FROM CENTRALIZATION TO DECENTRALIZATION OF SOLID WASTE MANAGEMENT

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Abstract
The problems associated with the management of solid wastes in today urban areas in Indonesia are complex because of the quantity and diverse nature of the wastes, the development of sprawling urban areas, the funding limitation for public services in many large cities and most of all is the difficulty in finding location for landfill. In most cities, a solid waste management system comprises four functional elements as they adopted from western textbooks, namely: waste generation, on-site storage, collection and disposal, centralization system. However, this system fails to provide the most efficient and economic solution, commensurate with all constraints imposed by the users of the system and those affected by it or according its use. The waste generation is at present an activity that is not very controllable. On-site storage requires a large and continuous effort. These wastes cannot be tolerated for long time because of their biodegradability, and they must be moved within a reasonable time. Bandung has experienced long delay for collection which cause not only problem with aesthetic, but also strong odor, and nuisance to the whole city. Disposal is the ultimate fate of all solid wastes, whether they are residential or others. To find a site for landfill in Java is almost impossible since an empty land meeting the environmental impact statement and without creating nuisances and hazard to public health such as contamination to ground water are not available. There is only one solution to solve solid waste problem - decentralization of solid waste management. What is important in the decentralization system is to control and to reduce the quantity from waste generation. From the stand point of efficiency, the best place to sort waste materials for recovery purposes is at the source of generation. Homeowners are expected to be more aware of the importance of separating their own wastes - between organic and inorganic. On-site composting in every household or off-site composting in every neighborhood is a practical option.

Keywords: centralization; decentralization on-site composting

INTRODUCTION

Garbage has always been an element of civilization. Garbage is part of sanitation, and it is true when Stobart in 1935 mentioned, "there is no truer sign of civilization and culture that good sanitation" (Corbit, 1989). However, as the public in every city in Indonesia has become increasingly concerned about environmental threats and resource conservation, it has become less accepting of waste. This holds true, for example in the Bogor Municipality where some aspects of managing solid wastes have proven difficult to solve. Until recently, little emphasis was place on on-site treatment.

Given the current rate of waste generation, people in the municipality will soon require more land for disposal, and local sanitation department will require more money for collection and transportation. In this so called Rain City, disposal practices of open
dumping at Dreded, Rancamaya and Galuga have had adverse environmental effects especially into groundwater of its neighboring areas. Changes from centralization system as practices in most cities all over the world thus required in the way Bogor Municipality, and all parties concerned manage into more decentralization of their solid waste. It is based on the concept of shifting solid waste from inadequate centralization towards more manageable divisions of neighborhood areas. Recycling, reusing, and composting methods are integral to this process.

OBJECTIVE

This paper has several important theoretical objectives and practices. First and foremost is to create a model on which to base future solid waste management and recycling system called Solid Waste Neighborhood Self Management or SWNSM. The SWNSM practically has been applied in one real estate in Bogor of 100 families - Bogor Raya Pelem. The second objective is to channel the sanitation department’s limited resources into the key areas of transportation and human resources. The third is to promote recycling and reuse of goods and materials, by enhancing opportunities for recycling throughout the municipal area. Finally, the last objective involves increasing awareness and understanding regarding the need for waste reduction, the potential for recycling, and the value of discards and residuals that yield secondary materials.

SOLID WASTE MANAGEMENT PROBLEMS IN BOGOR

The rapid rate of population growth in Indonesia’s cities has far outstripped the available resources and technology intended to deal with such increases. In many Indonesian urban development areas, adequate infrastructure is woefully lacking and is failing to keep pace with development. The municipality of Bogor is typical of the surrounding cities of Jakarta megalopolis. Specifically, population growth and area expansion have greatly overextended city infrastructure resources especially in the area of solid waste management.

Because solid waste management is a dynamic field, there is no ‘best’ method for all problems that arise (Tchobanoglous, 1977). However, in the situation being considered, there are four important issues that must be taken into account in order to determine the impacts of alternative courses of action.

First, Bogor’s urbanized area has more than double in the last five years, increasing from 5,255 ha to its present area of 11,850 ha. Consequently, the population has grown from less than 711,513 in 2000 to 831,571 in 2005. Thus, both the population and service area have changed a great deal.

Second, with a total population of 831,571 in 2005 and a growth rate of 3% a year, Bogor has become a large city with relatively complex problems. Of the amount of money spent on the collection, transportation, and disposal of solid waste, approximately 60 to 80% was allocated on the collection phase. New estate developments which spread from east to west and from south to north theoretically require new methods in setting up collection routes if they are to be handled as part of a centralized system. This fact is important because a small percentage improvement in collection operation costs can effect significant savings in the overall costs.
Third, disposal is currently a ‘no alternative’ option because it is the last functional element in the solid waste management system, and is the ultimate fate of wastes that are of no further value. Owing largely to a scarcity of available land, Bogor has already experienced great difficulty in finding adequate landfills to meet the needs of waste generation rate which has doubled during the past decade. The municipal government has proposed an extension of Galuga landfill site (9.6 ha) of approximately 22 km north of Bogor. Technical evaluation and community acceptance of that location are being discussed, but some local leaders are reluctance to give up their land for open dumping site.

Forth, technical, financial and institutional resources and capabilities are greatly restricted, thereby limiting Bogor’s waste service coverage to less than 55% of the total area. The environmental sanitation department collects and transports of only 1,218 m3/day garbage while its total production is 2,204 m3/day. This office has only two engineers responsible to design and operate all the systems. Since 2001 the annual operations budget has been relatively stable at 9,302,171,000 to 11,975,335,833 Rupiahs and only 17% directly paid by the people (see Table 1. below).

<table>
<thead>
<tr>
<th>Year</th>
<th>Expenditure (Rupiah)</th>
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<tbody>
<tr>
<td>2001</td>
<td>9,302,171,000</td>
</tr>
<tr>
<td>2002</td>
<td>10,242,705,000</td>
</tr>
<tr>
<td>2003</td>
<td>10,850,444,000</td>
</tr>
<tr>
<td>2004</td>
<td>11,675,335,833</td>
</tr>
</tbody>
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Table 1. Annual expenditure of Cleansing Department

Given its relatively small retribution, as well as limited human resources, it is very difficult for the department environmental sanitation to serve the whole area.

**METHOD**

Successful implementation of the decentralization system like SWNSM requires cooperation in all aspects of the operation. There are four basic strategies of the SWNSM action plan.

Firstly, neighborhood management should be responsible for gathering information, organizing, model maintenance and supervision as well as the promotion and marketing of the recycling and reuse of components (including composting). Secondly, real estate developer should donate a parcel of land for composting and recycling activities, as well as for small landfill site if necessary. Thirdly, neighborhood community organization which consist mostly woman and housewives, should assist the management by separating their household garbage into wet (organic) and dry waste (in-organic) in different containers.
Fourthly, workers recruited from neighborhood must be responsible for the day-to-day process of collecting, recycling, and composting.

![Diagram of Solid Waste Management System]

Figure 1. Solid Waste Neighborhood Self Management System

DATA, ANALYSIS AND DISCUSSION

Although the estate of Bogor Raya Permai is relatively small, the information and data on the physical composition of solid wastes are important in the selection and operation of equipment, assessing the feasibility of resource recovery, and in the analysis and design of SWNSM. The data in Table 2 are derived from day-to-day experience in Bogor Raya Permai.

Table 2. Physical Composition of Bogor Raya Permai Solid Waste

<table>
<thead>
<tr>
<th>No</th>
<th>Source of waste</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Food waste &amp; organic waste</td>
<td>63.1</td>
</tr>
<tr>
<td>2</td>
<td>Mix paper</td>
<td>6.7</td>
</tr>
<tr>
<td>3</td>
<td>Mix plastic</td>
<td>14.3</td>
</tr>
<tr>
<td>4</td>
<td>Textiles</td>
<td>1.7</td>
</tr>
<tr>
<td>5</td>
<td>Rubber and leather</td>
<td>0.6</td>
</tr>
<tr>
<td>6</td>
<td>Yard waste</td>
<td>6.3</td>
</tr>
<tr>
<td>7</td>
<td>Glass</td>
<td>2.1</td>
</tr>
<tr>
<td>8</td>
<td>Ferrous</td>
<td>2.3</td>
</tr>
<tr>
<td>9</td>
<td>Aluminum</td>
<td>0.1</td>
</tr>
<tr>
<td>10</td>
<td>Others</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Given the high percentage of organic waste material, the management of SWNSM recommended that residents compost the material either in their own yards (on-site) or composted collectively by the workers in the communal site. The family composter is
designed by Research Center for Human settlement, Ministry of Public Works made from recycled plastic with a diameter 50cm and a height of 80cm.

Cost analyses for project operation and maintenance are as follows: first, the annual landfill cost per household of 100 families = US $ 0.48 x 100 = US $ 48; landfill cost avoidance is thus $ 48. Second, the annual land haul cost is $ 2, land haul cost avoidance is thus US $ 200. Third, revenue from the sale of compost is approximately US $ 800 per year. Fourth, the cost of processing, including labor is US $ 1,200 per year. Fith, fees collected households total US$ 1,200.

CONCLUSIONS

Given the shortage of final disposal sites, the present systems cannot cope with disposal anymore. It is therefore necessary not only to restrain the increment of waste, but also to lessen it. It is possible to reduce the volume of waste disposed in landfills if citizens, the national government, and the private sector (including industries) establish reduction methods and works towards their implementation via a self-disposal system, rather than a centralized system.

Making the decentralization of solid waste management like SWNSM pay off is not easy and making people understand the importance of self-management is a challenge. Persuading neighborhood members to actually comply with a mandatory source-separation policy is nevertheless is a challenge too.

REFERENCES


Discussion Session

1. Comment: Housewives don't like garbage separating. Is newspaper separated to be sold? Used clothes are also reused by themselves. In Surabaya up to 30% is recycled by scavengers?
   Answer: The presentation is just in my residence.

2. Question: The composted material could be used only for flowers? How about food production?
   Answer: It can be used for fruits. I will consider animal feeding, next.

3. Question: Near the sea area, they throw it. How do you think how can we solve it?
   Answer: Education and strong enforcement. Education is one of the important solution. We have to teach that waste management needs money.

4. Question: Introduction of recycling system will period good chance to change their mind?
   Answer: Introduction in practice is easy, but in actually, it is costly, expensive.