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Practical Case Study

PRIORITY IMPROVEMENT OF SOLID WASTE MANAGEMENT PRACTICE IN JAVA

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Abstract: This report describes service scheme and some significant weak points for current solid waste management. The study area covers big cities in Java where population are concentrated, representing high quantity of solid waste which was pressing problems in most urbanized cities. The service management was administered by community and local government agency. Community and local government based services were accounted respectively for 10 – 80 % and 20 – 90 % of the total weight of waste. High proportion of community service did not truly represent community participation for clean and healthy environment since inappropriate handling was led to pollution. Inclusion of waste picker in the management scheme who reduces total weight of less than 10 % was insufficient in reduction of waste disposal. However, they have to be considered for existence since they live mainly from the sales of recycled materials. In the near future, socio-behavioral improvements need to be prioritized in these areas instead of pressing technological approach.

Keywords: Community involvement, service level, waste pickers

INTRODUCTION

Indonesia recognizes the establishment of the sustainable development paradigm as the international norm. Programmes have been addressed that includes the three main pillars of sustainability, i.e. society, ecology, and economy (SEE) [11]. Development should bring about benefits to the whole community, must mitigate or reduce negative impacts that are caused by exploitation of resources, and economically must increase the overall affluence of society. During rainy season 2006/2007, Jakarta was suffered from floods as well as many big cities in Java. This was not only an acute disaster but it was chronically happened. In addition to naturally high intensity of rain, the causing sources were very complex from ecological perspective, involving

anthropogenic miss management. In this human based management, solid waste was one of sanitation aspect which pressing issue in most big cities, western Java in particular during the last ten years [4 - 10]. With a population of more than one million people, metropolitan cities faces numerous environmental issues, pertaining to the management of domestic solid waste, particularly as an ever-increasing portion of the population strives to increase its standard of living.

The object of a solid waste management is broadly to collect, transport, and eventually dispose of waste in a hygienic and aesthetically acceptable manner at the lowest possible cost [3]. During the last ten years, the management paradigm has been changing to intensively reduce, recycle and reuse materials in an attempt to achieve low cost services by local government [4 – 10]. Some activities were formulated by Government of Indonesia in 1997 and presented in Agenda 21 [11]. These activities were to be implemented in the period 1998 –2003 that include composting, marketing strategy, education and awareness programmes that promote the use of compost and encourage active participation in composting activities, and provide incentives for consumer and producers to use compost. Local government strongly encourages community to manage their waste at the source with some stimulants such as the provision of separate small containers and small carts [1 - 2, 4 – 10]; however, the technological approach is still ineffective. Therefore in an effort to put this into context of anthropogenic miss management, this study reports solid waste management practice with an aim to learn weak points and suggest an improvement toward sustainable three pillars development.

MATERIALS AND METHODS

This study was established with the help of documents provided by local governments (ASERs and its associated documents), and site visit to several big cities in Java since 2003. Study area includes Jabodetabek from the names Jakarta, Bogor, Depok, Tangerang, Bekasi as well as the western Java cities of Serang, Bandung and Cirebon, and the east Java provincial city of Surabaya. The current study had been limited to urban activity and domestic wastes since solid waste management was a pressing issue in the areas.

Daily quantity of waste from households was observed for high income settlement of Surabaya. High income settlement was chosen with an assumption to represent the highest quantity of waste according SNI 19-3964-1994 [13]. Observation was carried out daily during the period of first week, second or third week, and fourth week. Monthly observation was organized twice a year, representing dry and wet season. Measurement of the waste quantity as well as composition was carried out in accordance to national standard on solid waste [12].

RESULTS AND DISCUSSION

Service Scheme

Solid waste management was identified as a typical scheme within the study area (Fig. 1). Collection, transfer, temporary disposal and final disposal chain was shared by the waste generators, the local community organizations (RT and RW) and the local government cleaning agency (Dinas Kebersihan).

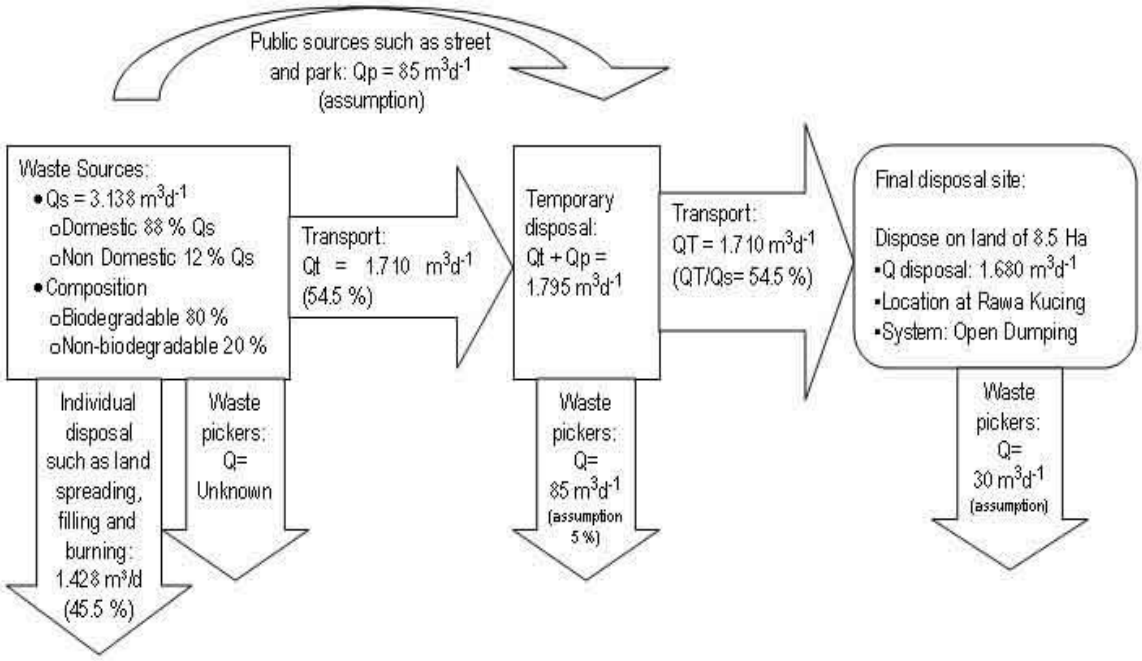

Fig. 1: Typical scheme of solid waste management in Java (example for Kota Tangerang)

Waste generators were responsible for the collection of their own waste by means of distributing plastic sacks, buckets or small containers which were then collected. A typical capacity of bucket or small container was in the range of 100 – 500 L. In order to evaluate the sufficiency of small container capacity, daily waste quantity generated by households for Surabaya is presented in Fig. 2. It shows waste was generated in highest quantity as well as its fluctuation in the first week. This was probably associated to when householders received monthly salary. Waste collection was carried out twice a week and hence, accumulated waste in the bucket or small container was 6 L cap^{-1} on daily average and 9 L cap^{-1} on maximum days. Each household has an average of five people and thus capacity of bucket was sufficiently 45 L. Additional space is required to take into account size variability of waste, therefore, the existing bucket or small container of 100 L was a sufficient capacity to be provided in each household.

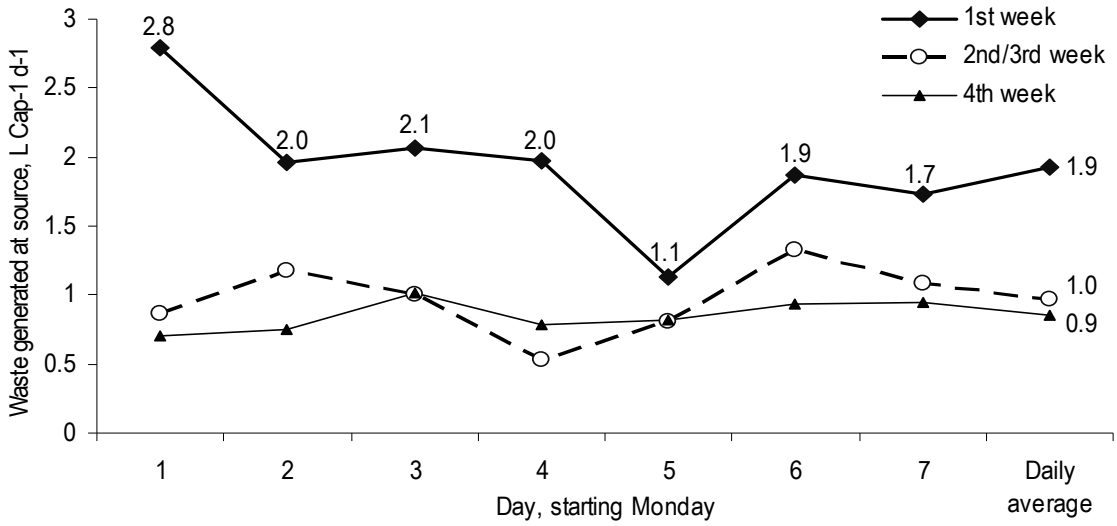

Fig. 2: Daily quantity of solid waste for Surabaya

A community group covering 40 – 60 households is organized as one RT as the smallest local community organization. RW consisting of 5 – 7 RTs was responsible for the haulage of its collected waste to the nearest temporary waste disposal. Collection and transportation as well as the provision of small carts [1, 2] were financed by households that were organized by RT and RW. Capacity and number of carts were not limiting the waste collection activity.

The temporary disposal station is called LPS or TPS which is classified into "landasan" and "depo". Landasan has an area of about 100 m^2 whereas depo encompasses 200 – 300 m^2 for storage and administrative office. Both landasan and depo were built with reference to national standard [12], and practically they have the same capacity of about 50 m^3. Solid waste was collected from the temporary stations to the disposal site (LPA or TPA) using open dump trucks and/or arm roll trucks with container. Transportation from the LPS or TPS to the LPA or TPA as well the provision of temporary stations were organized and financed by the Dinas Kebersihan. LPA or TPA was provided by Dinas Kebersihan, and the area provided mostly depends on the availability of land for solid waste disposal.

The current service scheme is clearly characterized into two organizations. Community-based service is conducted from waste generators to transfer activity into temporary disposal station. Local government agency based service covers the temporary and final disposals chain management practice.

Weak points

Quantity and composition of solid waste in each part of the scheme (Fig. 1) were different among the cities. However, generally the transported solid waste from temporary disposal sites and final disposal on land were significantly less than the generated quantity. Table 1 shows the amount and composition of solid wastes that were generated at source, transported from temporary disposal sites to final disposal site and service proportion of community to local government. In addition, waste pickers are included to rate their contribution in reducing waste disposal. Kota and Kabupaten are administrative classification of the study area. Quantity of solid waste in tonne day^{-1} was derived from the bulk density of 0.25 tonne m^{-3} and the results were rounded.

Table 1: Solid waste quantity and service proportion

Study area	Waste generated at source (tonne day^{-1})	Waste transported from temporary stations to final disposal site (tonne day^{-1})	Service proportion, community (%) : local government (%)	Waste pickers contribution (% of the total weight)	Proportion of waste composition, biodegradable (%) : non-biodegradable (%)
Kabupaten Serang	170	45	74 : 26	< 1	-
Kota Tangerang	750	400	45 : 55	4	80 : 20
Kota Jakarta	6,000	5,300	12 : 88	3	65 : 35
Kota Bekasi	1,100	260	76 : 24	< 1	70 : 30
Kabupaten Bekasi	290	210	18 : 72	< 1	70 : 30
Kota Depok	750	230	69 : 31	< 1	-
Kota Bogor	520	360	31 : 69	10	75 : 25
Kota Bandung	2,000	1,550	22 : 78	< 1	65 : 35
Kabupaten Bandung	2,250	400	72 : 18	< 1	65 : 35
Kota Cirebon	150	130	13 : 87	4	75 : 25
Kota Surabaya	2,200	1,300	40 : 60	4	65 : 35

Some householders have taken up the custom of burning the waste in front of their house or at the curbside or dump it on unused land or in rivers and canals, particularly when official collection is lacking. This has serious environmental consequences, such as local air pollution and increased incidence of flooding. Intermediate storage of waste along roadsides also attracts pests, animals and waste pickers. The potential environmental problems were embedded in the service proportion by community (Table 1). Thus, a high proportion of community service did not truly reflect high community participation for clean and healthy environment. This was supported by Sutomo [14] in her work with young generation's attitude towards the environment.

Most householders put unsorted solid waste in buckets or small containers. There were many householders have undertaken separation and put the separated waste in well packed plastic sacks. However, often before waste was collected, it was picked over by waste pickers who salvage materials that can be used again as is or sold to a recycling dealer. These waste pickers can disarrange separated waste. The workers on the collection carts often try to earn extra money. They may have contracts with junk dealers, by sorting out materials from the carts and/or temporary disposal site. Their secondary informal activity was nothing less than waste picker activity. As a result, solid waste was collected unsorted from households and from temporary disposal stations.

Transportation of waste from temporary disposal stations to the disposal site was often time consuming. A collection vehicle took several hours just to travel from the city to the landfill site because of the heavy traffic and crowded streets. Therefore most collection vehicles could undertake only 1 - 2 trips per day. Trucks were provided by private companies who are contracted by local government agency (Dinas Kebersihan). Trucks were often ancient and in poor repair. Often trucks were overloaded and waste spills out that brought about lose part of their load during their trips to the disposal site. Some modern compaction trucks were provided, however, they were equipped with chassis that are too weak to cope with the poor road conditions. These effectively reduce the number of trucks in the collection fleet.

Upon arrival at a final disposal site, a truck was lead to the active section of the dumpsite on tracks. There was no weighbridge at some of the dumpsites and inconsistent control of the total weight and volume of waste delivered due to the high frequency of truck arrivals. In addition, the actual operation of final disposal of solid waste deviates significantly from the technical sanitary landfill design. It was practically uncontrolled open dumping without ground water protection or monitoring and the leachate from the waste pollutes groundwater and/or rivers. A particular argument by the operator for uncontrolled open dumping was to allow waste pickers in sorting out all plastics, textiles, metals, etc. It is a common situation that waste pickers build temporary houses as well as permanent ones nearby and at final disposal sites. They live mainly from the sales of recycled materials. Particular conditions at final disposal were no real green buffer zone. If there is green zone, temporary houses of waste pickers were built within the zone.

It is important to note for a common word of "not in my backyard" (NIMBY). This was a paradigm attitude of householders. No one wants waste disposal is placed near the houses that it was probably due to no protection mechanisms such as land filling and green barrier. From the side of waste pickers, the NIMBY was realized into "now I must be involved" (NIMBI). It is good idea too apply NIMBI such as picking up reusable materials at any point of waste disposal, however, it failed in practice.

The appropriate NIMBI were identified for composting biodegradable waste by private sectors. This was supported by the fact that at least 65 % of total waste was biodegradable one (Table 1). There is good potential for large-scale composting to improve the management of municipal solid waste. However, most composting process was not operated in sufficient time to produce stable and mature compost. Composters were used to add microbial starter in order to

speed up composting process and no product quality assurance was provided. Positive image for compost should be maintained, however, it has to be governed by a set of regulations that prescribe its characteristics, leading to scale up the compost industry.

CONCLUSIONS

The weak point of current practical solid waste management was mainly socio-behavioral aspects. Knowledge of appropriate management and attitude were inconsistently practiced and hence, an effective waste management must become a priority for the local governments in order to prevent severe environmental degradation. Some suggestions to be considered to minimize the current problems mentioned above are at least as follows: 1) provide neighborhood advisory committee (NAC) for solid waste management in each part of management scheme, i.e. collection at household level, transfer activities, temporary disposal stations, and final disposal sites; 2) enforcement of laws and regulations on waste disposal; 3) introduction of well organized recycling systems; 4) more public support and attention for non-government organizations; 5) environmental education at schools concerning the needs of proper waste disposal and recycling; 6) more encouragement and enforcement for practicing NIMBI properly such as waste separation, reduction, reuse, recycle, good safety practice at any stage of management scheme and therefore, it involves all people at all level of solid waste organizations.

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