POLICY BRIEF

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Sustainable Management of Organic Waste: The need for coordinated action at national and local levels

Key Messages

- Current waste management practices in cities in developing Asia are a threat to human health and to the environment. These impacts extend beyond the local level because of the emissions of greenhouse gases and the resulting contribution to global climate change.
- Biological treatment methods for organic waste, which include composting, anaerobic digestion and mechanical-biological treatment, have a number of well-documented advantages over current and conventional waste management practices. These methods have been successfully implemented in a number of cities, but their uptake is still limited.
- Governments play a key role in mainstreaming biological treatment and coordinated policy action at national and local levels is needed. This policy brief therefore recommends a number of concrete government actions that can facilitate the uptake of these methods.
- National governments are recommended to focus on stakeholder engagement, formulation and implementation of supportive policies, and information management. Local governments are recommended to liaise more effectively with their national governments, develop clear strategies and plans, engage the local stakeholders, and nurture innovations and grassroots initiatives.

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1 Introduction

This policy brief explains why local governments in developing Asia should expand the use of biological treatment methods for organic waste[1]. It emphasises the role played by national and local policies and argues that coordinated policy action at both these levels is needed. Biological methods, which include composting, anaerobic digestion and mechanical-biological treatment, have many advantages over current treatment practices, the main ones being open dumping, disposal in simple landfills and open burning, and can reduce the overall need for final disposal. Benefits at the local level include environmental protection, reduced costs for waste-handling and transportation (in the case of decentralised treatment), and socio-economic benefits for the local communities, including green jobs. Lower emission of greenhouse gases is another significant benefit of biological treatment, although this might not be a strong driver for change at the local level. Even though biological methods have been successfully implemented in a number of cities and their benefits are well documented, these techniques are not yet widely used in the region. We argue that national and local governments have key roles to play in mainstreaming biological methods, and in this brief we recommend policy packages that can facilitate the uptake of such techniques.

2 Current waste management practices are unsustainable

Current management of urban waste in Asian cities is a threat both to people and the environment and clearly not sustainable. The disposal sites typically found on the outskirts of Asian cities – mainly open dumps and simple landfills with rudimentary equipment for environmental protection – are polluting groundwater and surface waters, emitting foul odours and generating methane – a strong greenhouse gas[2] that can also cause dump fires. In addition, dumping and landfill disposal require suitable land, which is in short supply in many parts of the Asia-Pacific region, and bury materials that could be recycled into new products and nutrients that could be returned to productive soils. There are thus many reasons why municipalities should devote more efforts to improving their waste management systems and promote better treatment methods. However, local governments typically have very limited resources and capacity and may therefore need various kinds of encouragement and assistance from the national level as well as other forms of external support in selecting and implementing more sustainable systems and technologies.

The challenges related with organic waste are not new; they have been recognised for many years and there is an extensive literature on the topic including many recommendations for improvement. Despite this, the situation in most cities remains deeply worrisome. Responding to the seriousness of these challenges, the Institute for Global Environmental Strategies (IGES) has studied local practices in organic waste management in Asia and related government policies for a number of years. This policy brief highlights some of the findings of those studies.

3 Biological treatment is good for the environment but can also offer economic and social benefits

Municipal solid waste in cities in developing Asia typically contains 50-70% organic materials. For this fraction of the waste stream, biological treatment is a feasible option that can combine low environmental impacts with economic and social benefits. Text Box 1 introduces the three main methods for biological treatment. All these three methods are significantly better for the local environment, as well as for the global

[1] In this Policy Brief the term “organic waste” refers to biodegradable waste, such as food waste, garden waste and paper.

[2] According to the latest assessment report published by the Intergovernmental Panel on Climate Change (IPCC, 2007), methane is 25 times more potent as a greenhouse gas than carbon dioxide when regarded over a 100 year timeframe.

climate, than open dumping and landfill disposal. They can also offer a number of economic and social benefits, and indirect environmental advantages, which can be summarised as follows:

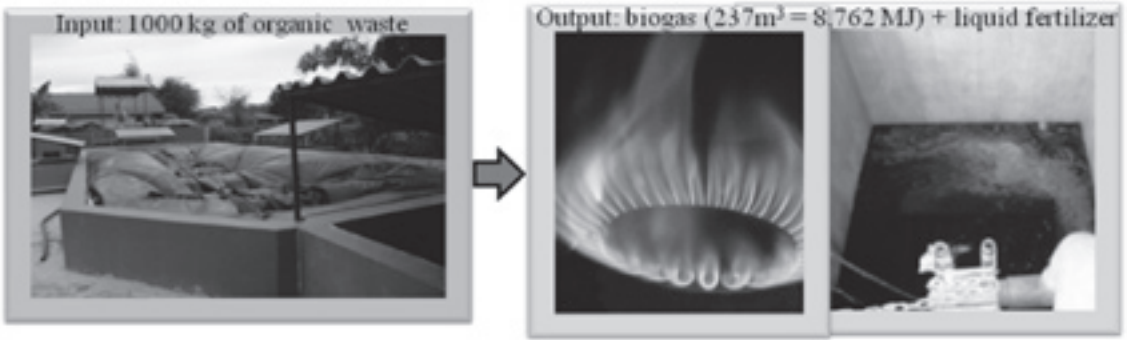
- They can save money for the municipality by reducing the need for waste collection, transport and final disposal. Decentralised systems can be especially cost-effective in this regard. Many Asian cities spend 15-20% of their municipal budgets on waste management, mostly on collection and transportation.
- The end-products (compost and liquid fertiliser) can contribute to improved soil properties and reduce the need for agrochemicals, provided that their quality can be ensured. This can improve productivity and lessen the costs for farmers. Reduced demand for nitrogen fertilisers can also bring environmental benefits since fertiliser production is energy-intensive and generates large emissions of greenhouse gases.
- Anaerobic digestion generates biogas and can thereby contribute to local energy security. Energy generation can provide tangible benefits for residents and thereby strengthen their incentives for supporting the system, for example by sorting waste at source. If the biogas replaces fossil fuels, anaerobic digestion will also have an additional climate benefit in terms of reduced greenhouse gas emissions.
- They can generate jobs for unskilled and semi-skilled labour. The number of jobs created depends on several factors, but as a rule-of-thumb it is reasonable to expect two jobs per ton of daily organic waste generation.
- Community-based systems can be a source of additional income for low-income households and communities. They can also contribute to environmental awareness-raising more generally and help developing the social capital of communities involved.

In addition, experiences from several cities show that separation of organic waste at source can increase the recycling rates also of other recyclable materials, such as plastics, paper and metals. When the wet kitchen waste is separated it becomes easier to collect these recyclable materials, less effort is required for sorting and cleaning them and their market value increases. The result can be a kind of multiplier effect on the reduced need for landfill disposal: when households separate one tonne of organic waste, the need for final disposal is typically reduced by much more than one tonne. This means that the waste management costs for the municipality are further reduced, households can increase their income by selling more recyclables and getting better prices, and the environment benefits from increased recycling.

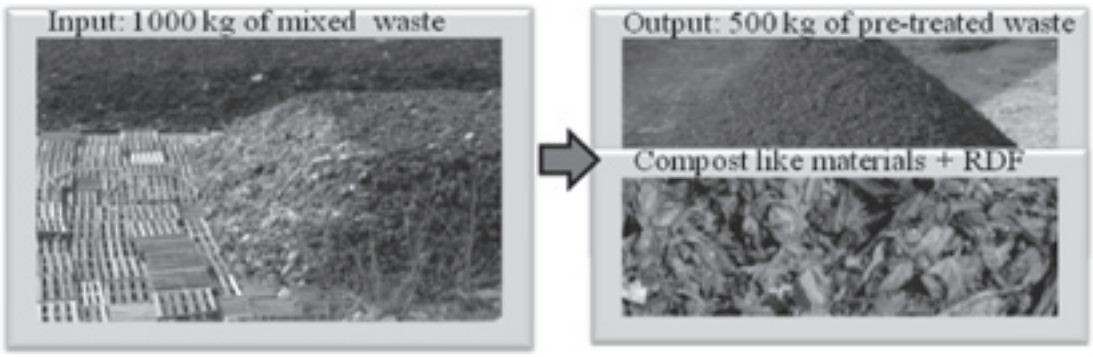
Box 1 Methods for Biological Treatment

Composting is a process where naturally occurring microorganisms degrade organic materials into carbon dioxide and water. The process requires oxygen so some form of aeration, such as regular turning of the compost pile, is needed. Composting generates heat and a properly managed process will effectively eliminate harmful pathogens, making the product – compost – safe for humans to handle. A number of different composting designs exist, ranging from small scale manual techniques suitable for single households up to large scale mechanised facilities. Composting facilities of various sizes and designs can be found in most countries in the Asia-Pacific region. A noteworthy case is Surabaya (Indonesia) where the municipality managed to reduce the amount of waste to be landfilled by more than 25% over a period of just 4 years, partly as a result of a successful introduction of composting. The system in Surabaya includes household composting and community-based composting targeting household waste as well as centralised composting facilities treating waste from food markets and parks.

Anaerobic Digestion (AD) is also a process based on microbial degradation. The difference from composting is that the microorganisms that are active in AD require oxygen-free (anaerobic) conditions and generate methane instead of carbon dioxide. AD must therefore be done in a closed tank, both in order to prevent air from disrupting the degradation process and in order to contain the methane. Small-scale AD has been successfully implemented in many rural areas in Asia, especially for treating livestock waste (sometimes mixed with household waste). In urban areas, it is most suitable for specific organic waste streams, especially waste with high fat contents, and for combined treatment of sewage sludge and various kinds of organic solid waste. Compared to composting, AD is a more sensitive process that requires better process control. It should therefore be regarded as a more advanced technology. Muangklang Municipality in Rayong Province and Sam Chuk Municipality in Supanburi Province, both in Thailand, are examples where small-scale AD facilities (1.5-2 tonnes of organic waste per day) have been successfully implemented. These municipalities are distributing the biogas produced to households living near the facilities, as replacement for the LPG that Thai families usually use for cooking.



Mechanical-Biological Treatment (MBT) is not a fixed technology but a term used for various forms of pre-treatment carried out before landfill disposal. It can be useful for treating waste containing a high fraction of organic materials and that has not been properly separated at source. A typical MBT system includes manual and/or mechanical sorting where large items and recyclables, including some hazardous materials, are removed, separation where high-calorific waste (mostly plastics) are diverted to be used as fuel, and composting where the organic fraction of the waste is partly degraded. MBT can reduce the volume of waste to be disposed on landfill by around half, facilitate recovery of recyclables, reduce the disposal of hazardous waste (due to the sorting), generate fuel pellets (Refuse Derived Fuel, RDF) suitable for replacing fossil fuels in industrial processes, and reduce greenhouse gas emissions. A MBT facility is typically large in scale and co-located with the disposal site. An example of successful implementation is Phitsanulok in Thailand where a MBT system capable of treating 100 tonnes of mixed municipal waste per day has been in operation for more than a decade.



4 Final disposal remains the dominant treatment option

Although biological methods offer several advantages, both at the local level and for the global climate, they are still not widely practiced. The current trend in urban waste management in Asia is rather towards improved versions of final disposal. This can mean anything from slightly improved dumping sites retrofitted with basic protection equipment to fully equipped sanitary landfills. By establishing such improved

disposal sites cities can significantly improve the local environment, especially if waste collection systems are upgraded so that less waste remains uncollected or disposed informally. However, the costs of constructing and operating landfills of high environmental standard are considerable. Final disposal also suffers from a number of serious drawbacks, including potential environmental impacts, and are often met with opposition from local communities. In many countries across Asia there is a strong public opinion against landfills, making the establishment of new disposal sites politically challenging. The difficulty of securing land for landfills close to cities has also often led to long transport distances, thereby further increasing the costs for waste management as well as the associated air pollution.

However, final disposal remains the dominant treatment method and is often considered the only feasible option – in spite of its drawbacks. Our research, which is based on discussion with government officials responsible for waste management at local and national levels as well as numerous case studies across the Asia Pacific region, has identified a number of reasons why final disposal remains the most common option for of waste management systems:

- Low priority given to treatment and disposal; efforts mainly focused on collection and transportation
- Insufficient budget availability and allocation to waste management, and a resulting lack of resources for investments in new technologies
- Inefficient and costly waste collection systems limiting the resources available for treatment. Many cities spend 75-80% of the money allocated to waste management on collection and transportation alone
- Limited knowledge about other treatment options
- Low awareness of climate impacts of landfills, as well as of the risk for local environmental impacts
- Low priority of climate change mitigation
- Lack of experience in strategic and integrated planning, often combined with a preference for a single technical solution to all waste streams
- Undeveloped markets for organic soil improvers, such as compost and sludge from anaerobic digestion
- Subsidies to chemical fertilisers distorting the market and making it difficult for organic products to compete successfully
- The widely-held perception that source separation of organic waste is almost impossible to achieve
- Municipal administrations' lack of experience in effectively engaging households and other stakeholders, including the private sector, in waste management

It is an important policy task to address these factors and to facilitate the adoption of biological treatment methods as significant complements to landfills. At the end of this brief we present a number of concrete actions that can be taken by policy-makers at national and local levels.

5 Climate change – strengthening the rationale for biological methods

In developing Asian countries, the greenhouse gas emissions from urban solid waste management are still rather modest but that situation is changing. Growing urban populations and increasing per-capita generation of organic waste mean that the potential emissions from the urban waste sector are on the rise. This, in turn, increases the importance of waste treatment methods that can protect citizens' health and the local environment while also having minimum impact on the global climate.

However, as noticed above, current technology trends in Asia – with a strong focus on landfill disposal – will lead to escalating greenhouse gas emissions. Across the region, many cities are investing to improve their disposal sites – often constructing deeper landfills with equipment for compaction and systems for leachate collection and treatment. This upgrading of disposal sites will surely benefit the local environment, but also poses a threat to the global climate. Since it is easier for the conditions inside of deep compacted landfills to become anaerobic[3] than in ordinary shallow waste dumps, the improved landfills provide suitable living conditions for microorganisms that produce

[3] Anaerobic means conditions where little or no oxygen is present. Under such conditions, the microorganisms that normally degrade organic waste into water and carbon dioxide cannot live; instead, other kinds of microorganisms that produce methane will dominate the degradation process.

methane. For example, it has been estimated that 1kg of food waste disposed in a shallow landfill (<5m deep) can generate 0.42kgCO_2eq of methane while the corresponding figure for the same amount of waste disposed in a deep compacted landfill (>5m) can reach 1.05kgCO_2eq of methane.

There is clearly a risk that when local governments upgrade their waste disposal sites they will reduce local pollution but at the same time increase their contribution to a global environmental problem. We argue that national governments have a key role to play in solving this dilemma. This can be done by providing stronger incentives for local decision-makers to adopt treatment technologies that are able to reduce the local environmental problems associated with organic waste, that offer additional local benefits and that also have low climate impact.

6 Landfill gas recovery – possible but not an ideal solution

Methane generated in landfills can be captured and flared (so that it becomes carbon dioxide and water) or used as a source of energy. There are many landfills equipped with such gas recovery systems to be found in all parts of the world. However, recovery of landfill gas (which consists of roughly 50% methane and 50% carbon dioxide) is not without problems from a climate perspective. Even under favourable circumstances in advanced countries, the recovery rate seldom reaches 80% (meaning that more than 20% of the methane generated is emitted to the atmosphere) during the active recovery phase. When calculated over the whole lifetime of a landfill, a realistic range of recovery rates for developing countries is 15-40%, meaning that far more than half of the methane still goes to the atmosphere and contribute to climate change.

Using methane from landfills as a source of energy can generate additional climate benefits if the gas replaces fossil fuels. However, many landfill gas recovery projects in developing countries have found it economically unfeasible to generate energy from the captured methane, not at least since electricity is often subsidised. The existence of favourable feed-in-tariffs for electricity from renewable energy sources can improve the economic viability. Revenues from carbon trading can have a similar positive effect.

From a climate protection perspective, a landfill equipped with gas recovery is clearly superior to a landfill that lacks such facilities. Thus, for existing landfills where degrading waste is generating methane emissions, installing a gas collection system makes good sense – at least in theory and under favourable conditions. However, in tropical climates organic waste degrades rapidly so the amount of gas that can be recovered from an old landfill is usually quite small. In addition, a retrofitted gas collection system can never be as effective as a system that was included in the original landfill design.

Landfill disposal with gas recovery can also be regarded as a realistic option during a transition period when capacity for organic treatment is strengthened. It will take time before a majority of Asian cities are ready to implement organic treatment at full scale and in the meantime gas recovery has a role to play. However, policy-makers at national and local levels need to avoid a situation whereby waste management gets locked-in into landfill disposal and they should be clear about this being a temporary solution.

7 Policy packages for more sustainable waste management

Government policies play a crucial role in increasing the use of biological methods. Although some governments have framework policies favouring biological methods, there is often a lack of concrete actions supporting the implementation. In many cases there are also obstacles to the uptake of biological methods caused by conflicting policies. In addition, waste management is typically governed by at least two levels of government – national policies and municipal regulations – and the role-sharing, mandates and responsibilities can be unclear.

Box 2 The Case of Phnom Penh

In 2001, a centralised composting facility was established in Phnom Penh, Cambodia. The project was led by an NGO, the Cambodian Education and Waste Management Organization (COMPED) and the investment was supported by a German state government. Phnom Penh Municipality gave permission to COMPED to build the composting facility using 2,000 square meters of land adjacent to the Stung Meanchey disposal site. COMPED agreed with the manager of the wholesale agricultural market to collect green waste separately and bring it to the composting facility. The capacity of the facility is 5 tonnes/day. Former informal waste collectors were employed as operators and received a stable income. COMPED sold compost to farmers and could thereby cover the operation costs. However, the composting activity decreased in 2009 when Phnom Penh Municipality closed the Stung Meanchey disposal site and did not offer any support for composting at the new site. Finally, the composting in Phnom Penh was discontinued in 2010. The composting activities in Phnom Penh could easily be restarted and scaled up since the local know-how and experience remains. However, the necessary supporting policies are currently lacking. Recently, the Ministry of Environment of Cambodia began to encourage the 3Rs (reduce, reuse and recycle) for waste management. The new national strategy intends, among other things, to increase the use of composting and other biological methods but the detailed policies have not yet been formulated. This case illustrates the significance of supporting policies and provides an example of how policy ambitions at the national level and concrete policy action at the local level can go in opposite direction.

In order for biological methods to expand, it is essential that governmental policies and actions are harmonised so that they provide clear incentives to local stakeholders. For this to happen, national and municipal decision-makers need to co-ordinate their initiatives better than they do currently. The case study from Phnom Penh presented in Box 2 illustrates that significant improvements can be achieved locally, but that that long-term commitment from the local government is needed in order to sustain such improved practices. The case also suggests that appropriate national policies can play an important facilitating role. In this final section we present seven groups of actions to be taken by national and local governments. For some of these recommendations we provide examples of countries/municipalities where the suggested measures have already been fully or partly implemented.

Given that the circumstances differ among countries and also among municipalities, the recommendations *should be read selectively*; not all recommendations will be relevant, or equally important, to all. Priorities and the order in which measures are introduced will vary from one location to another. However, based on our experience from the region we believe that most of our recommendations are relevant to the vast majority of national and local governments.

What should national governments do?

A. Engage Stakeholders

- Form a task force involving all relevant line ministries to review existing policies, set common targets, and indentify needs for policy revision
- Establish a platform for interaction with local governments on a regular basis
- Encourage and support knowledge transfer on waste treatment technologies and models for involving stakeholders among cities, both domestically and at the international level
- Give recognition to cities that have successfully introduced biological treatment and encourage other cities to learn from their experiences
- Engage media in nation-wide campaigns on the benefits of improved waste management and the importance of source separation

A good example of stakeholder engagement is an annual award programme run by the Ministry of Natural Resources and Environments in Thailand, which focuses on best practices of solid waste management at the local level. Municipalities that are awarded become models for other cities to be inspired by and to learn from.

B. Formulate Supporting Policies

- Allocate sufficient financial resources to the waste management sector and dedicate resources to strengthening the capacity of local governments to select and implement better technologies
- Adopt policies supporting private sector participation and strengthen the capacity of local governments to form effective public-private partnerships
- Review agricultural policies, especially subsidies to fertilisers, in light of how they influence the market for organic soil improvers, such as compost
- Establish quality standards for organic soil improvers and strengthen capacity for quality testing and a credible labelling scheme
- Include the solid waste sector in national climate change mitigation strategies and set targets on reduced disposal of untreated organic waste
- Acknowledge the significance of sustainable waste management and work towards improving the status of the waste management profession

In Taiwan, the pursuit of zero waste has become a nationwide movement and six national strategies have been adopted, including regulatory amendments, education, financial incentives, technical support, and monitoring and reporting. In order to approach the goal of zero waste, stepwise policy targets have been set for the near mid-term and long-term future.

C. Strengthen Information Management

- Facilitate access to reliable information on various waste treatment technologies, including technical performance, costs, and maintenance requirements. Provide financial assistance to academic and research institutions for carrying out practical research on new technologies and their application. Work together with practitioners' networks, academia and international organisations for dissemination
- Strengthen the systems for collecting and managing waste data. Lack of accurate data is one of the obstacles to effective policy development at the national level
- Ensure that pilot projects are properly evaluated and documented, and that experiences gained from such projects are widely shared

What should local governments do?

A. Liaise with the National Government

- Provide the national government with regular updates on good local practices, and on progress and challenges in the implementation of national waste strategies and policies
- Call attention to areas where national policies create obstacles for biological treatment

B. Formulate Local Strategies for Implementation

- Ensure commitment from the highest political level and assign responsibility for sustainable waste management at an appropriate level in the municipal administration
- Encourage waste avoidance and reduction, especially for food waste. Many traditional practices, such as feeding animals with food waste, have multiple benefits but are becoming less common
- Reduce administrative hurdles for the establishment of biological waste treatment facilities, and consider providing land at low cost and subsidies or soft-loans for setting up new facilities
- Reinforce efforts to collect and manage data needed for planning and monitoring

Mungklang municipality in Thailand can be considered a good example of a local authority that has formulated strategies for sustainable waste management. In line with these strategies, the municipality has implemented low-cost integrated waste management through a model that emphasises awareness raising and participation. As a result, disposal of food waste has been drastically reduced through the development of an integrated system which combines anaerobic digestion, composting and feeding waste to animals.

C. Coordinate Local Stakeholders

- Work closely together with multiple stakeholders, including for example NGOs, media, women's groups, religious organisations, private enterprises, schools, networks of informal waste collectors, and local academic institutions
- Facilitate private sector participation, and identify what tasks can be carried out more effectively by private contractors
- Strengthen stakeholders' incentives to contribute, for example by sharing some of the economic

savings from reduced waste collection, transport and landfill disposal with communities and organisations that reduce waste volumes through biological treatment

- Start by targeting organic waste from large sources, such as fresh food markets, restaurants, hotels, and schools, and expand gradually to household waste
- Assist in the establishment of viable markets for compost and liquid fertiliser, for example by connecting potential sellers and buyers, and by using compost in municipal gardens, parks, and government premises

Surabaya, the second-largest city in Indonesia established more than a dozen composting centres and achieved a wide adoption of small-scale composting within a short period of time. This was possible through an active involvement of the residents, community groups, local NGOs, private companies and the media. The money spent by the municipality on activities to promote composting amounted to as little as 1-2% of the total solid waste management expenditures. The city has achieved a significant reduction of landfill disposal.

D. Nurture Innovative Practices

- Recognise the value also of small-scale initiatives and aim to develop a system based on a combination of different collection models and treatment technologies
- Avoid the temptation of trying to find one single technical solution for the city's waste treatment; a system that combines various treatment technologies is better at exploiting the resource potential of the waste stream and is therefore more likely to be sustainable
- Regard biological treatment not as a time-limited project but as an ongoing activity that needs long-term commitment and may need continuous encouragement and regular adjustments

Starting in 1996 Phitsanulok municipality in Thailand is encouraging the residents to propose and apply practical solutions for waste reduction at the household level (e.g. through composting and the use of food waste as animal feed). The remaining discarded mixed waste is collected and treated in an MBT process where recyclables are extracted, a waste fraction suitable as fuel is turned into pellets, and the organic waste is pre-treated before final disposal.

• Related IGES Publications

A guide for technology selection and implementation of urban organic waste utilisation projects in Cambodia. IGES Policy Report 2012. Available in English and Khmer.

A guide for sustainable urban organic waste management in Thailand: combining food, energy, and climate co-benefits. IGES Policy Report 2012. Available in English and Thai.

Practical guide for improved organic waste management: climate benefits through the 3Rs in developing Asian countries. IGES Policy Report 2011. Available in English, Khmer, Lao, and Thai.

Reducing Waste through the Promotion of Composting and Active Involvement of Various Stakeholders: Replicating Surabaya's Solid Waste Management Model. IGES Policy Brief No.9, 2009. Available in English and Japanese.

Urban organic waste: from hazard to resource. In: Climate Change Policies in the Asia-Pacific: Re-uniting Climate Change and Sustainable Development. IGES White Paper II, 2008. Available in English and Japanese.

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