.5%)	705 (31.5%)	2,241
Unit Cost (US\$/Ton)	1.39	1.97	0.30	1.72	5.37

The use of improper waste storage at the generation points: Most of waste storage at generation points is open bin in which fly, rats and other rodents may easily thrive. The vector may propagate more if the waste is not picked up regularly. The waste storages or transfer stations are sometime overloaded and the wastes spilled which may leach out during rain into the street or ditch. And it may cause the drainage clogged up and may lead to the flood. Moreover, waste pickers, sometimes, litters the space while searching out for the recyclable materials.

Less encouragement for the composting at community level: Recently, many communities initiate the composting in their neighborhoods. However, it is not supported substantially by the municipality. The communities still have to pay the waste transportation and disposal fee at the same price. Also sometimes they do not have a sufficient market to sell the compost produced. The existing composting plants may not operate properly for various reasons (e.g. technical issues, lack of market, comparably low quality of compost produced).

Lack of appropriate final disposal practices: Poor operation of the final disposal site mainly operated as open dump, has resulted in infiltration of leachate to the surrounding areas. Self burning of waste contributes significantly to air pollution. Waste picking at final disposal may not only disturb the waste pickers' health but also reduce the efficiency of site operation such as waste unloading and spreading, soil covering, and compaction of site.

5 STRATEGIC ACTIONS

MSW management should be improved by adopting multi-pronged strategy. It would be necessary to clean the generation areas, widen its coverage, adopt cost effective transportation. It would also be necessary to recover the material resources from the waste and finally disposed of the waste in the environmentally compatible manner. As MSW management is meant for public, it would be necessary to make them aware for their responsibility and seek their participation. Accordingly, five major areas for strategic actions have been identified and discussed below.

Collection and transportation: The efficiency of MSW collection and transportation should be improved through increasing coverage of collection area, cost effective transportation by the use of vehicles and scheduled transportation system. The increased coverage may reduce the waste quantity disposed through improper way such as dumping into rivers, banks, ditches, etc; thereby protecting the environmental quality.

Intermediate treatment: It is considered that composting is appropriate for MSW generated in

Indonesia which is dominated by organic wastes. The technical assistance and financial support should be provided by national and local government to improve the existing composting plants and to encourage composting at household level. The composting at source may help municipality to deal with the limitation of budget for transportation and disposal.

Final disposal: Land use plan should make a provision for landfill facility as per the sources of MSW generation. Municipalities with scarcity of land could share the site with their neighbor cities with clear understanding on sharing the responsibility. Since the beginning, the public should be involved in the project to promote their acceptance. The government should prohibit the development of new open dumping and improve the existing landfill site.

Institutional and financial aspects: Financially, the system could be more stable through public-private partnership. For this it would be necessary to develop appropriate institutional arrangement so that there would be assured commercial viability for private sector as well as fulfilling the social responsibility by the public sector. With careful consideration of income level and regional variety, existing MSW management fee can be redesigned for better service.

Public participation and environmental education: To promote public participation in the MSW management as far as the cleanliness and waste discharge from each household is concerned, the environmental education is quite important. Usually, the adult may not be easily motivated and the opportunity for taking education is restricted if compared with the children. The environmental education for children can be effectively carried out, especially by introducing related subjects in school curricula. Therefore, SWM-oriented environmental education is proposed to be implemented for school children in Indonesia.

In order to achieve the improvement, a detailed action plan is presented in Table 7.

6 SUMMARY AND CONCLUSIONS

Waste is like a mirror that reflects various aspects of a society. The state of a society is closely related to its economic, historical, cultural, environmental and other aspects. These aspects differ depending on the country, city or community, as do waste problems. Understanding the state of a society, therefore, provides a direction to an understanding of the waste problems in that particular society.

Increasing waste generation due to rising population and waste generation rate become a challenge for Indonesian government to establish proper MSW management. Recently, MSW management in Indonesia takes a serious attention at different levels of governments as well as at community level. The

community is taking a part particularly on waste collection from the generation points to transfer station. Generally, the municipality transports the waste to the final disposal site. Due to the land scarcity for landfill, the large city, oftentimes, should place the site at other small neighbor city. It may reduce the efficiency of transportation system. Moreover, the open dumping applied at disposal site worsens the problem. In order to improve the situation, there is an urgent need to act strategically on improving of overall MSW management system. The strategic actions include variety of management aspects such as collection and transportation, intermediate treatment, final disposal, institutional and financial aspects, and public

participation and environmental education.

The efficiency of MSW collection and transportation should be improved through increasing the coverage and to find cost effective system. A composting is the most appropriate treatment for MSW generated in Indonesia and it needs to be promoted further. Final disposal with an open dumping practice should be strictly prohibited and accordingly there is a need to improve the existing sites. Public-private partnership is required to ensure sustainability of MSW management system. The insertion of environmental education into school curricula could be an affective way to promote public awareness on MSW.

Table 7 Strategic Actions of MSW Management in Indonesia

Aspects	Short term	Long term
Collection and transportation	<ul style="list-style-type: none"> - Increasing the coverage with due consider to the existing collection and transportation practices and public awareness. - The large capacity of collection vehicle should be considered for effective transportation. - Timing /scheduling and vehicle routes should be modified. 	<ul style="list-style-type: none"> - Improving the coverage gradually along with promotion of public awareness. - Privatization of collection and transportation service for better efficiency. - Separate collection should be promoted for effective utilization of recyclable material. - Establishing modern transfer station by utilizing old dumpsites.
Intermediate treatment	<ul style="list-style-type: none"> - Providing technical assistance and financial support for composting in each municipality - Improvement and rehabilitation of existing composting plant. - Encourage the use of individual composting at each household. 	<ul style="list-style-type: none"> - Introduction of recycling facility. - Establishing the sufficient market for compost. - Organizing the recycling route for recyclable materials.
Final disposal	<ul style="list-style-type: none"> - Illegal dumping should be strictly prohibited - Improvement of operational management existing landfill sites, especially for proper soil cover and leachate treatment. - Building consensus for regional landfill among the contributing municipalities. 	<ul style="list-style-type: none"> - Utilizing old dumpsites as modern transfer stations. - Proper reclamation plan for used landfill site. - Utilizing the methane gas produced in the landfill.
Institutional and Financial aspects	<ul style="list-style-type: none"> - Establishing an institutional system of promotion for 3R by internalizing informal recycling system. - Introducing tariff system based on quantity and composition of waste. - Introducing the incentive scheme in MSW management activities to private sector. - Human resource development through professional training at various level of management 	<ul style="list-style-type: none"> - Establishing deposit system for promotion of 3R for some material. - Subsidy for private sector engaged in 3R activity. - Establishing private sector in MSW management service.
Public participation and Environmental education	<ul style="list-style-type: none"> - Informing to public about waste management by publishing report, leaflet, etc. - Initiating environmental education for students. - Increasing public participation on waste collection as well as the monthly fee. 	<ul style="list-style-type: none"> - Implementing environmental education for each level of education system. - Establishing waste recycling system at source. - Development of community based waste management system.

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