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IGES/Kitakyushu Initiative Policy Brief #1

Reducing waste through the promotion of composting and active involvement of various stakeholders: Replicating Surabaya's solid waste management model

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Solid waste management is a common, as well as a primary, environmental concern for many cities in developing countries. Despite the fact, Surabaya City, the second largest city in Indonesia with a population of three million, has successfully reduced its waste generation by more than 20% over a short period of time. The city has intensively promoted composting practices by setting up more than a dozen composting centres and distributing thousands of compost baskets to residents, and has actively involved residents and community groups in waste reduction activities by co-organising a community cleanup campaign with local NGOs, private companies and the media. It is worth mentioning that the amount that the city has spent for a series of activities was only one to two percent of the total solid waste management expenditures.

Surabaya's achievement exemplifies how a city can reduce a large amount of waste in a few years by primarily targeting organic waste, which usually makes up more than half the amount of municipal solid waste, and mobilising internal resources, mostly its residents, community groups, NGOs and private companies. In fact, similar practices have been adopted in some other cities, which have resulted in similar waste reduction achievements. This paper exemplifies how Surabaya's success was achieved by highlighting the economic feasibility and significant environmental benefits of composting practices and thereby strongly recommends local governments to adopt similar strategies by targeting organic waste first.

Surabaya City, Indonesia | Bago City, Philippines | Bangkok, Thailand

Various types of composting centres and compost baskets/containers for household use in various countries

Solid waste management is a common, as well as a primary, environmental concern for many cities in developing countries. Cities must allocate a large part of their budgets to handle daily solid waste management operations, which range from waste collection, transportation and final disposal to procurement and maintenance of facilities and equipment. Open dumping is a typical problem, but often budget-tight cities do not have the financial capacity to establish and operate sanitary landfills. To address these problems, many cities are promoting the 3Rs (reduce, reuse and recycle) concept and trying to reduce the amount of waste generation at source rather than later at the end-of-pipe.

An exceptional example is Surabaya City in Indonesia, which has posted outstanding achievements in successfully reducing the amount of waste generated by targeting organic waste first rather than implementing a comprehensive 3Rs programme and promoting composting practices throughout the city by actively

"The daily average waste generation, which used to be more than 1,500 tonnes a day in and before 2005, has decreased to 1,300 tonnes in 2007 and 1,150 tonnes in 2008"

involving various stakeholders. The daily average waste generation, which used to be more than 1,500 tonnes a day in and before 2005, has decreased to 1,300 tonnes in 2007 and 1,150 tonnes in 2008 as shown in Figure 1. The city has perceptively become cleaner and greener in a short period of time, as acknowledged by many residents and with its achievements honoured with the Adipura Award (Clean City Award) from the central government for three consecutive years since 2006.

Remarkably, this is not a feat achieved by a small city, but by the second largest city in Indonesia of three million inhabitants. Therefore, this model is not considered to be one that is unique to small cities, but that is applicable to other cities as well; and in fact, it has been adopted by many other cities. Let us see how Surabaya's case worked, why it was so successful, and how we can draw lessons from that.

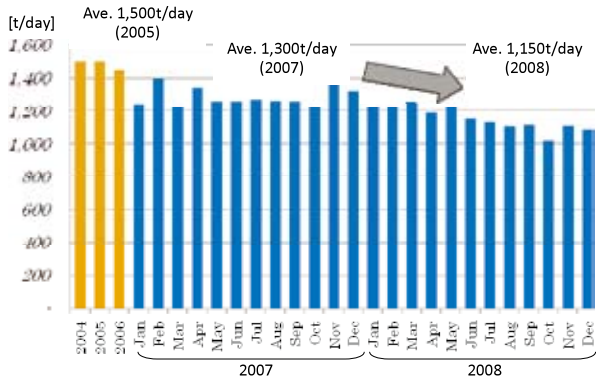


Figure 1: Average daily amount of waste disposed at Benowo Final Disposal Site* in Surabaya

* Note: Benowo is the only final disposal site in Surabaya City.
(Data source: City Development Planning Department (BAPPEKO), Surabaya; prepared by Maeda (2009))

Surabaya has turned cleaner and greener in a short period of time *(Photo courtesy of PKK Surabaya (above) and Cleansing and Landscaping Department, Surabaya (below))*

Scaling up of a successful community solid waste management model

Surabaya's success had three critical stages.

"The composting centre started producing good-quality compost ... This method was further modified for use at each household"

First, an efficient solid waste management model was developed in one community. Technical cooperation on community solid waste management between the Kitakyushu International Techno-cooperative Association (KITA) from Kitakyushu City, Japan and Pusdakota, a local NGO, began as a city-to-city environmental cooperation activity between Kitakyushu and Surabaya in 2004. After six months of trial and error, an efficient composting method—the Takakura Method, named after a composting expert from Kitakyushu—was developed based on a traditional windrow composting method (see Annex 1 for details) and adopted at Pusdakota's composting centre. The composting centre started producing good-quality compost in large quantities from separately collected organic waste from the community. This method was further modified for use at each household over a period of a few months. Some households started producing compost from kitchen waste using compost baskets provided by Pusdakota and used the product for plants and flowers. Many households followed suit, which changed the mind-set of residents and discouraged dumping of waste on the streets and creeks, and as a result, the community became greener and cleaner. Pusdakota also started functioning as a community waste station by collecting organic and inorganic waste, including recyclables, separately, thus encouraging waste segregation at source.

Pusdakota collects waste separately from the community (yellow box for organic and blue for inorganic waste)

Pusdakota produces compost from separately collected organic waste

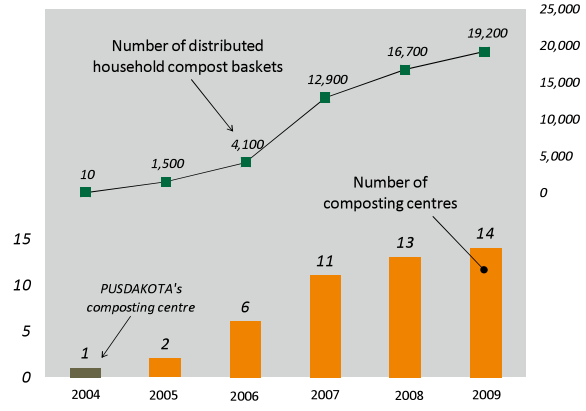
Compost baskets distributed to residents *(Photo courtesy of KITA)*

"The city currently operates 13 composting centres ... and has distributed 19,000 baskets for free"

"These NGOs have set up a network of community environmental leaders ... who teach the residents how to produce compost from daily kitchen waste using the baskets"

Second, Surabaya City scaled up the project by adopting the same composting method at existing composting centres, establishing new centres and distributing thousands of compost baskets to residents. The city currently operates 13 composting centres, which process a large amount of organic waste collected from vegetable markets and streets/parks maintenance activities, and has distributed 19,000 baskets for free as shown in Figure 2. The city purchased the baskets from Pusdakota, thus supporting its operation, and outsourced distribution to PKK (*Pemberdayaan Dan Kesejahteraan Keluarga;* a family welfare programme), a women's group, and other NGOs by taking advantage of their grassroots access to communities. These NGOs have set up a network of community environmental leaders called environmental cadres, who teach the residents how to produce compost from daily kitchen waste using the baskets, as well as what environmental and health impacts can be expected from its use by keeping the kitchen environment garbage-free. In this way, only those who have a comprehensive understanding of the functions and resulting impacts are able to receive the baskets and take part in the programme. Environmental cadres then follow-up by monitoring usage of the baskets to troubleshoot common problems. This is why many households continue to practice composting at each household with low drop-out rates, and this number continues to increase. As of today, there are about 28,000 environmental cadres which cover all 8,800 communities (or RT, *Rukun Tetangga*) in the city.

PKK promotes waste segregation at source, composting at each household and manufacturing goods from plastic waste for income generation *(Photo courtesy of PKK Surabaya (2008))*



Compost basket

Composting centre

Figure 2: Number of compost baskets and composting centres in Surabaya

** The city adopted the composting method at three existing composting centres in 2005 and 2006 and has since established ten additional centres. There are 13 composting centres managed by the city, in addition to the one managed by Pusdakota.*
(Data source: Pusdakota, Kitakyushu City, and Cleansing and Landscaping Dept., Surabaya; prepared by Maeda (2009))

Third, the city, in collaboration with NGOs, private companies, and the media, organised a community cleanup campaign called the Green and Clean Campaign. The number of participating communities (RTs) in the campaign increased from 325 in 2005, the first year of the programme, to 1,797 in 2008, which is about 20 percent of all RTs in the city. The campaign became popular due to the wide media coverage in local papers and on TV programmes and the festival-like award ceremony which is held back-to-back on the city's Anniversary Day.

Award-winning communities of the Green & Clean Campaign in Surabaya

"a solid waste management model initiated in one community was successfully scaled up and replicated in many other parts of the city"

In this way, a solid waste management model initiated in one community was successfully scaled up and replicated in many other parts of the city with the active involvement and mutual co-operation of various stakeholders, as shown in Figure 3. Among them, the city and PKK in particular played a vital role in providing political and financial support and co-ordinating various stakeholders.

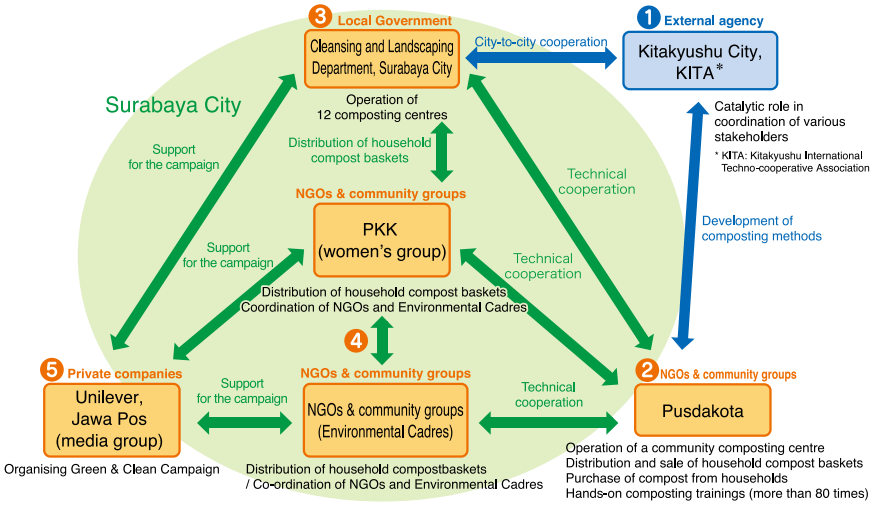


Figure 3: Relationship of main stakeholders in Surabaya *(Prepared by Maeda (2009))*

Incentives and financial implications

(1) Why do people practice composting?

"First, most people enjoy using the self-produced compost for plants and gardens. Second, people notice the hygienic effects of keeping the kitchen environment garbage-free"

What are the incentives for people to practice composting? There are generally three reasons for this. First, most people enjoy using the self-produced compost for plants and gardens. Second, people notice the hygienic effects of keeping the kitchen environment garbage-free, which would otherwise rot and attract flies and cockroaches, and consequently may have an undesired impact on the health of family members. And third, people can make some extra income, although small, by selling the compost and plants grown using it. For example, Pusdakota purchases the compost produced by the basket users at IDR700 (USD0.07)[i] per kilogram, which enables a household to receive an income of IDR4,200 (USD0.42) a month by processing one kilogram of organic waste a day as about 20 percent of the input ends up in the final product. Some people scale up their composting activities to increase their income by collecting additional organic waste from other households, gardens and streets, or instead selling seedlings, herbs and vegetables grown with the compost.

In this way, people are motivated to practice composting. However, it should also be noted that not everyone may be supportive. Household-based

composting is easy, but still requires continuous care, as people have to cut kitchen waste into small pieces after each meal and mix it with the compost, maintain the moisture content within an appropriate range and avoid contact by flies and cockroaches so that eggs are not laid, which ends up infecting the compost. For instance, only about 200 out of 1,000 households practice composting in the community where Pusdakota is located and others are content with the usual waste collection on a few days a week, which infers that, at best, a maximum 20 percent of the population would possibly adopt household-based composting.

"at best, a maximum 20 percent of the population would possibly adopt household-based composting."

Streets were decorated with green plants using compost
(Photo courtesy of KITA)

Residents grow herbs, plants and vegetables using compost to generate income

(2) Does free distribution of compost baskets make business sense?

Surabaya City has distributed 19,000 compost baskets for free over the past five years, but does it make business sense and is the policy recommendable for other cities to copy? Let us examine that by calculating the costs and benefits.

The city has procured baskets from Pusdakota at about IDR100,000 (USD10) a unit. Assuming the distribution cost, including the promotion and education activities carried out by NGOs and environmental cadres, was also IDR100,000 (USD10) per basket, then the total expenditure by the city for the five-year period was IDR3.8 billion (USD380,000).

On the other hand, assuming each basket contributes in reducing one kilogram of organic waste a day, then 19,000 baskets reduce 19 tonnes a day, which is roughly 6,900 tonnes a year. As the cost for solid waste management in Surabaya is about IDR230,000 (USD23) per tonne of waste (see Box 1), the cost saved from the waste reduction is, assumedly, IDR1.6 billion (USD160,000 = 6,900t x USD23/t) a year. Based on this assumption, the initial investment virtually returns in 2.5 years, and further, the waste reduction effect continues. In addition, as the actual total amount of reduced waste is much larger than the compost production capacity at composting centres and households combined (see Box 2 and Figure 4), it is inferred that the promotion of household-based composting and separate collection of organic waste function as encouragement to further reduce other dry waste. Therefore, it is concluded that the free distribution of thousands of compost baskets pays off in few years and is recommendable for other cities to follow suit.

"the free distribution of thousands of compost baskets pays off in few years and is recommendable for other cities to follow suit."

Box 1: Solid waste management cost in Surabaya

Surabaya City spends about IDR100 billion (USD10 million) for solid waste management annually (see Figure 5). When divided by the total annual waste generation, which was about 475,000 tonnes (= 1,300t x 365 days) in 2007, the solid waste management cost per tonne of waste is about IDR210,000 (USD21), whilst the construction cost of the 27-hectar Benowo Final Disposal Site in 2001, which reached capacity in seven years and was further expanded later on, was IDR65 billion (USD6.5 million). When divided by the total amount of waste over a seven-year period, the construction cost per tonne of waste is about IDR20,000 (USD2). Thus, by adding them together, the total solid waste management cost in the city is IDR230,000 (USD23) per tonne of waste.

(Data source: City Development Planning Department (BAPPEKO), Surabaya; calculation by Maeda (2009))

"it is inferred that the promotion of composting has a multiplying effect of more than two times in terms of waste reduction."

"managing a composting centre is profitable providing there are buyers. However, it is not easy to secure a market for compost and often demand fluctuates seasonally."

Box 2: Breakdown of the reduced waste in Surabaya

Where does the 200 tonnes of reduction in waste generation from 2005 to 2007 come from? The processing capacity of all of the composting centres in the city is about 40 tonnes a day, while the processing capacity at households is, assuming 40,000 households practice composting — including 19,000 basket users and others who have replicated those activities using other types of composting containers — by processing one kilogram every day, another 40 tonnes. Even adding these figures together only results in 80 tonnes a day as shown in Figure 4. Therefore, from where does the remaining 120 tonnes come? The likely assumption is that organic waste, as well as other dry waste, is reduced as a result of composting and other activities by households. This assumption is supported by the fact that many communities practice waste banking, i.e. the collection of recyclables to generate income, and manufacture handicrafts from plastic waste as activities in the Green and Clean Campaign. Therefore, it is inferred that the promotion of composting has a multiplying effect of more than two times in terms of waste reduction.

Various types of compost containers other than the Takakura basket (far left) used in Surabaya

Bags made of plastic waste (left); recyclables collected at a waste bank (right)

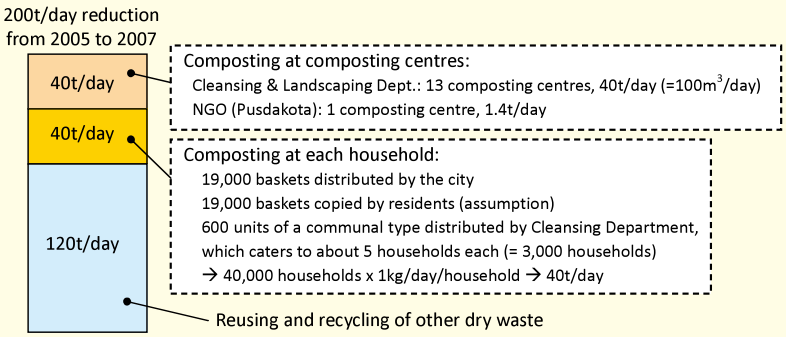


Figure 4: Breakdown of reduced waste by each measure in Surabaya
(Data source: Cleansing and Landscaping Department, Surabaya; prepared by Maeda (2009))

(3) Is the operation of a composting centre financially sustainable?

Are the composting centres managed by Pusdakota and the city both financially sustainable? The answer is that they are not only financially sustainable but also profitable. Let us look at their financial statements to confirm this.

Pusdakota collects about 1.4 tonnes of organic waste from 1,000 households every day, which is about 40 tonnes a month. From that, about 10 tonnes of compost is produced and sold to the city as the ingredients for compost baskets and the rest is sold to farmers, private vendors, schools and community residents. Monthly income is about IDR10 million (USD1,000) as the selling price is IDR1,000 (USD0.1) per kilogram, whilst, the monthly expenditures are about IDR7 million (USD700) for workers' salaries, fuel, utility fees and other administrative costs. Consequently, monthly profits are about IDR3 million (USD300). As seen here, managing a composting centre is profitable providing there are buyers.

However, it is not easy to secure a market for compost and often demand fluctuates seasonally. In fact, Pusdakota stores a large stock of compost in a work space which could otherwise be used for production increase. Another challenge for NGOs and community groups is the capital cost to establish a composting centre.

"financial and political support by the local government is essential to support the start up and operations of community composting centres."

These are the two main reasons why there is still only one community composting centre in Surabaya even after years of Pusdakota's successful operation, which is well-known within the city, as well as nationwide.

Therefore, financial and political support by the local government is essential to support the start up and operations of community composting centres. In fact, by taking into account the waste reduction effect and subsequent reductions in waste management costs, local governments have enough resources to extend their financial and political support. For example, Pusdakota's composting centre reduces waste generation by 40 tonnes a month, which is equivalent to saving IDR9.2 million (USD920 = 40t x USD23/t) a month in solid waste management costs, assuming that can be used to support operations and assist other groups in starting up other composting centres.

Pusdakota's community-based composting centre
(Photo courtesy of KITA)

Surabaya City's market-waste composting centres

Market-waste composting centres managed by the city produce about 300 tonnes of compost a month, which is all used for the maintenance of city parks and road-side trees by replacing the use of chemical fertilisers and soil conditioners. The average monthly waste input is 1,200 tonnes, which is equivalent to the saving of IDR270 million (USD27,000 = 1,200t x USD23/t) a month of the solid waste management cost. Meanwhile, the monthly operation cost of the 13 composting centres is only about IDR40 million (USD4,000) for fuel and utility fees (not including workers' salaries as they are city officers). Thus, the city saves a significant amount in solid waste management costs, as well as the procurement cost for chemical fertilisers and soil conditioners, which is now used to upgrade and procure waste management tools, equipment and facilities, including the establishment of new composting centres.

"the operation of composting centres is not only financially sustainable but also has a significant waste reduction impact."

As seen here, the operation of composting centres is not only financially sustainable but also has a significant waste reduction impact. Therefore, local governments are strongly recommended to set up composting centres, as well as support community groups and NGOs to establish their own centres.

(4) How much did Surabaya City spend to achieve these results?

How much did Surabaya City spend to achieve that significant reduction in waste generation? The answer is only one to two percent of the total solid waste management expenditure. As shown in Figure 5, the budget allocated for the promotion of composting and waste segregation, including operation and maintenance of 13 composting centres, distribution of compost baskets, supporting the activities of PKK, NGOs and environmental cadres, and organising the Green and Clean Campaign, were only IDR1.5-2 billion (USD150,000-200,000) annually from 2006 to 2008, whereas about IDR100 billion (USD10 million) was spent for other ordinary solid waste management tasks. This implies that other cities can also achieve similar results by allocating only one to two percent of their own solid waste management budget.

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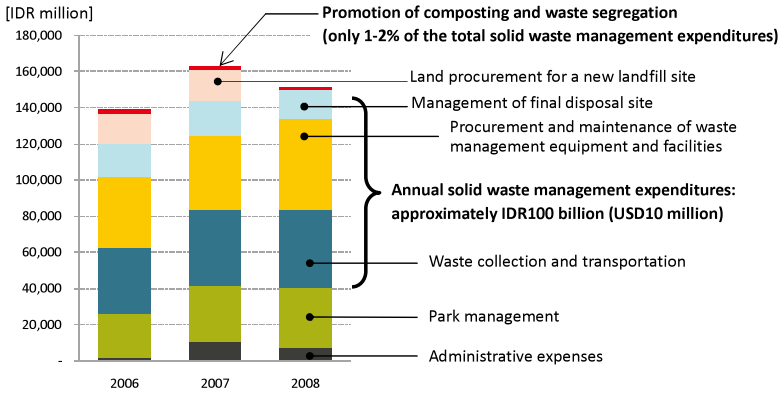

Figure 5: Annual expenditures of Cleansing and Landscaping Department, Surabaya, 2006-2008
(Data source: City Development Planning Department (BAPPEKO), Surabaya; prepared by Maeda (2009))

(5) To what extent have greenhouse gas emissions been prevented?

To what extent have composting organic waste in Surabaya prevented greenhouse gas emissions at the final disposal site and what are the financial implications and projections for the future?

Assuming an average of 80 tonnes a day of organic waste, which comprises 60 tonnes of food waste and 20 tonnes of park and garden waste, were composted in 2007 and the same trend continues until 2012, the carbon dioxide emissions prevented at the final disposal site were about 4,000 tonnes in 2007, 7,000 tonnes in 2008 and will be 12,000 tonnes in 2012 as shown in Figure 6. Suppose the market price of a tonne of carbon dioxide is USD5, then the city has potential to earn USD20,000 in 2007, USD35,000 in 2008 and USD60,000 in 2012. However, in reality, the composting project is not registered as a CDM project and the transaction costs necessary for validation, registration, verification and certification until receiving actual credits are significant. Yet, there are already some similar composting CDM projects registered. If a methodology specialised for Surabaya's model is developed and approved, the implication is huge as it has tangible social and environmental impacts (co-benefits) and potential to be replicated in many other cities. Countries which need to purchase carbon credits, including Japan, may consider this option by taking into account the positive impacts.

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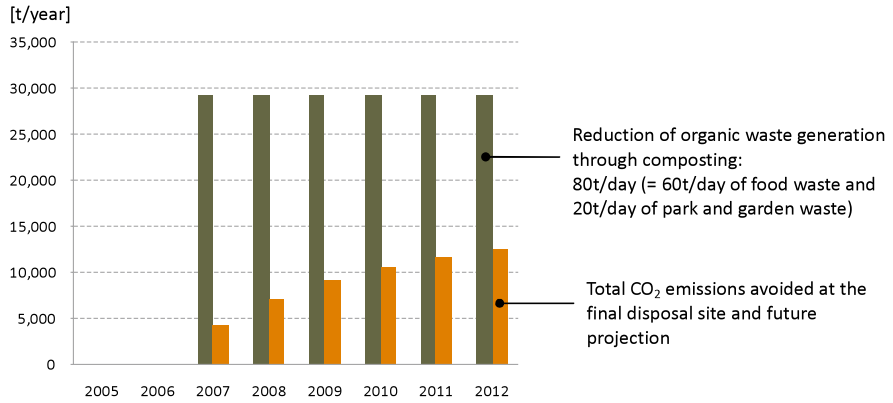

Figure 6: Reductions of organic waste generation and consequent greenhouse gas emissions in Surabaya
(Prepared by Maeda (2009), based on the first order decay model from "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (version 04)" , CDM Executive Board, UNFCCC)

Replication in other cities

Surabaya's solid waste management model has been transferred to other cities in various ways since it became well-recognised nationally and internationally. First, NGOs in the city, including Pusdakota, started disseminating the efficient composting method to other NGOs and community groups in and outside the city through trainings and technical assistances. Kitakyushu City has also disseminated the practice in Semarang and Medan, as well as in Bangkok, Thailand, using its city-to-city environmental cooperation relationships. Lately, Kitakyushu City and the Institute for Global Environmental Strategies (IGES), in cooperation with the Japan International Cooperation Agency (JICA) Indonesia Office and the ministries of the Indonesian Government, started similar projects in cooperation with five cities, namely Makassar, Palembang, Central Jakarta, Balikpapan and Tarakan, which are currently being implemented.

IGES has also assisted in implementing a similar project in Bago, Philippines, since 2008, which has also contributed to a significant reduction in waste generation and the steady production of compost. Similar approaches have also been disseminated from Bago to other cities in the country, namely to Cebu, Talisay and Puerto Princesa. This practice was also transferred to other countries including Sibu, Malaysia and Lalitpur, Nepal, with the participation of delegates from those cities at a workshop held in Bangkok under the Kitakyushu Initiative programme where they learned how to apply the method to their own cities.

"Surabaya's waste management model, especially the composting component, has been replicated in many other cities in various forms"

In this way, Surabaya's waste management model, especially the composting component, has been replicated in many other cities in various forms as shown in Figure 7. The main reason behind this is because of its simplicity and low-cost nature due to the usage of only local resources.

Legend:
- Cities to which composting practices have spread as a result of activities by local NGOs
- Cities to which composting practices have spread as a result of activities by Kitakyushu City and IGES
- Both cases

Figure 7: Cities where Surabaya's waste management model and composting practices were adopted
(Source: Pusdakota, KITA, Kitakyushu City and IGES; prepared by Maeda (2009))

Recommendations for further replication

As seen here, Surabaya's solid waste management model has been proved effective in reducing a significant amount of waste generation in a short period of time by chiefly targeting organic waste and actively involving various stakeholders. The main message here is that to achieve maximum results, cities should target organic waste first rather than implement a comprehensive 3Rs programme. The model also makes business sense as exemplified in this paper. Therefore, it is highly recommended that other cities adopt a similar strategy using the following five steps.

"to achieve maximum results, cities should target organic waste first rather than implement a comprehensive 3Rs programme."

Step 1 Waste reduction target setting and institutional setup

First of all, local governments should set waste reduction targets with the mayor's support. A lead department should be designated, which is often the solid waste management department, and co-ordination with other related departments, including park management, environment management and city planning departments, should be made.

Step 2 Set up market-waste composting centres

Local governments can immediately start a composting programme by setting up a composting centre and processing the organic waste from vegetable markets, which are otherwise transported and disposed at final disposal sites. What is required are space and a building for the composting centre, a shredder for cutting the waste into pieces and technical training for the staff. The project can start at a small scale, such as processing one tonne a day as a trial run and using the compost product at city parks, and gradually scale up after confirming effects.

Step 3 Identify community partners and distribute compost baskets

"It is recommendable to identify partner communities or schools where strong leadership or community bonds already exist rather than targeting the entire city from the beginning."

It is recommendable to identify partner communities or schools where strong leadership or community bonds already exist rather than targeting the entire city from the beginning. Developing a network of community environmental leaders who teach the residents how to use compost baskets and monitor progress is also an effective approach as exemplified in Surabaya's case. Active involvement of PKK, which works closely with the city government and co-ordinates other NGOs and environmental cadres, is another advantage other Indonesian cities can emulate as PKK is present in every city. Compost baskets can be distributed for free as the waste reduction impacts will be larger than the actual distribution cost in a few years.

Step 4 Set up community-based composting centres

"The city government may have to act as the buyer of the compost product or assist marketing of compost to farmers to support operations, especially at the beginning stage."

Supporting local partners in establishing community composting centres through the provision of capital, buildings and equipment is an effective approach to encourage community participation in solid waste management. Providing a shredder and technical training for existing community material recovery facilities is also an option. The city government may have to act as the buyer of the compost product or assist marketing of compost to farmers to support operations, especially at the beginning stage. City governments can also encourage community participation by first setting up market-waste composting centres, gradually accepting household waste and then handing over operations to the community as is currently in the trial stage in Surabaya.

Step 5 Organise a community cleanup campaign

Organising a community cleanup campaign and allowing communities to compete with one other is an effective approach to encourage community participation. Co-organising the campaign with private companies and media groups is a good strategy to mobilise resources, as well as to widely publicise the campaign and encourage further participation of communities.

Recommendations for local NGOs and community groups, central governments and external supporting agencies

"Local NGOs and community groups may use this paper to leverage support from local governments to set up community-based composting centres and distribute compost baskets"

Local NGOs and community groups may use this paper to leverage support from local governments to set up community-based composting centres and distribute compost baskets by highlighting the economic and environmental impacts.

For central governments, it is advisable to support local governments in implementing such projects through the provision of financial support for the construction of composting centres, promoting its usage to farmers, and providing other financial and political incentives to reduce waste generation.

External supporting agencies are recommended to assist local and central governments in scaling up model projects so that chronic waste problems will gradually improve. Developing an appropriate CDM methodology and assisting local governments in applying for CDM projects are also an area where support from external agencies are needed, which could further boost the scaling up and replication of similar practices.

Annex 1 Composting methods developed in Surabaya

The windrow method is a traditional composting method used in many countries in which organic waste is placed in a pile of about one metre in height, sometimes after shredding and mixing with soils or other materials, and is left to decay naturally for a few months. In contrast, the Takakura Method, a composting method developed in Surabaya that has been applied in many other cities, uses fermentative microorganisms as seed compost, which were originally cultured from local fermented foods, such as soy sauce, yoghurt, and fermented beans (*tempe* and *tape* in Indonesian), fruits and vegetable peels, rice bran and rice husks.

"The most remarkable feature of the Takakura Method is its rapidness: it takes only one to two weeks to decompose a large part of the organic compounds"

The most remarkable feature of the Takakura Method is its rapidness: it takes only one to two weeks to decompose a large part of the organic compounds, as compared to the windrow (or other) method which usually takes more than three months. Collected organic waste is mixed with the seed compost, which contains various kinds of selective fermentative microorganisms, and shredded into pieces for better mixture and to expedite the fermentation process. Then, the shredded mixture is placed in a pile and stirred once a day manually to aerate the mixture as shown in Figure 8. The temperature inside the compost piles reach up to 70 to 80 degrees Celsius in the first few days due to the intensive decomposition of organic compounds, which also kills pathogens and seeds of weeds. In general, with the additional application of more seed compost, the fermentation period becomes shorter. When seed compost and shredded organic waste are mixed in a ratio of one to one in a tropical climate as of the case in Surabaya, the intensive fermentation period ends in about a week and the temperature of the compost piles falls to around 40 degrees Celsius.

Figure 8: Operational flow of the Takakura Composting Method
(Prepared by Maeda (2009) with technical supervision by Kouji Takakura, JPec Co., Ltd.)

Usually, the main constraint in setting up a composting centre in urban areas is the availability of land and appropriate sites. However, by adopting the Takakura Method, composting becomes operational in smaller spaces due to its high productivity. Surabaya City has taken advantage of this to set up more than a dozen small composting centres in various places such as adjacent to vegetable markets, city parks and government buildings. From past experience in Surabaya, it is calculated that one tonne of daily organic waste supply can be processed in a 100 sq. metre space, and similarly, 200 and 300 sq. metre areas can process three and five tonnes daily, respectively.

"one tonne of daily organic waste supply can be processed in a 100 sq. metre space, and similarly, 200 and 300 sq. metre areas can process three and five tonnes daily, respectively."

Another advantage is its economical nature due to limited mechanical input, i.e. use of shredders only, labour-intensiveness and use of local materials. Seed compost is made from local foods and does not contain any imported materials. The final compost product can be reused as seed compost, thus rendering the production economical.

The Takakura Method also guarantees safer and cleaner working conditions as no harmful substances are used, there is no resulting leachate or offensive odours, and pathogens are eliminated.

The quality of the final product is also guaranteed by its years of use at city parks, gardens and farmlands in Surabaya. However, what should be noted here is that the final product is not fully matured, i.e. organic compounds are not fully decomposed into inorganic materials, but are "half-matured," where still yet un-decomposed organic compounds exist with high concentrations of active microorganisms (Fujiwara 2003). Once

"Once the half-matured compost is spread to the soil, those active microorganisms improve soil permeability and water retention capacity by aggregating soil particles ... half-matured compost has the capacity to enrich the soil, especially the nutrient-poor soil"

the half-matured compost is spread to the soil, those active microorganisms improve soil permeability and water retention capacity by aggregating soil particles and by consuming the remaining organic compounds. Therefore, half-matured compost has the capacity to enrich the soil, especially the nutrient-poor soil, with the application of the compost on the surface where there is enough oxygen supply. It is recommended that half-matured compost be applied more than two weeks before planting so that microorganisms will stabilise in due time and not harm plants. It can also be applied to existing plants a certain distance away.

Maturation of compost can also be completed at a composting centre, but this requires a large space as it has to be left to mature for many weeks and months. This is not an option for many cities with many tonnes of organic waste per day. The Takakura Method presents a solution for this problem by proposing to complete the maturation in fields, rather than at composting centres, which will in turn improve the productivity of such centres.

Another remarkable feature is its applicability at both household levels and composting centres. The bottom line is its use of fermentative microorganisms. For household use, one only need to mix kitchen waste with seed compost in a ventilated basket for fermentation, while for composting centres, the same process is conducted on a larger scale. In this way, Surabaya City has targeted both organic waste from households, as well as vegetable markets, streets and parks, by applying the same composting method through the distribution of thousands of compost baskets and establishing a number of composting centres.

Reference: Fujiwara, Shunrokuro 2003. How to produce and use compost: from the principle to application, Nobunkyo, original in Japanese（「堆肥のつくり方・使い方、原理から実際まで」藤原俊六郎 著 2003年3月 社団法人 農村漁村文化協会）

References

Cleansing and Landscaping Department, Surabaya 2008. *Experiences in solid waste management in Surabaya City,* a presentation by the Cleansing and Landscaping Department, Surabaya in the Kitakyushu Initiative Workshop on Community-based Solid Waste Management and Supporting National Policies in Surabaya on 27 August 2008.

IGES Kitakyushu Office 2009. *Waste reduction programme through the promotion of organic waste composting by Kitakyushu (KitaQ) System: Information kit.* (http://kitakyushu.iges.or.jp/publication/index.html)

KITA 2007. *FY2006, Separation at Source and Composting of Waste in Surabaya, Indonesia: Promoting the Reduction and Recycling of Waste,* Report, March 2007, Kitakyushu International Techno-Cooperative Association.

PKK Surabaya 2008. *Management of Environment Cadre,* a presentation by the Cleansing and Landscaping Department, Surabaya in the Kitakyushu Initiative Workshop on Community-based Solid Waste Management and Supporting National Policies in Surabaya on 27 August 2008.

Uli Peduli 2008. *Program Lingkungan (Green & Clean Programme),* Uli Peduli, Unilever Surabaya, a presentation by Uli Peduli in the Kitakyushu Initiative Workshop on Community-based Solid Waste Management and Supporting National Policies in Surabaya on 27 August 2008.

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