Eco-City Planning In Developing Countries: The Role of Organic Waste Management

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Abstracts

This report aims to indicate challenges and future possibilities for Eco-City planning in terms of the role of organic solid waste management in developing countries. Eco-City, which seeks to reduce garbage and energy consumption, and recycle and reuse waste, has attracted our attention as a concept for sustainable urban development. Awareness of the concept of Eco-City planning is increasing in municipalities or cities in developing countries with rising environmental concerns. Among municipalities or cities in developing countries implementing Eco-City projects, Namakkal in India and Surabaya in Indonesia have played advanced roles in organic waste management, which is considered a part of the Eco-City program. The two cities have successfully achieved their goals with a community-oriented approach, although they face budget constraints in the same way as most cities in developing countries.

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1. Introduction

The idea of the eco-city approach emanates from the application of ecological principles to urban planning, design and implementation to ensure sustainable development. Eco-city planning in urban management is reflected in three aspects. First, a city is viewed as a system of economic, social and environmental processes with resource input and output characteristics. Second, cities are part of the global ecological system, which affect and are affected by natural ecological processes. Third, ecological principles such as carrying capacity, ecological value, diversity, ecological chain, resource management and ecological footprints are equally relevant in urban planning processes (Stanley C.T. Yip, 2008). In urban planning, the focus should be on not only spatial issues such as location and physical structures (tangibles), but also the use of scarce resources such as energy, food, water and clean air (intangibles). In urban planning, the tangibles (spatial) should therefore be carefully integrated with the intangibles (non-spatial) to ensure sustainable city development (Stanley C.T. Yip, 2008).

There are several building blocks that are pulled together to create an eco-city. They include parks, water supply, sewerage, solid waste management, energy efficiency, air quality, transportation, land use, housing and community development, and economic development (Stanley C.T. Yip, 2008). The focus of this paper is to discuss how solid waste management can be used as one of the instruments in eco-city planning in a developing country context. This study intends to review existing organic solid waste management policies in some Asian developing countries and suggest appropriate policies to resolve problems associated with organic solid waste generation, collection and disposal. The rest of this paper is structured as follows: section 2 discusses the issue of solid waste management in developing countries; section 3 describes the objectives of this study; section 4 and 5 review existing waste management policies in selected Asian countries; section 6 reviews the appropriate menu of policies to help developing countries solve problems associated with waste collection and disposal; and the final section is the conclusion.

2. Solid Waste Management

Solid waste generation in urban areas continues to grow, due to the pressures of high population, consumption and industrialization. Organic waste poses health threats in many heavily populated cities in the developing world. In some cities, organic waste is deposited in open dumpsites creating a nuisance and health hazards for neighboring communities. To reduce immediate health hazards and the leakage of environmental pollutants, local governments tend to upgrade their dump sites to landfills, fitted with gas and liquid effluent (leachate) recovery systems. This technique is considered to be an unsustainable solution to organic waste management in the long term. There are few suitable landfill sites in the face of land scarcity in many cities. Substances leached from landfill sites also contaminate surrounding soil, plants, surfaces and underground waters, not to mention methane, a powerful greenhouse gas, generated from the degradation of organic materials. According to IPCC (2007), effective management of the waste sector can prove invaluable for climate protection in the long run. Biogas resulting from the decomposition of organic waste under anaerobic conditions consists of about 50% methane, which has a radioactive forcing 25 times higher than CO_2, and is currently the second largest contributor to global warming after CO_2 (IPCC 2007). Emissions from waste are already significant and expected to increase further due to economic growth and changing consumption patterns in developing countries.

2.1 Organic Waste Treatment and Disposal

The most common handling methods for solid waste in developing economies are open dumping and simple landfills, due to the low investment and operational costs. Efforts to upgrade open dumps to landfills are constrained by concerns about emission of methane gas, especially in deep, compacted landfills under anaerobic conditions. Waste management under these conditions will only transfer local problems to the global problem of climate change. The good news is the availability of alternative treatment methods, which can contribute to improved waste management without far-reaching consequences for the global climate. Broadly, there are three organic waste management techniques. They are waste reduction, improved landfill-based and thermal and biological treatment methods.

The most fundamental strategy for sustainable waste management is the waste reduction approach, and any waste management plan should incorporate some waste reduction efforts because of the benefits of saving resources and reducing costs. The preferred solution is generally considered to be prevention rather than clean-up under the so-called four R's of

“reduce”, “reuse”, “recycle” and “recover”. The best way to reduce waste is by not creating it in the first place, which requires changes in consumer habits, attitudes and practices. Two systemic approaches to encourage source reduction are Life Cycle Analysis and Cradle-to-Grave management. Reuse is common among bottle industries and it provides huge financial and environmental benefits. Recycling means to pass an object once again through a series of changes or treatments with a view to its reuse, and this technique is common in paper, plastics, glass, and metal industries. Recovery means to apply a waste object to a new use by extracting energy or a use from it. A popular option is waste-to-energy facilities that burn waste for fuel to produce heat or power for domestic or industrial use. The benefits from the above-mentioned measures include waste reduction, energy savings, cost savings and reduction of the extraction of virgin raw materials. It is imperative to note that significant waste reduction can only be achieved if households change their consumption patterns and daily habits in positive ways, especially in most developing countries. Experiences in developing countries show that households composting for their own use and feeding of domestic animals can be used as waste reduction methods.

Improved landfill-based methods are categorized into landfill gas treatment and mechanical biological treatment methods. Under landfill gas treatment, part of the landfill site is covered and the gas produced in the cell is collected through a system of pipes. The gas, if not flared, can substitute for fossil fuels thereby contributing to the reduction of greenhouse gas emissions. Under the clean development mechanism (CDM) guidelines, a gas recovery rate of 50% is recommended in project proposals but gas recovery systems are not entirely suitable for treating organic waste. Using oxidizing cover layers can also reduce methane emissions from landfills. With these well-aerated layers, methanotrophic bacteria can decompose the methane. The efficiency of oxidizing layers is influenced by layer thickness, layer substrate, temperature and humidity (Chiemchaisri 2008).

Methane can also be reduced through aeration of the whole landfill. By installing a piping system and pumping air into the landfill cells, it is possible to reduce the prevalence of anaerobic conditions and thereby methane generation. In mechanical-biological treatment (MBT), unsorted waste undergoes pre-treatment before disposal in landfills. Common MBT pre-treatment systems includes mechanical separation where recyclable materials such as ferrous metals and plastics are removed, and biological treatment where the organic fraction is partly degraded under anaerobic or aerobic treatment. MBT can reduce the volume of the waste by up to 40% and lower the leakage and gas emissions from landfills significantly (Visvanathan et al. 2005). If the treated waste contains low levels of pollutants, it can be used for landscaping. In China and Thailand, some MBT systems have been installed through financial and technical assistance from Germany. In most of these cases, the technology is simplified with more manual separation and only aerobic treatment.

Incineration, composting, anaerobic digestion and animal feed are the main thermal and biological treatment and disposal methods. Incineration has the advantage of effectively eliminating huge volumes of organic waste that may pose hygienic hazards. Incineration is not attractive in developing countries because organic waste is wet with low caloric content and thereby requires extra fuel such as coal to incinerate (Solenthaler and Bunge 2005). In the face of emissions of highly toxic dioxins and other pollutants, high investment costs combined with advanced technology are required to make incinerators efficient. Composting is an aerobic process where micro-organisms decompose organic materials under controlled conditions. Composting can be done by individual households or at a centralized compost site. The residual product is pathogen-free and it can be used for improving soil structure and nutrients especially in sandy and clay soils with low organic matter content. Compost can also be used to improve the water holding capacity of soil in arid regions. Poor management of the composting process can, however, generate a bad smell and even spread vector-bone diseases. Vermi-composting can generate significant amounts of N2O gas (Hobson et al. 2005). Experiences from the developing world indicate that it is a more appealing approach to waste management as it is technically uncomplicated and can be a good alternative to using landfills in urban settings. Anaerobic digestion is used in the treatment of agricultural waste, organic industrial waste and municipal waste. The process used is basically the same as in a compacted landfill except that the process takes place in a closed tank from which the gas is collected. Anaerobic digestion generates fewer odors than composting and a digester requires less space than a composting facility with similar capacity. The gas can be used for energy generation, can replace fossil fuels, and the residue can be treated in an aerobic process and used as fertilizer. There are fears of high leakages of methane from tanks especially when this method is employed in developing countries. Disposal of food waste as animal feed plays a minimal role in the handling of organic waste in developing countries.

In summary, it is not advisable from a sustainability point of view to dispose of organic waste in landfills without pre-treatment or gas control. Landfill gas recovery and use of oxidizing landfill covers have important roles to play for reducing future GHG emissions from existing landfills.

It is imperative to note that each individual technique mentioned above cannot completely address problems such as gas emissions, lost valuable nutrients and water contamination, and the necessary precautions should be taken when applying these techniques in waste management. Efficient management of organic waste therefore requires innovation from city managers to

draw synergies from various waste handling techniques.

2.2 Solid Waste Management Policy

Waste management policy is largely driven by the policy objective(s) of waste management. Broadly, there are five waste management objectives: public health and sanitation, environmental safety, waste minimization, resource recovery and climate co-benefits (Hedzri, 2009). For instance if the objective of the policy is environmental or public health concerns, then landfills or open dumping may be preferred. If the policy objective, on the other hand, is waste minimization, resource or climate benefits, composting, waste treatment or recycling may be preferred.

Over the past few years, waste management authorities have been gravitating towards the use of waste hierarchy (3Rs) policy, as financial and technical constraints make it difficult to sufficiently provide waste collection and disposal services in the face of sprawling urban growth in many developing countries. Further, the public demand for environmental quality and the concern for low emissions of Green House Gases (GHGs) have made open dumping and uncontrolled landfills untenable to many waste management authorities in developing countries.

Waste management policy based on the principle of the waste hierarchy marked a shift from the 'end-of-pipe' waste management to the path of sustainable consumption and production. The 3Rs approach reflects the spirit of "mottainai" in Japanese parlance, a term conveying a sense of regret for resources that turn into waste without reaching their full usefulness. It involves the socialization of the 3Rs to achieve the policy goal of waste minimization at all levels (local, national and global) towards the top of the waste hierarchy (Hedzri, 2009). Information campaigns are tools that can be used to promote the 3Rs to increase awareness, and change attitudes and the behavior of people towards the manner that they handle waste.

The 3Rs concept engages stakeholders at various levels of government while at the same time building a seamless and sustainable relationship with households, local communities and firms in the waste management chain. Governments, households and firms have their respective roles to play in ensuring minimal waste generation at the source, sufficient recovery along the waste chain and optimal waste treatment and disposal with minimal environmental, health and climate change impacts. Households have been active in rubbish collection and composting of organic waste into manure for agricultural purposes. Firms can also take responsibility to retrieve and recycle their packaging waste under the appropriate legislation.

However, it must be recognized from the outset that there is a fundamental tension between the objectives of recycling and disposal of waste. The urban poor in developing economies are still relying on disposal sites for their livelihood. There is, therefore, a need for conscious policy efforts to reconcile the said tension between recycling and disposal to ensure policy acceptance across a broader spectrum of society.

It is worth noting that the 3Rs approach can conveniently be combined with climate change objectives, as it provides co-benefits in terms of reduced GHGs emissions from landfills through CDM funded investment.

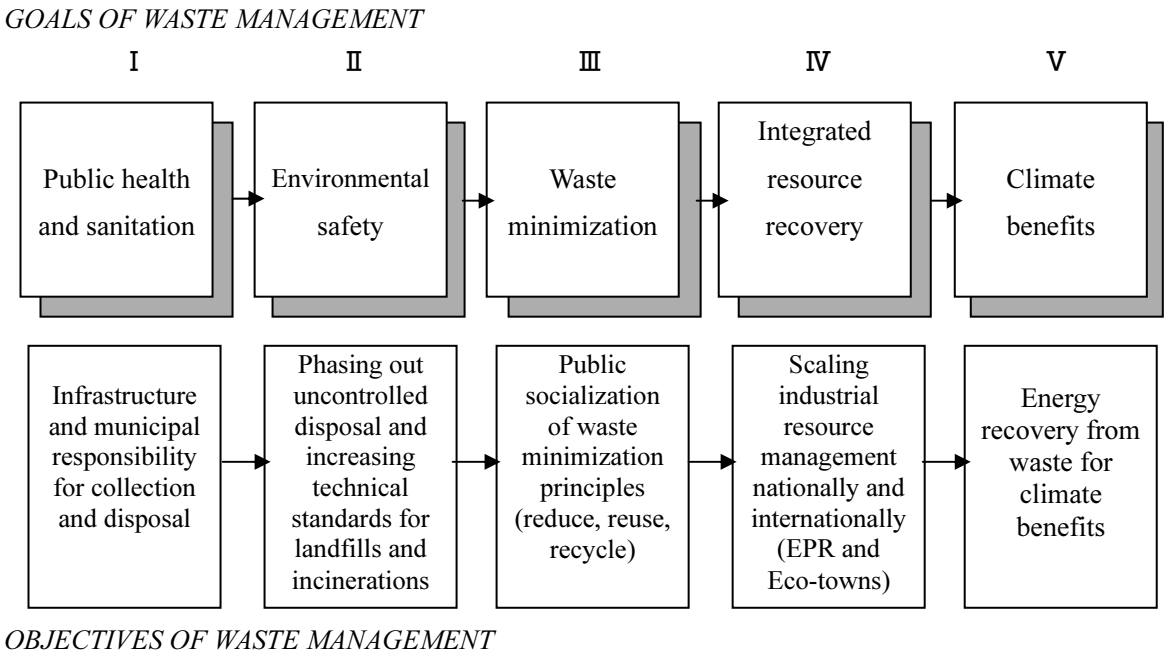

Figure 1. Solid Waste Management (Hezri, 2009)

3. Objectives

1. Evaluate existing policy of organic solid waste management in developed and developing countries.
2. Suggest appropriate policy for the developing country in order to solve solid waste management problems.
3. Design a policy framework to realize regional green growth based on the successful Surabaya model.

4. Case study: Waste Reduction Model in Namakkal, India

Another issue regarding solid waste management systems is lack of public awareness. Namakkal municipality, located in the southern part of India, is known as a successful Eco City. The Namakkal municipality is noted as the first city in the Asia Pacific region to focus on "development of eco-town through Sustainable Solid Waste Management, Resource conservation, Rain Water Harvesting and improved productivity of the local administrative authority." (Namakkal Municipality, 2011) To achieve their goal, the municipality has implemented projects such as the following:

The criteria and objectives that the Namakkal Municipality set to improve the existing resource management practices are as follows (Namakkal Municipality, 2011):

- "Identify areas of new business generation potential through recycle, recovery and reuse potentials
- Promote public/private partnership for waste processing, recovery, recycle and reuse
- Develop plans for effective management of existing resources
- Explore possibilities of rainwater harvesting and prepare concrete action plan for implementation
- Demonstrate rainwater-harvesting system on model basis in one area during the monsoon
- Identify potential for development of useful saleable products out of solid wastes
- Publication of literature and pamphlets in vernacular language on housekeeping and waste management using 5S approach and Green Productivity
- Organizing interaction meeting/workshops
- Increase awareness on resource management
- Develop a GIS based management system for the local authority
- Help local authority in developing Environment Management System to obtain ISO - 14001 Certificate"

The Namakkal Municipality website also mentions that all efforts that were taken, such as conducting door-to-door collection and removing dust bins from streets throughout the entire town, implemented municipal-level solid waste management. As a part of the Eco City project, the municipality has been implementing advanced solid waste management since 2004. Thanks to their efforts, the municipality has achieved their goal of a "Zero Garbage Town", which means no garbage on streets in the municipality.

On the other hand, they have struggled with low public awareness and it took a long time to encourage the public to collect and bring their garbage to certain places. Citizens and organizations such as commercial institutes and hospitals and the like were initially unwilling to adopt a door-to-door system because of less interest in the Eco City project. To achieve the goal of a "Zero Garbage Town", people who are in charge of this project made efforts to encourage citizens to bring their garbage to certain places for six months: they provided information about garbage collection and notices about door-to-door collection. Although the case of the municipality was successfully implemented, lack of public awareness could be a burden for policy makers because of the extensive time and labor required.

5. Case study: Waste Reduction Model in Surabaya, Indonesia

On a national scale, Surabaya is the center of development of the Eastern Indonesia area. Regionally, Surabaya is the capital, the center of trade and services in the East Java province. Surabaya is one of the cities in Indonesia that is committed to realizing a low carbon urbanized society in the future. Surabaya has an area of 33,048 Ha wide and it is located on the northern shore of eastern Java at the mouth of the Mas River and along the edge of the Madura Strait. Surabaya is the second largest city in Indonesia with a population of 3,055,055 people in year 2010. The growth rate was about 2.67% per year from 2001 to 2004.

5.1 Issues in Solid Waste Management in Surabaya

Like almost all cities in Indonesia, the open dumping method is the most popular method used to manage solid waste.

The lack of finances (since handling garbage imposes a considerable burden on finances the city has no choice but to resort to the open dumping method), limited involvement from the public, and poor waste management (from collecting, transporting and managing the shortage of well-trained staffs) are the reasons why there is poor solid waste management in Surabaya city. Surabaya has only one place for open dumping, which is in Benowo Landfill.

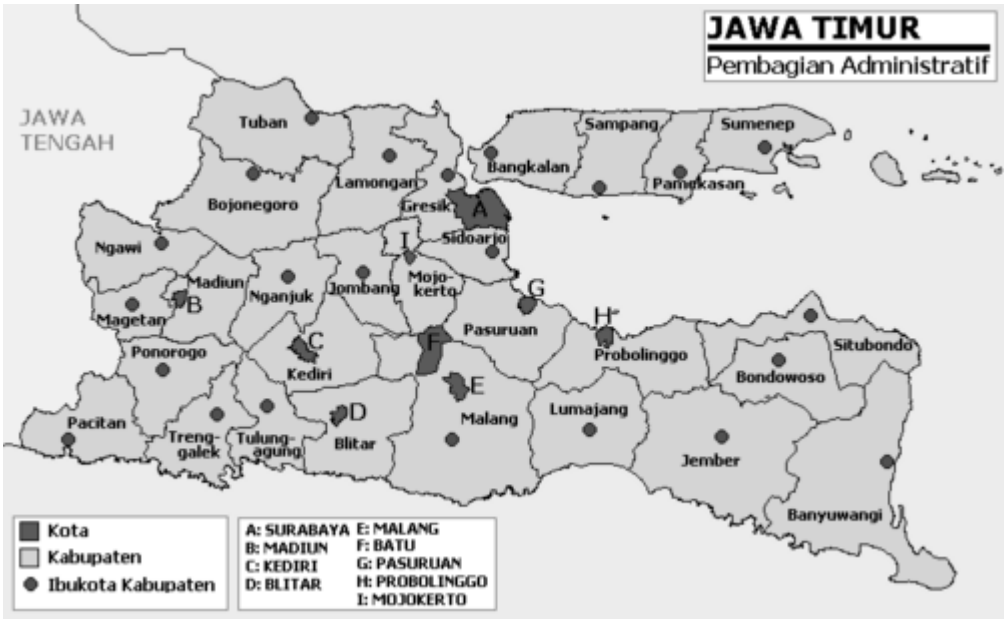

Figure 2. East Java Province

5.2 Composting Organic Waste Management Project

As mentioned in the Kitakyushu International Workshop Report, in the Asia-Pacific region, waste management issues are a vital problem in daily life from households to communities, cities, regions and at the country level. The role of stakeholders is very important where each activity directly affects the effectiveness of the system. The main constraint for the local government is financial. It is agreed that a multi-stakeholder partnership is a viable solution to settle financial problems.

The participation of external agencies such as international and local organizations as well as private entities in solid waste management (SWM) has contributed to encouraging community-based management in Surabaya city through the implementation of the 3Rs (Reduce, Reuse, and Recycle). These actions may be considered as only a small portion of all the hard work that needs to be done to tackle urban organic waste. However, this action cannot be underestimated, as it will consequently lead to savings in the operational cost of waste transportation and reduce the impact on disposal sites. Furthermore, it reduces waste collection and management costs and opens up income opportunities for communities and households.

In Surabaya City, household organic waste composting has adopted the Takakura method that utilizes baskets for household composting. This methodology was developed by Pusdakota, a local NGO, in 2004, with technical assistance from Kitakyushu International Technocooperative Association (KITA) and JPec Co., Ltd., Japan (Kitakyushu official website). The active support and promotion of the Surabaya Women's Welfare Organization (PKK) promotes this project into a successful practice.

The workshop project report also mentioned that around 20,000 baskets have been distributed by the City and through NGO networks, and 12 composting centers have been set up to process organic waste from households and fresh produce markets. Several campaigns, namely "Green and Clean Award" and "Surabaya Merdeka dari Sampah (No waste independent Surabaya)" together with private companies and national newspapers, have successfully encouraged community-based solid waste management and competition among communities. As a result, the daily amount of waste transported to Benowo Landfill has reduced by more than 10% from around 1,500t/d in 2005 to 1,300t/d in 2007. This project has proved to successfully increase the hygienic condition of streets and communities. The basic concept, activities, and also the rewarding process based on the workshop report are listed in the table below.

6. Analysis of Appropriate Policy for Solid Waste Management in Developing Countries Based on City Characteristics

6.1 Philippine Case

The Philippines generates 0.34 kg of municipal solid waste per capita per day (UNCRD et al. 2009). The economic structure results in the Philippines promoting community-based management. The laws enacted tended to be too general and open ended, promoting arbitrariness of operations. Consequently, the law enforcement record was far from satisfactory. Lack of resources and inadequate institutional facilities proved to be major hurdles. The closure of operation at San Mateo landfill also stirred up national debate on waste management. Options for managing waste were further reduced when the 1998 Clean Air Act stalled plans to build incinerators. These culminated in the 2000 Payatas open dump tragedy whereby 234 people living or working on a dumpsite perished because of landfill failure (Hezri, 2009).

Table 1. Surabaya Model[1]

Items	Surabaya Model
Key person	The highest-ranked position : Mayor
Fund	Obtained from the solid waste management budget : about 1%
Community Structure	Bottom-Up, Hierarchy : Human Networking
Basic Concept	Reducing waste from its source: Reducing environment waste and reducing waste dumped into landfill; Waste sorting between organic and inorganic waste;
	Waste treatment: Composting conducted in households and city scale, where in household scale is done using the household scale composter and in the city scale Surabaya city has built 15 compost centers.
Activities	Socialization to the community; Recruitment and training of instructors; Distribution of cleaning tools (composter bin, takakura basket, cart, and build compost centre).
User/ Buyer	Government builds new green areas/ parks that will used the compost production
Composting center	There are 13 composting centers provided by the government
Award	Rewards to communities willing to process waste are given through the Green and Clean event; Rewards to environmental instructors are given through national day awarding; Law Enforcement through Judicial Operations.

The groundbreaking Ecological Solid Waste Management Act of 2000, also known as the Republic Act (RA) 9003 specifies the following activities: the achievement of a recycling rate of 25% or above by 2006 and increasing thereafter; segregation at source and collection; establishment of material recovery facilities (MRFs); and eco-labeling and green procurement. The law targets closure of open dumpsites by January 2007, but more than 850 (open and controlled) are still operating in 68 out 81 provinces, and only 2,500 out of 43,500 barangays (villages) have MRFs. In Metro Manila, all of the 8 major disposal facilities had been converted into controlled disposal facilities (Serrona & Yu 2009). Because funds are not always available for waste management, waste collection and disposal are now driven by community initiatives. The barangay units are given the responsibility of segregating and collecting biodegradable, compostable, and reusable waste (Hezri 2009; DENR 2003).

6.2 Malaysia Case

Malaysia, a high middle income country with a population of 28 million, generates 0.8 kg. waste per capita per day. (Hezri, 2009). Malaysia takes a State-led approach on organic solid waste management. In Malaysia, streets were cleaned by the local district health authority by the late 1960s and consequently the government enacted two acts for maintenance: The Local Government Act 1976 and the Street, Drainage and Building Act 1974. Like other developing countries such as the Philippines, Malaysia has problems with solid waste management because “The laws enacted tended to be too general and open ended, promoting operation arbitrariness (Hezri, 2009).” Due to the problems, the country has not achieved a satisfactory level

[1] *Compiled from the Kitakyushu Workshop Project Report*

and has difficulties with handling the project with" lack of resources and inadequate institutional facilities.(Hezri, 2009)."

Additionally, Malaysia has been facing budget constraints. "The waste collection budget ranged between 20% and 70%, depending on the size of the municipality or city, and only roughly 76% of generated waste was collected (Hassan et al. 2000)". Also, Malaysia cannot manage waste disposable: "31.9% of waste were disposed by open burning, while 6.5% were thrown into the river system (Murad & Siwar, 2007)."

Another serious issue for waste disposable in Malaysia is the lack of new disposal sites, as most of the existing disposal sites are exhausted. Idris et al. (2004) states that in Malaysia, there were 77 open dumps (mainly in the rural states), 49 controlled tipping landfills, and only 35 sanitary landfill sites. Compared to Japan, this land space issue is less serious today but it is likely to become serious because of population growth. There is an alternative solution for the lack of disposal stations, but citizens' concerns make the situation more difficult. For instance, in 2003, the city of Broga developed a plan to build a 1500 tonne thermal incinerator but eventually decided not to implement it because of citizens' opposition. Residents in Broga were concerned about dioxin contamination and took the federal government to court in 2005. The federal government finally cancelled the project in 2006.

6.3 Policy Framework

Two crucial problems in organic waste management are public awareness regarding cleanliness (Namakkal case) and lack of funds (Surabaya case). By combining the experiences of Namakkal and Surabaya, it is possible to suggest what kind of policy could be adopted to tackle the problem of organic waste management. In order to successfully implement projects to address organic waste management in one city in another country, there are several key aspects that the local government must applyin their municipality. The key aspects encompass available waste management systems, community structure, 3R initiatives, system level, technology adoption and also the user/ buyer for the composting products. Below are the evaluations for the two sample countries, namely the Philippines and Malaysia. We evaluated whether there is a possibility to apply a project similar to the Surabaya model, emphasizing the community-based approach to gain public awareness.

Table 2. Key Factors in Comparison between Surabaya and the Philippines

Key Factors	Surabaya	Philippines	Suggested Policy
Available Waste Management System	Open dump landfill	Open dump landfill	The same policy can be implemented
Community Structure	Bottom-up structures	Bottom-up structures	The same policy can be implemented
3Rs (Reduce, reuse, and recycle) policy	Multi partnership	Community and NGO initiatives (concentrated only on recycling)	Multi partnership to concentrate on composting garbage is appropriate
System Level	Household and city level	City level	Should encourage at the household level, to increase efficiency
Technology Adoption	Handled by the Takakura basket technology	Funds, human resources, and technology equipment	Government can provide the Takakura basket for free or at the base price (non-profit)
User/ Buyer	Local government	Local government	No particular problem

In the case of the Philippines, communities and NGOs have already been involved in waste recycling management. For further implementation of the Surabaya model in the Philippines, the initiatives from the government would have a greater effect on the project. The waste management system level is also still at the base of the city level, while the household level was untouched, and in the Surabaya project the encouragement at the household level is much more important to make the program successful. Fortunately, consumers for compost already exist in the Philippines case. For this reason, to accelerate the compost process, the "Takakura basket" technology must be transferred to solve this matter.

Table 3. Key Factors in Comparison between Surabaya and Malaysia

Key Factors	Surabaya	Malaysia	Suggested Policy
Available Waste Management System	Open dump landfill	Open dump landfill	The same policy can be implemented
Community Structure	Bottom-up structures	Bottom-up structures	The same policy can be implemented
3Rs (Reduce, reuse, and recycle) policy	Multi partnership	Government initiatives (focus on recycling)	Community-based approach is appropriate
System Level	Household and city level	Pilot Project in Putrajaya only for sorting garbage	Should encourage at the household and city level, so it becomes more comprehensive
Technology Adoption	Handled by the Takakura basket technology	Funds and land space	Government can provide the Takakura basket for free or at the base price (non-profit) and the composting center
User/ Buyer	Local government	None	Building more parks or further consideration

In the case of Malaysia, the major considerations come from the 3R policy. Only the government is involved in waste recycling management; no other party initiated policy implementation. For further implementation of the Surabaya model in Malaysia, the initiatives from the other parties like NGOs, private companies and also community participation are imperative to completing the project. The waste management system level was unclear; therefore encouragement at the household and city level must be emphasized. The other major problem is that there are no consumers for compost. To solve this issue, the government must support the construction of several parks in the city area. Even the technology transfer for the "Takakura basket" can be implemented in the same way as the Surabaya model.

The following diagram shows the framework for implementing the successful Namakkal and Surabaya models. The first model emphasized public awareness and comprehensive action by the government, while the latter model emphasized a multi partnership to encourage the community to implement the project at the household level and city level. This model can be implemented mostly in bottom-up government structures.

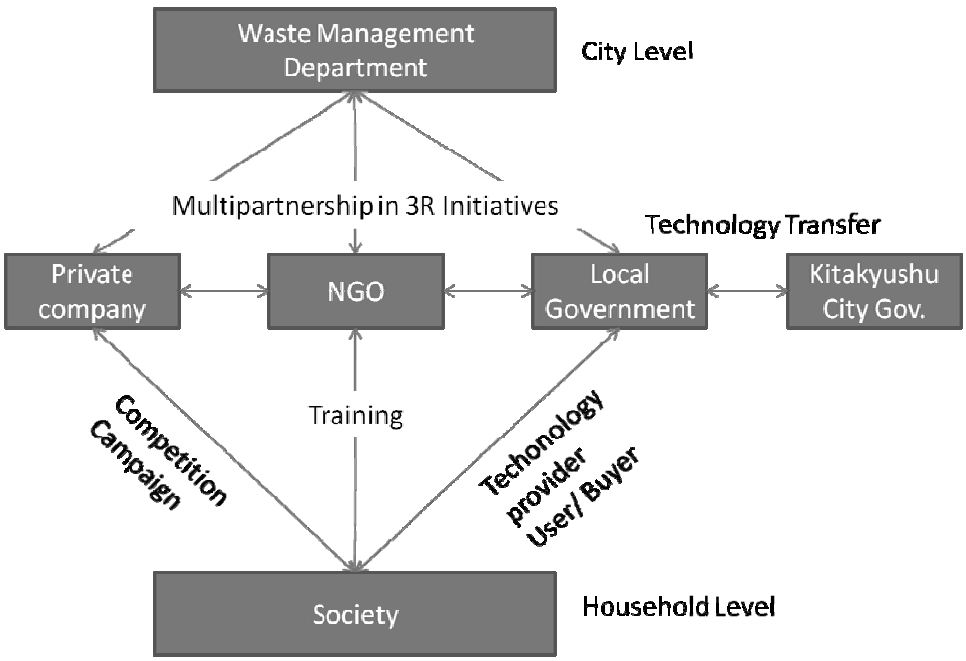

Figure 3. Policy Framework

The 3Rs can be categorized as the third step in waste management policy (Figure 1). The Surabaya model, which involves the recycling process, can be considered as one of the small parts of the implementation of the 3Rs. However, it is viable solution for developing countries in which the first step (providing municipal waste locations) and second step (improving landfills and incinerators) are not viable for the local government due to lack of funds. This model can be encouraged as a short-term process and may also be simply implemented by the public as part of routine activities. If public awareness to keep the city as clean as possible has already been achieved then the government can move forward to the next step. Of the 3R initiatives, the last R, s Recycle, is the most important for the government to address. The recycling process for the whole city cannot be a burden and cannot be tackled just at the household level or by small-scale recycling industries that are run by women or local organizations. Thus the government must encourage other feasible programs to recycle non-organic waste on a larger scale.

As for the issues of significantly low public awareness and lack of funds for organic waste management in developing countries, another effective way is to integrate the initiatives of government, organizations, communities and each individual household. Their goals and objectives must be all integrated. Integration requires the coordination of each and every one of them to become an agent for change. Each of the change agents comes from a different perspective and the ability to communicate between them is a crucial factor in achieving success. (Hezri, 2010)

Even though organic waste is a prominent issue in developing countries, international cooperation in technology transfer, equipment and the introduction of competent human resources will be helpful in the development of domestic waste management capacity in developing countries.

7. Conclusions

1. Organic waste management is a common problem in developing countries;
2. The main problems are due to lack of funds, space, human resources and technology;
3. As a result, the open dumping method is the most common method used to manage solid waste in developing countries;
4. The Surabaya model may be applied to other developing cities, due to similarities in city characteristics;
5. Key factors that play an important role must be addressed to successfully implement the project;
6. The key person/partner is the most important party to ensure successful implementation of the project. For example, sometimes the role of NGO also needs the support of the government, and vice versa.
7. Using a simple method like the Takakura basket is one of the ways to reduce the funds required to manage organic solid waste;
8. Market mechanisms also play an important role: if the city has already succeeded in reducing waste by composting, but there are no users/ buyers for the compost product, then the project can be considered a failure;
9. Systems that need to be encouraged are not only at the household level but also the city level;
10. Although the project seems very simple, but it requires support from all stakeholders to ensure success. For this reason, this project adopts a community-based approach.

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