

# Valuing Waste, Transforming Cities



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# **Valuing Waste, Transforming Cities**

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# Acronyms and abbreviations

<b>\$</b>	United States dollar
<b>3R</b>	reduce, reuse, recycle
<b>AHKMT</b>	Dr Akhtar Hameed Khan Memorial Trust
<b>BDT</b>	Bangladeshi taka
<b>CDA</b>	Capital Development Authority
<b>CDM</b>	Clean Development Mechanism
<b>CEO</b>	chief executive officer
<b>CITENCO</b>	City Environment Company
<b>CO<sub>2</sub></b>	carbon dioxide
<b>COMPED</b>	Cambodia Education and Waste Management Organization
<b>CSARO</b>	Community Sanitation and Recycling Organization
<b>ENDA</b>	Environment and Development in the Third World
<b>ESCAP</b>	Economic and Social Commission for Asia and the Pacific
<b>GAEA</b>	Global Action for Environmental Awareness
<b>IGES</b>	Institute for Global Environmental Strategies
<b>IRRC</b>	integrated resource recovery centre
<b>KPI</b>	key performance indicator
<b>LGED</b>	Local Government Engineering Department
<b>LPG</b>	liquid petroleum gas
<b>NAMA</b>	nationally appropriate mitigation action
<b>NGO</b>	non-government organization
<b>PKR</b>	Pakistani rupee
<b>RDF</b>	refuse-derived fuel
<b>UNCRD</b>	United Nations Centre for Regional Development
<b>URENCO</b>	Urban Environment Company
<b>VND</b>	Vietnamese dong

# Executive summary

## ***Waste is a valuable resource and an untapped opportunity***

A waste crisis is emerging in the Asia-Pacific region, stoked by escalating quantities of waste, on the one hand, and poor regulation and management, on the other. Urban populations and economies are expanding, and with increasing numbers of people earning and spending more, consumption and waste are rising. The World Bank estimates that the generation of waste per day in the Asia-Pacific region will more than double, from 1 million tonnes in 2012 to around 2.5 million tonnes, by 2025. Such rates of waste generation are difficult to manage, and in countries where regulation is already weak, this challenge is a serious one. This is particularly the case in towns and cities in low- and middle-income countries, which tend to lack know-how, resources and economies of scale for safely handling waste.

Within this waste crisis, however, is a considerable and largely untapped opportunity. A major portion (tending to range between 50 and 65 per cent) of the solid waste generated in low- and middle-income cities is organic. This waste, which includes food scraps and garden waste, can be recycled into compost or transformed into biogas and used as an energy source. In addition, recyclable inorganic materials, like paper, plastic and glass, make up 26–33 per cent of the solid waste in these countries. Overall, around 90 per cent of solid waste in these cities can be recycled—which represents a massive opportunity for waste recovery.

In effect, waste is being wasted. By dumping, burning or landfilling, the value of both organic and inorganic waste is lost. Recycling these materials allows municipalities, communities and businesses to capture and retain this value. But creating a recycling culture requires changes in perception: waste, especially organic waste, must be seen as a resource and an opportunity.

## ***Integrated resource recovery centres: An inexpensive solution with many benefits***

The integrated resource recovery centre (IRRC) is a small-scale, decentralized, community-based waste-to-resource model that uses simple techniques to capture the value of waste. IRRCs are inexpensive to build and relatively straightforward to operate because they require no or little mechanization. They can transform organic waste into compost or biogas; they can also process faecal

sludge into compost. IRRCs can produce refuse-derived fuel and other waste-based products, and they can process recyclable inorganic materials. All of these outputs have a potential market value as a resource.

An IRRC creates a range of economic, social and environmental benefits for municipalities, communities, businesses and national governments while managing a waste problem. As for the many economic benefits, by diverting waste from landfill sites, an IRRC can save a municipality substantial expenditure on transport costs, extend the life of existing landfills, reduce government spending on chemical fertilizer subsidies and improve the yield of crops. The scope of social benefits includes the generation of green jobs for low-income groups, improved living conditions and improved community understanding of critical environmental issues. Additionally, the IRRC model generates such environmental benefits as reduced pollution, improved soil fertility through the application of compost and increased management of methane emissions (a harmful greenhouse gas).

***Waste-to-resource initiatives require government commitment, strong partnerships, financial sustainability and behaviour change***

Successful waste-to-resource initiatives (including an IRRC) depend upon four requisites. First, government commitment to the initiative is imperative. Such commitment may come from the municipal, provincial and/or national governments and is necessary for financial, technical and policy support. Second, cost-recovery is vital if a waste-to-resource facility is to provide long-term and sustainable benefits to a city. Cost-recovery should derive, to the extent possible, from the sale of the resources recovered from waste, such as compost or recyclable materials. Facility managers, however, must also seek out additional sources of revenue, typically through waste collection and tipping (or gate) fees, government subsidy and other forms of financial support. Third, source separation of waste is critical because it permits the acquisition of good-quality, clean and uncontaminated organic and inorganic materials. This involves the separation of waste at its origin (such as households and businesses), its collection and its transportation to the plant. Finally, stakeholder engagement is critical because waste-to-resource initiatives rely upon the proactive contribution of a range of actors, stretching from groups of informal workers to national government agencies. Different stakeholders have access to different types of resources, such as expert knowledge, community trust, political legitimacy or informal sector connections, and must be engaged accordingly.

## ***Successful waste-to-resource initiatives are built on the bedrock of partnership***

Partnerships are essential for sustainable waste-to-resource initiatives. Such initiatives tend to be multisectoral and multifaceted, requiring simultaneous action from government bodies, community groups, households, businesses and individuals. Important lessons regarding partnerships include:

- **Partnerships need to be based on trust and a shared vision.** Strong partnerships evolve around a core of mutual interests and common vision. This requires partners to identify their related needs and understand how the waste-to-resource initiative will return shared benefits.
- **Partnerships across different spheres of government are needed.** Of the many partnerships that waste-to-resource initiatives rely upon, those with the local, provincial and national governments are the most critical.
- **Partnership arrangements should align with local conditions and specific needs.** Local conditions greatly affect the capacity, characteristics and performance of waste-to-resource initiatives. Each city has a unique profile of actors, challenges, drivers of change and institutional and policy set-ups.
- **Different partners can contribute resources to the initiative.** Because different stakeholders can access, control and deploy different types of resources, complementarity needs to be considered early in an initiative's setting-up process.

## ***Successful waste-to-resource initiatives improve awareness and change behaviour***

For waste-to-resource initiatives to foster change among different stakeholders, it is essential to create as much awareness of its necessity and benefits as possible. It is through information sharing and government and community outreach that the required changes in behaviour are achieved. Important lessons include:

- **Changes in mind sets and perceptions are essential.** Successful waste-to-resource initiatives engender and depend upon a comprehensive and sustained change in the public's perception of waste as a resource. Such a change is difficult but vital to achieve.



- **Changing behaviour takes time, patience and sustained engagement.** To achieve behaviour change, waste-to-resource managers need to focus on educational community outreach and delivering awareness-raising and capacity-building campaigns to households, markets and commercial units. This is not easy, and results are not seen overnight. With persistence, good results can be achieved.
- **Source separation begins with changing individual actions.** Waste separation at source involves households, markets, hotels, restaurants and other producers of waste dividing their waste into various components, such as organic waste and recyclable inorganic material. This process begins with individual actions and builds from there.
- **New behaviour needs to be supported by appropriate infrastructure.** The commitment of households, markets and commercial units to separate their waste is lost if they perceive that their efforts are in vain. Waste collection infrastructure, including bins and containers, as well as waste transportation systems need to be aligned with the goal of waste separation.
- **Informal sector engagement helps to achieve broad community change.** The informal sector has an integral role in waste collection and recycling in many cities in low- and middle-income countries. Engaging this sector to support waste separation at source and having a broader programme of waste recovery can generate multiple benefits, especially in terms of community change.

***Successful waste-to-resource initiatives rely on sound facility management and operational performance***

Careful management of waste-to-resource facilities and keen attention to operational performance are vital for success. Facility managers need to adopt a range of good practices if sound, sustainable initiatives are to be achieved. Important lessons in management and operations include:

- **A business plan, job descriptions and careful accounting are fundamental.** Waste-to-resource facilities should operate as a business to the fullest extent possible. Such an approach greatly facilitates cost-recovery, thereby allowing the facility to maintain its operations over the long term.

- **Key performance indicators need to be established and monitored.** Good management requires the monitoring of operations, which is dependent on systematic data collection. Such data should include the amount and type of waste received at the facility, the amount of waste rejected (and why), the amount of compost or biogas produced and the time it took, and the amount of biogas and recyclables sold.
- **Diversifying revenue sources builds financial resilience.** To be sustainable over the long term, waste-to-resource initiatives must develop a robust portfolio of revenue sources. Given the size of sales of compost and recyclable materials and the fluid, often unpredictable conditions and context in many cities, diversification of revenue sources greatly increases the financial resilience of operations.
- **Collection and tipping fees are usually required to achieve cost-recovery.** Waste-to-resource facilities that achieve operational cost-recovery usually do so by increasing the revenue derived from collection and tipping (also called gate) fees.
- **Improving quality helps to open markets.** Revenues increase when waste-to-resource facilities improve the quality of their products. This is true for compost products and recyclables. Recyclables need to be cleaned, compacted, sometimes shredded and packaged. In many cities, a market already exists for recyclables.

### ***Successful waste-to-resource initiatives can be replicated and scaled up***

Supportive policy and an enabling regulatory and market environment are helpful for the replication and wider scaling up of waste-to-resource initiatives. Important lessons for creating such an enabling environment include:

- **Scaling up is a long-term goal requiring shifts in policy and behaviour.** The most important precondition for scaling up waste-to-resource operations is a readiness for change. Scaling up means that more and more communities, businesses and government bodies will be engaged and expected to adopt new practices.
- **Scaling up should be incremental and modular.** The IRRS is a small-scale, decentralized waste-to-resource model usually servicing a specific ward, commune or community. It is thus based in and reliant upon the community it serves. To expand the waste-to-resource initiative to other communities

within a city, new IRRCs can be built. In this way, expansion can be modular (community-by-community, city-by-city) and incremental.

- **Engaging markets can support the sale of biogas, compost and other products.** In some countries, chemical fertilizer and commercial gases are subsidized heavily by the national government. Reducing the retail price of these products through subsidy, however, tends to exert downward pressure on compost and biogas prices. As a result, to foster compost and biogas sales, existing policies on fertilizer and gas subsidy should be reviewed.
- **Policy change is best achieved following a successful pilot project.** To encourage policy change, policymakers should draw on successful piloted waste-to-resource initiatives. Findings, lessons and documented experiences from the field are particularly useful and help to ensure that new or revised policies are in line with local conditions and realities and thus foster sustainable replication and scaling up.
- **National programmes and financing are especially useful for replication.** Progress and efficacy in replicating waste-to-resource initiatives are greatly enhanced when the initiative is supported through national programmes. In particular, incorporating or transforming a waste-to-resource initiative into a national programme tends to mobilize useful national policy and financing.
- **International climate change financing can be leveraged for replication.** Because waste-to-resource initiatives reduce the emission of methane, a harmful greenhouse gas, they can be considered climate change mitigation projects. Thus, they are eligible to receive financing from international climate change mitigation mechanisms, such as nationally appropriate mitigation actions (NAMAs).

## ***Structure of this report***

This report is divided into three parts.

Part I—Out of the Waste Crisis—highlights the challenges and opportunities for improving municipal solid waste management in developing countries in the Asia–Pacific region and the benefits of adopting a waste-to-resource approach. It presents key data for understanding the scale of the challenge and the opportunity. It also introduces the IRRC model, developed by Waste Concern and promoted by ESCAP across the region as a method for capitalizing on the opportunity through waste recycling and recovery. Part I also discusses the many benefits and essential requisites for successful waste-to-resource initiatives.

Part II—Lessons Learned—presents important findings gathered over six years of experience within the ESCAP regional programme on pro-poor and sustainable solid waste management in secondary cities and small towns. These lessons are divided into four themes: (i) partnerships (ii) awareness raising and behaviour change (iii) managing and operating an IRRC, and (iv) creating an enabling environment for replication and scaling up. Each of the four sections concludes with a series of recommendations for policymakers and governments at the local and national levels. It is hoped that these recommendations will provide guidance on how to facilitate and manage pro-poor and sustainable waste-to-resource initiatives.

Part III—City Profiles—encompasses fact sheets of the eight cities where the ESCAP regional programme established an IRRC or waste-to-resource initiatives more generally: Kushtia (Bangladesh), Battambang and Kampot (Cambodia), Islamabad (Pakistan), Matale and Ratnapura (Sri Lanka) and Kon Tum and Quy Nhon (Viet Nam). All of these are secondary cities or small towns, with the exception of Islamabad, which is a large capital city. Each fact sheet includes an overview of the city and outlines the waste-to-resource initiative that was implemented, the results and the impacts.

# **PART I**

## **OUT OF THE WASTE CRISIS**

- The waste crisis in Asia and the Pacific and the urgent need for change
- An inexpensive solution for transforming waste into resources: The integrated resource recovery centre
- The benefits of waste-to-resource initiatives
- Critical requisites for successful waste-to-resource initiatives







# Introduction

Growing urban populations and economies across the Asia-Pacific region are generating an increasing amount of solid waste. Too often, especially in low- and middle-income urban centres, that waste is poorly managed. As a result, a waste crisis has emerged.

A large portion of the solid waste found in low- and middle-income cities is organic—up to 80 per cent in some cases. This waste, which includes food scraps and garden waste, can be recycled into compost, which represents a vast and largely untapped opportunity for cities across the region to manage waste usefully while creating jobs.

Until recently, low- and middle-income cities lacked viable models for making the most of this opportunity. Many of the region's experiments with large and often expensive waste-to-resource initiatives using foreign technology have failed. What is proving successful are smaller, low-tech, decentralized models, such as the integrated resource recovery centre (IRRC) concept developed in Dhaka, Bangladesh, home to perhaps some of the most challenging low-income conditions globally. The IRRC model has proven to be uniquely suited and highly relevant to the realities of low- and middle-income cities.

The IRRC transforms waste—something typically given no value—into a resource that can be sold. Such a waste-to-resource model can bring about sweeping changes in the way that societies, governments and markets understand waste. The IRRC model also generates a range of economic, social and environmental benefits for local communities, businesses and governments, including financial savings for municipalities, job creation, reduced environmental pollution and reduced greenhouse gas emissions.

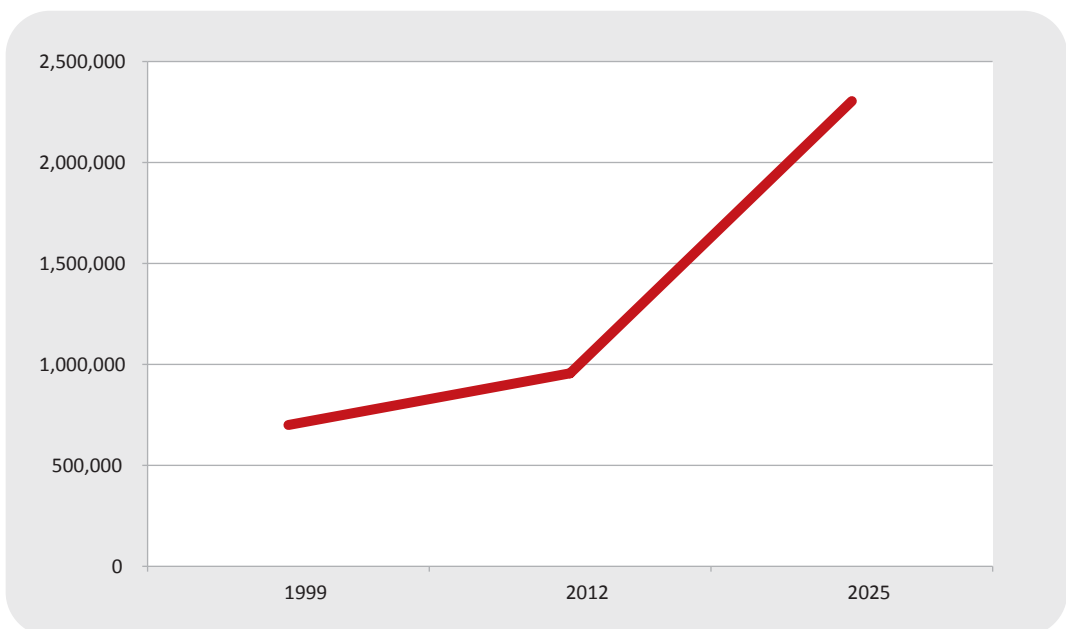
# 1. The waste crisis in Asia and the Pacific and the urgent need for change

## 1.1 Escalating waste

Rapid urbanization, demographic growth and economic development are changing the Asian–Pacific landscape and generating a tremendous amount of waste. The rise in well-being and prosperity of urban residents links closely to increased consumption and production patterns with consequences for waste streams.

Increased municipal solid waste is particularly noticeable in low- and middle-income countries, where consumption has previously been relatively low. In these countries, the rate of waste generation has risen quickly and is expected to accelerate over the next decade and beyond (Figure 1).

**Figure 1. Total amount of waste (tonnes) generated per day in the Asia–Pacific region**



Source: ESCAP, based on World Bank data. See World Bank, *What a Waste: A Global Review of Solid Waste Management*, Urban Development Series Knowledge Papers (Washington, D.C., 2012).



## 1.2 Overburdened local governments

From small towns to megacities, everyday waste often outweighs the management capacity of local governments. The Asia–Pacific region’s waste crisis is a combined issue of increased waste and poor management. Limited technical understanding, financial resources and regulatory support restrict many local governments’ ability to keep up. The situation has become extremely urgent and a paradigm change is required.

This is particularly the case in secondary cities and small towns, where the majority of the region’s urban population live. And it is here that the bulk of the region’s urban population growth is expected to occur.<sup>1</sup> Overwhelmed and seeing no alternative, too many local governments are relying on open dumping and uncontrolled landfilling to cope with their waste management demands. But dumps and uncontrolled landfills present numerous issues for a municipality and its residents. First, there is the expense. Many dumps are located far from where waste is generated and collected, which thus entails higher transport costs for waste collection agencies. An average of 20–50 per cent of an annual municipal budget in low- and middle-income countries is spent on solid waste management, of which up to 80–90 per cent can be spent on waste collection alone.<sup>2</sup>

Then there is the range of social and environmental issues. Dumpsites tend to produce a foul odour, which communities find unpleasant. Far worse but less noticeable, leachate, trace elements and heavy metals released from the waste can pollute aquifers and waterways that provide the water used for drinking and cooking; they also pollute the soil and food crops, which can affect long-term food security and create public health issues. Openly dumped waste attracts vermin, resulting in a higher incidence of disease among local populations, and burning waste pollutes the air and can lead to respiratory illnesses.

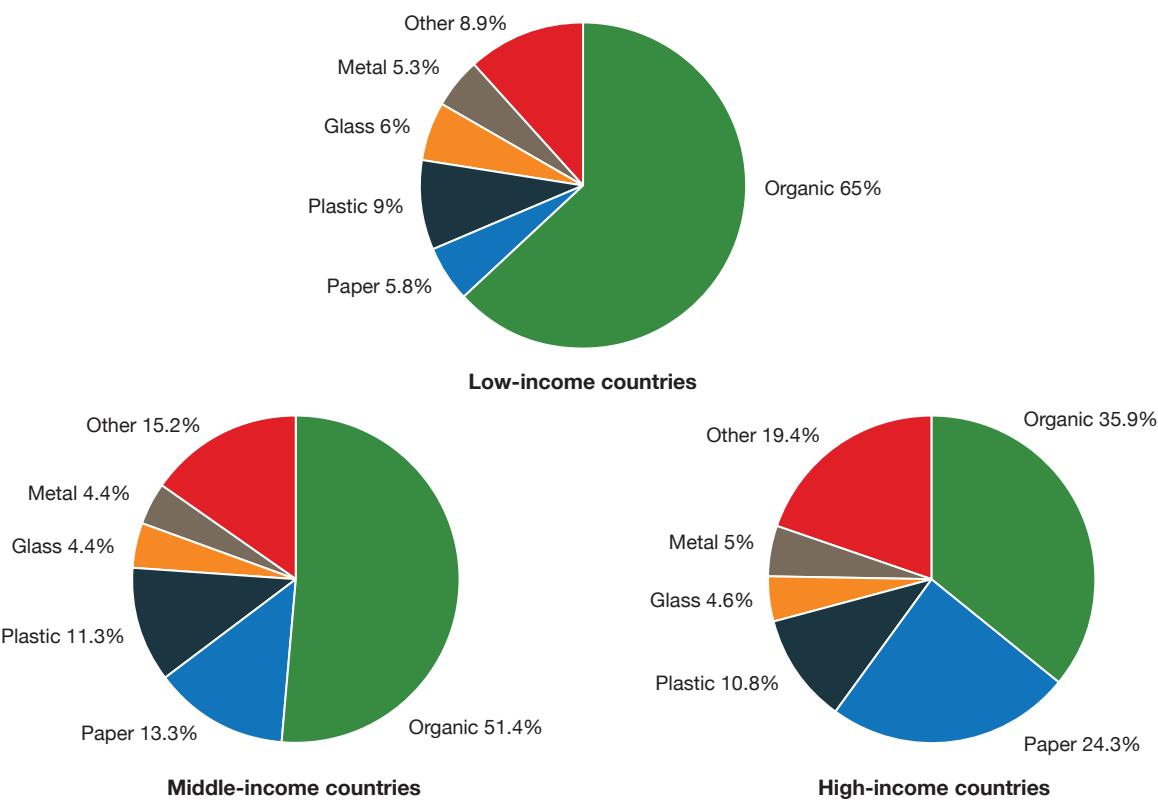
<sup>1</sup> United Nations, *World Urbanization Prospects: 2014 Revision* (Geneva, 2014).

<sup>2</sup> World Bank, *What a Waste: A Global Review of Solid Waste Management*, Urban Development Series Knowledge Papers (Washington, D.C., 2012).

# 1.3 The opportunity to turn waste into a resource

Although a formidable challenge, the Asian–Pacific waste crisis presents also a unique opportunity to create resources and usher in the needed paradigm change in waste management: Between 50 and 65 per cent of municipal solid waste in low- and middle-income countries is organic and can be turned into high-quality compost for use in agriculture, gardening or landscaping or made into biogas to produce heat and electricity (Figure 2). There are also significant opportunities for recycling the inorganic materials, such as glass, plastic and metal. Between 25 and 35 per cent of municipal solid waste is recyclable inorganic waste; this proportion will increase over the coming decades as countries further develop. With the appropriate paradigm shift, it is possible that up to 90 per cent of total municipal solid waste could be recovered, reducing the need for huge landfills and the use of raw materials.

**Figure 2. The opportunity for organic and recyclable waste in municipal solid waste streams in the Asia-Pacific region**



Source: World Bank, *What a Waste*.

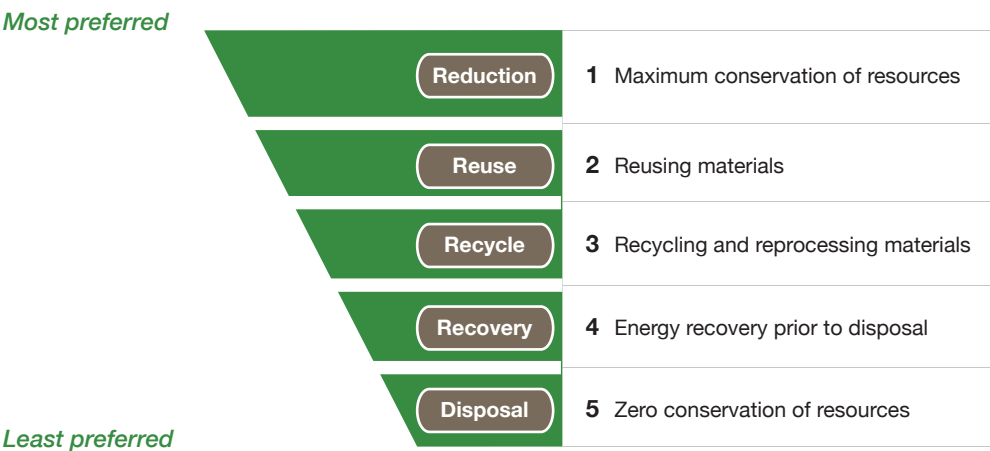
# 1.4 Recovering the value of waste

Seizing the opportunity to make substantive use of the recoverable material in municipal solid waste streams requires a change in how governments and the public perceive waste. Currently in the Asia and Pacific region, waste is viewed as a financial burden—and never seen as a benefit. The economic value of waste needs to be recognized, harnessed and exploited. Once the potential of waste is valued, how it is managed will inevitably change.

The change needed requires a huge shift in personal and organization behaviour. All societies must practise the ‘3R’ principles—reducing consumption and waste generation, reusing used products and materials and recycling waste (Figure 3). This requires more than just a change in practice; it is reliant upon changes in people’s mind set, which takes time and the extensive engagement of numerous stakeholders: households, communities, local and national governments and educators.

Much can be learned from the informal sector’s range of strategies for deriving value and income from waste. In many low- and middle-income towns and cities, informal networks of waste pickers and recyclers already collect and recycle 15–20 per cent of municipal waste. To move societies towards a 3R culture means engaging with the informal sector and recognizing its essential role in sustainable waste management. Expanding that role will create many benefits not only for the urban poor but for a city more generally in terms of environmental and economic benefits (see Section 3 on the benefits of waste-to-resource initiatives).

**Figure 3. Moving waste management towards waste recovery**



## 1.5 An affordable and practical model for waste recovery

Along with changes in perception and mind set, improving waste management requires tangible solutions. These solutions must be practical, affordable and easy to implement. Experience from around the region emphasizes that such solutions work best when they recognize, accommodate and build from existing limitations and opportunities at the local level, including waste composition characteristics and the human and financial constraints of local authorities.

A number of waste-to-resource solutions have been designed and tested in the region. Some of these have been large, centralized facilities based on foreign technologies and largely incompatible with local know-how, resources and behaviours. Many of these initiatives have failed. Smaller, decentralized and localized solutions also have been developed, and many of them have proven to be incredibly effective. One success story in particular is the integrated resource recovery centre model developed by Waste Concern and which the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) now promotes extensively across the region.



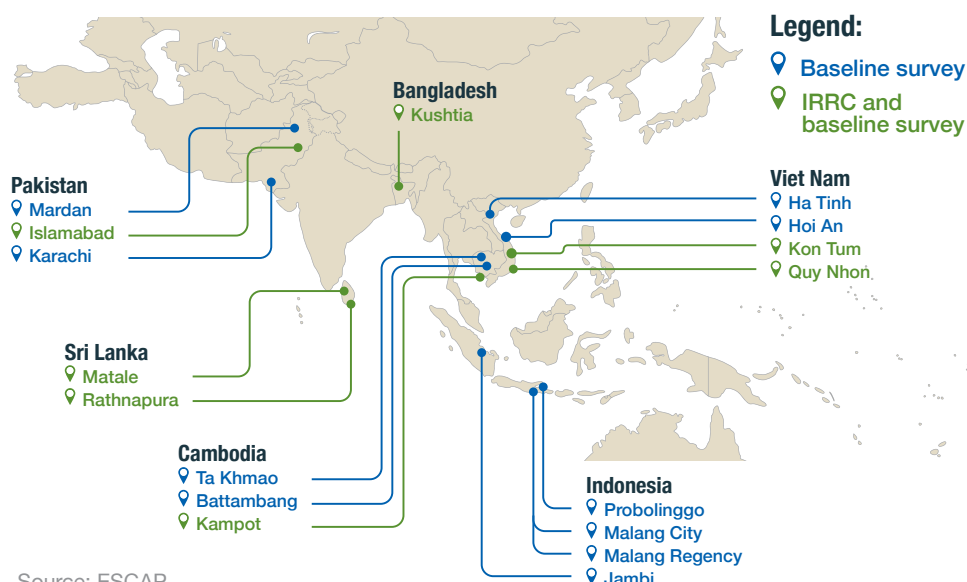
## 2. An inexpensive solution for transforming waste into resources: The integrated resource recovery centre

### 2.1 The integrated resource recovery centre model

ESCAP began developing the IRRC model across the Asia-Pacific region in 2007 after a regional assessment of viable low-cost and low-technology solid waste management practices that can thrive in unique conditions cited it as exemplary. Having been conceived, tested and refined in Dhaka, the IRRC approach was found to be robustly suited to the realities of low and middle-income cities.

In 2009, ESCAP launched a regional project called the Pro-Poor and Sustainable Solid Waste Management in Secondary Cities and Small Towns in Asia-Pacific. Under this project, ESCAP and Waste Concern, in partnership with national and local governments, community groups and technical teams, promoted the IRRC model in 17 cities, ultimately establishing facilities and pursuing associated activities in seven of them (Figure 4).

**Figure 4. ESCAP-promoted integrated resource recovery centres**



Source: ESCAP.

## 2.2 Why integrated resource recovery centres are versatile solutions

IRRCs provide communities and governments with a practical, affordable and decentralized alternative for sustainable solid waste management. The centre is a small-scale facility that can receive different types of waste, including organic and inorganic waste, and then transform it all into resources, such as compost, biogas and other fuels and clean recyclable material. The model relies upon the separation of waste at source and involves community engagement. Because it is based on the sale of resources produced in the facility as well as other sources of revenue, such as collection fees, sustainable operations and cost-recovery are possible.

The IRRC model can help cities manage municipal solid waste in a more efficient and effective manner because it:

- comprises both physical facilities and social systems;
- provides a low-cost mechanism for transforming organic and recyclable waste into valuable resources and thus generates revenue;
- utilizes simple technology and is non-mechanized;
- engages communities in behaviour change for separation of waste at source;
- offsets cost and land needed for landfills;
- brings a range of social, environmental and economic benefits; and
- is uniquely suited to the realities of cities in developing countries.





### Box 1. Conception and development of the first integrated resource recovery centre

In the early 1990s, Dhaka struggled with immense volumes of waste, much of which was dumped illegally, generating a range of public health, environmental and economic problems. A new approach to solid waste management was drastically needed. Noticing the high percentage of organic material among the city's waste, Iftekhar Enayetullah and Abu Hasnat Md. Maqsood Sinha, co-founders of Waste Concern, an NGO based in Dhaka, realized the potential of composting.

“As in many tropical countries, Dhaka's climate speeds up the process of decomposition,” explains Iftekhar Enayetullah, co-founder and Director of Waste Concern. “The heat and moisture in the air mean that organic matter tends to decompose quickly.”

When Waste Concern developed the first IRRC in 1994, it could receive 3 tonnes of organic waste per day for composting. Since then, IRRCs have become increasingly popular in many Bangladeshi cities and across the Asia-Pacific region, capable of managing up to 20 tonnes.

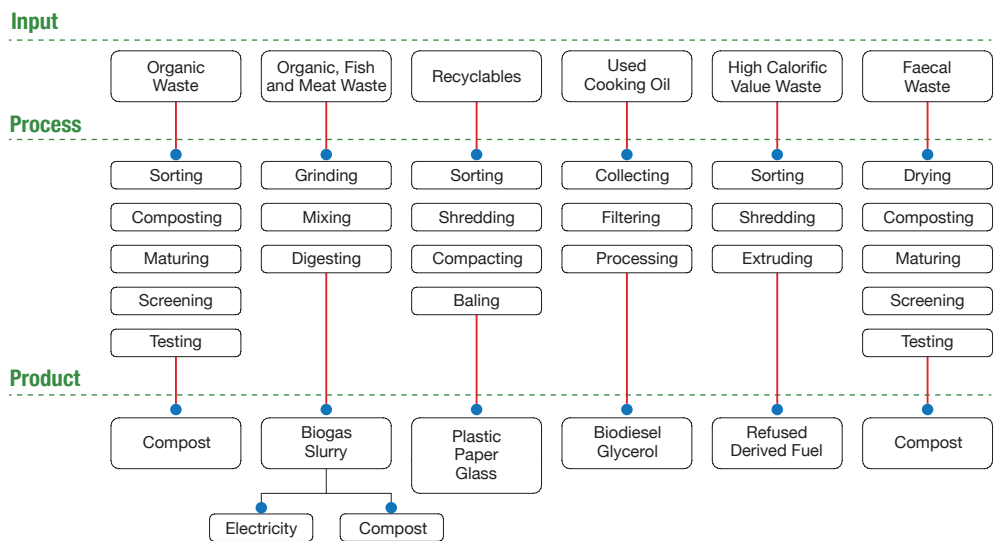
“We confronted many challenges when we first started working. Compost had a bad reputation in Bangladesh, mainly because there were so many poor-quality compost products on the market,” says Abu Hasnat Md. Maqsood Sinha, Waste Concern's other co-founder and its executive director. Through the IRRCs that it operates, Waste Concern ensures a high-quality compost product, which has slowly but surely won over the market. Now Waste Concern distributes its compost to farmers and gardeners all over Bangladesh and even to India and other countries.



# 2.3 How integrated resource recovery centres transform waste into resources

The IRRC transforms waste into resources using a range of techniques, such as organic composting and gas capture, and the processing of clean recyclable materials, such as glass and plastic. The specific techniques used in a particular facility depend on the waste composition and the needs and limitations of the communities and city that it serves. Generally, the techniques used in IRRCs are simple and straightforward, and this simplicity constitutes one of the main strengths of the model (Figure 5). Facility capacity ranges between 2 and 20 tonnes, requires minimum mechanization and incurs low operational costs.

Figure 5. Common techniques used in integrated resource recovery centres



Source: Adapted from Waste Concern.



Beyond cleaning recyclable inorganic material, there are five main techniques used in the IRRC model:

- **Composting organic waste.** This is the most common process used in an IRRC. For a typical 3-tonne capacity plant, 12 perforated composting boxes are built of bricks, and each box can accommodate 15 tonnes of organic waste. Excess water and leachate drains from the biodegrading waste in the boxes and is collected and channelled to tanks for processing. For composting to be successful, incoming waste must be organic and non-contaminated. The composting process must also be closely monitored to ensure that the right temperatures are reached to kill any pathogens, germs or weeds in the organic waste.
- **Co-composting organic waste with faecal sludge.** Another option is to jointly compost organic waste and faecal sludge collected from septic tanks and pit latrines. In this process, faecal sludge is transported to the co-composting plant where it is pumped into large shallow pools, called drying beds. Here the sludge separates into solid and liquid matter. The liquid passes through cocopeat filters for cleaning and then is released when it meets water-quality standards. The solid matter remains in the drying beds, where it dries before being added to the wet organic waste during the composting process described above.
- **Producing biogas from organic waste.** Still another option is to use organic waste to produce biogas through anaerobic digestion, which is decomposition without oxygen. Biogas, which is a mixture of methane and carbon dioxide, can then be used as a cooking fuel or to generate electricity. For anaerobic digestion to be successful, incoming organic waste must be of high quality and contain no inorganic matter.
- **Producing refuse-derived fuel.** Material that does not work for composting or biogas production can be used to make refuse-derived fuel (RDF). In this process, combustible materials are sorted from other waste types and crushed and shredded into a uniform size. They are then dried and compacted to form a small pellet, or RDF. RDF can be used as an alternative to fossil fuels, especially coal, in certain industries, such as cement factories and brick kilns.

- ***Producing biodiesel out of used cooking oil.*** Used cooking oil collected from households and restaurants can be converted into biodiesel. Conversion is based on a reaction between the cooking oil and alcohol, which yields biodiesel and glycerol. Biodiesel can be a stand-alone fuel or can be mixed with petroleum-based diesel.

To ensure the financial sustainability of an IRRRC, it is critical to identify a viable market locally for all the resources that can be derived from waste.

The rising popularity of IRRCs across the Asia-Pacific region is due to the many benefits that the model returns to communities, governments and the environment, as the next section details.



### 3. The benefits of waste-to-resource initiatives

Waste-to-resource initiatives produce a wide range of advantages to communities, municipalities and the environment. Some benefits are largely local, such as financial savings to municipal budgets, while others have global implications, such as reduced greenhouse gas emissions.

Even more importantly, waste-to-resource initiatives help governments and communities tackle a variety of critical development challenges, including:

- lack of formal job opportunities for the urban poor;
- inadequate waste collection and waste disposal;
- pollution of land, water and air due to unmanaged organic waste;
- public health challenges related to the rise and spread of diseases; and
- increasing cost and relative scarcity of land for landfill sites.

By addressing these challenges, as the following sections explain, waste-to-resource initiatives actively contribute to each of the three pillars of sustainable development – economy, society and the environment.



## 3.1 Economic benefits of waste-to-resource initiatives

As outlined below, waste-to-resource initiatives generate economic benefits primarily for local and provincial governments but also for national government. With municipalities spending a significant share of their operating budget on waste management, financial savings in this sector can be particularly desirable.



### *Extended landfill life*

Diverting waste means that landfills last longer; this reduces the need for new landfills and therefore saves money in the long term. Over the course of a year, an IRRC processing 10 tonnes per day will save 4,000 cubic meters of waste from landfill – the volume of two Olympic-size swimming pools.



### *Reduced landfilling costs*

By diverting municipal waste from landfill sites, waste-to-resource initiatives can save a municipality substantial landfill operation costs.



### *Reduced subsidy for chemical fertilizer*

Many governments subsidize the production of chemical fertilizer. But increased use of compost reduces the need for fertilizer and, hence, for subsidy, which enables the national government to use those valuable funds elsewhere.



### *Improved crop yield*

The use of organic fertilizer (compost), a common product of waste-to-resource initiatives, can improve crop yields by 30 per cent, thus delivering increased economic benefit to farmers and communities.



## 3.2 Social benefits of waste-to-resource initiatives

Low-income households often end up taking on precarious informal sector employment including as waste pickers. By engaging manual labourers, waste-to-resource initiatives can provide secure, safe and long-term work for the most marginalized of workers. As the following highlights, waste-to-resource initiatives enable a range of social benefits for communities.



### *Better job opportunities*

Waste-to-resource initiatives generate jobs for low-income groups. A facility processing 10 tonnes of organic waste per day creates 20–30 full-time jobs.



### *Improved living conditions*

A facility processing 10 tonnes of organic waste per day brings direct benefits in terms of cleanliness and improved health and hygiene to 20,000–30,000 residents.



### *Reduced disease incidence*

Waste-to-resource initiatives cleanly and efficiently manage organic waste, resulting in reduced vermin, insects and foul odours within communities.



### *Better environmental awareness*

Waste-to-resource initiatives rely on communities separating their waste, and this in turn develops communities' understanding of a range of environmental issues.

## Box 2. Meet the workers in Kampot, Cambodia

*“I couldn’t find a job for many years,” says Chum Tagoon, 66. “Then I joined the IRRRC and began to earn a living again. Before that, I had to borrow from my family and my wife’s family.”*



Mr Chum joined the Kampot IRRRC in October 2013. A year later, when additional staff were needed, his wife joined too. As a supplement to their salaries, the Chums earn income through the sale of recyclables and sometimes vegetables and fruit grown in the front yard of the IRRRC, with the compost they produce.

*“Before here, I worked on construction sites,” says Tan Sidany. “There, you never knew how long the work would last. Sometimes I only got a few days of work a month.”*



When Mrs Tan, 40, began working at the IRRRC, she earned less than she was paid on construction sites. “But here my salary comes every month, it’s more secure. And we have a roof to work under – you don’t get that on construction sites. If it rains, we were wet, and if it is bright, we were hot.” Mrs Tan supports her three children with her salary and after several years with the IRRRC, now earns more than she did when working in construction.

## 3.3 Environmental benefits of waste-to-resource initiatives

Along with the economic and social opportunities, waste-to-resource initiatives generate a range of benefits for both the local and global environment. Many of the positive effects accrue only by correctly managing organic waste, which, when badly managed, has many negative effects on the environment.



### *Reduced pollution*

Badly managed organic waste pollutes soil and waterways. Waste-to-resource initiatives that process organic waste can greatly reduce this pollution.



### *Reduced greenhouse gas emissions*

If not managed, organic waste emits methane—a gas 25 times more harmful to the climate than carbon dioxide. An IRRC processing 10 tonnes of organic waste per day will save the equivalent of 1,300 tonnes of carbon dioxide—the amount produced by 271 cars driving every day for a year.



### *Improved soil quality*

Adding compost produced in waste-to-resource initiatives to the soil helps to strengthen its quality, improve its water retention, boost its fertility and reduce the need for chemical fertilizer.



### *Low-carbon fuel*

Organic waste can produce methane. Capturing this gas protects the climate and provides a low-carbon fuel. An IRRC processing 10 tonnes of organic waste per day can meet the energy needs of 222 households.

### Box 3. Quantifying the benefits of waste recovery

Because waste-to-resource initiatives reduce methane emissions from organic waste, they contribute towards climate change mitigation. And yet, this type of initiative has been largely overlooked by the Clean Development Mechanism (CDM), one of the flexible instruments established under the Kyoto Protocol of the United Nations Framework Convention on Climate Change. Instead, large-scale end-of-the-pipe projects, such as landfill gas recovery initiatives, have benefited greatly from the CDM. Along with the climate change mitigation benefits, waste-to-resource initiatives create green jobs, improve health outcomes, improve waste collection, result in cost savings from the reduced need for landfills and improve crop yields through the use of compost. In the case of composting projects in selected developing countries in the Asia-Pacific region, the many benefits have been calculated to be as high in value as \$184.21 per tonne of CO<sub>2</sub> equivalent reduced. This calls for a re-prioritizing of waste-to-resource initiatives, compared with other waste management solutions, such as landfills, including in the context of climate change mitigation initiatives.

Source: ESCAP, Waste Concern, south pole group, United Nations Framework Convention on Climate Change, *Valuing the Sustainable Development Co-benefits of Climate Change Mitigation Actions: The Case of the Waste Sector and Recommendations for the Design of Nationally Appropriate Mitigation Actions (NAMAs)* (Bangkok, ESCAP, 2015).

The many benefits, however, are only generated when waste-to-resource initiatives are successfully managed. As the next section explains, good management is based on four critical requisites.







## 4. Critical requisites for successful waste-to-resource initiatives

Successfully launching and sustaining a waste-to-resource initiative relies upon (i) government commitment, (ii) cost-recovery, (iii) waste separated at source and (iv) stakeholder engagement and education. Without these critical requisites, facilities will struggle and falter.

Encountering challenges and working within constraints is an essential reality of managing waste-to-resource initiatives, especially in low- and middle-income countries. Thus, one of the core tasks of managers is to find viable solutions for overcoming the challenges, which stem from policy gaps, technical or financial limitations or stakeholder behaviour. The four requisites provide managers with the fundamental conditions for overcoming the challenges.

After several years of waste-to-resource initiative operations in cities across the Asia-Pacific region, the four requisites were singled out as the keys to success.<sup>3</sup> Each requisite is closely interlinked, with high degrees of interdependence and interrelatedness. Thus, when these four requisites are in place, a solid and dependable structure for advancing waste-to-resource initiatives is essentially guaranteed.

### Requisite 1. Government commitment

Government commitment is the most important requisite for long-term success. It may come from local, municipal or provincial government, depending on how government responsibility for municipal waste management is structured and how a waste-to-resource initiative is designed. Unless an appropriate level of government is committed to waste-to-resource initiatives and fully engaged and willing to provide the required financial, technical or policy support, success will remain difficult.

Government commitment is necessary for a variety of reasons. First, a government commitment to a waste-to-resource initiative translates into the allocation of resources. In the cities where ESCAP and its partners have been

<sup>3</sup> Donovan Storey, Lorenzo Santucci, Rowan Fraser, Joao Aleluia and Laksiri Chomchuen, "Designing effective partnerships for waste-to-resource initiatives: Lessons learned from developing countries," *Waste Management and Research*, forthcoming.



working, local governments provided the land on which the waste-to-resource facility was built (except in Islamabad, Pakistan). Second, government commitment also translates into support and cooperation from government-owned bodies, such as garbage collectors and market associations. This is important because as a municipality begins to shift towards sustainable solid waste management organizational change will be required of other actors within the city's waste management system. Third, with government commitment comes its readiness to make the supporting policy and regulatory changes that are needed. This might involve, for example, the issuance of new regulations for households in terms of domestic recycling or waste separation. Policy and regulatory changes also include the design and provision of incentives, which are often required to strengthen a shift towards sustainable waste management.

The economic, social and environmental factors highlighted above are tremendous incentive for governments to embrace this practical solution. Additionally, in towns and cities with a growing tourism industry, commitment to improved waste management can link to the development of more attractive tourist destinations. In other towns and cities, the driving motivation may be environmental, while in others it may be the result of personal interest among local leaders.



#### Box 4. Government commitment in Matale, Sri Lanka

In 2007, a small waste-to-resource facility with a processing capacity of 2 tonnes of organic waste per day was established in Matale, a city in central Sri Lanka. Two years earlier, Hilmy Mohammad, who had just become the city's mayor, was concerned about the waste problem. "I wanted to make a difference," he recalls.

Matale is a city of 50,000 people generating around 30 tonnes of municipal waste per day. In 2007, most of that waste was dumped at an open landfill on the edge of the city. This caused pollution and was costly for the municipality. "We wanted to find an alternative," explains Mayor Hilmy. Under his direction, the city government provided land for the construction of the waste-to-resource facility.

"Mayor Hilmy proposed to build the facility on land close to his house," says Ekanayaka Banda, CEO of Micro Enrich Compost, the social enterprise that operates the waste-to-resource facility. "This was a sign of his commitment to the project." When he visited one of the IRRCs in Dhaka, the mayor witnessed first hand how the facility was operated and gave permission to go ahead.

In Matale, government commitment has also been expressed through a range of community awareness-raising activities and by the provision of labourers for the facility. Because the municipality continues to pay the salary of these labourers as well as the electricity and waste supply charges, the financial burden on the waste-to-resource initiative is greatly reduced, making cost-recovery easier. At the same time, costs incurred by the municipality in supporting the waste-to-resource initiative are less than the cost of sending waste to a landfill, making it beneficial for the city.

Since the first waste-to-resource facility was built, commitment to the initiative has resulted in two more facilities being constructed. In total, the three facilities in Matale now have a processing capacity of 9 tonnes of organic waste per day. By 2016, this will rise to 12 tonnes per day as a result of a planned 3-tonne expansion, which the Central Environment Authority is funding. Matale is slowly moving towards a total waste solution, in which nearly 100 per cent of the municipal waste could pass through waste-to-resource facilities.

Source: ESCAP and Waste Concern.

## Requisite 2. Cost-recovery

Cost-recovery is vital if a waste-to-resource facility is to provide long-term and sustainable benefits to a city and its residents. Cost-recovery means that the revenue the waste-to-resource facility generates is greater than the expenses it incurs. Cost-recovery should derive, to the extent possible, from the sale of goods (such as compost, biogas, recyclables and RDF) produced in the facility. Such revenues are usually not sufficient to cover expenses, however. Thus, facility managers must seek other sources of revenue, typically through waste collection and gate fees, government subsidy and other forms of financial support.

Such financial support from local government should be understood within its broader economic context. Landfilling brings many negative externalities, such as pollution and public health issues, which can be costly over the long term. Most negative externalities are highly localized, affecting communities, crops, waterways and economies. When local governments provide financial support to waste-to-resource initiatives, they are paying to avoid these negative externalities.

Cost-recovery is important for a number of reasons. Most critically, cost-recovery allows a waste-to-resource facility to become financially sustainable. Second, cost-recovery can help stimulate private sector uptake of the waste-to-resource model and broader replication. As a decentralized, community-based waste-to-resource model, the IRRRC relies upon replication for full effectiveness.

Nonetheless, cost-recovery can be a challenge, especially because it requires partners and stakeholders to affect change in community practices and the policy and regulatory environment. Waste-to-resource managers and partners must work with a variety of stakeholders to identify, secure and maintain sources of revenue; this is typically time consuming and relies upon the provision of an adequate service in return. Once a facility achieves cost-recovery, careful and dynamic financial management must be maintained even as revenue streams, the quantity of waste collected, collection fees, compost and recyclables sales and other financial variables fluctuate.

### Box 5. Achieving cost-recovery in Quy Nhon, Viet Nam

In 2007, a small 2-tonne-per-day IRRRC was established in Quy Nhon, a city of 300,000 people on the coast of Viet Nam. It took a few years before the facility achieved operational cost-recovery. Since 2012, the facility has operated independently of external financial support and now generates a profit.

Revenues generated by the IRRRC are sufficient to pay the salaries of the plant manager and five labourers. Some 80–85 per cent of the IRRRC revenue derives from waste collection fees paid by approximately 700 households as well as two hospitals and a vocational training centre. Revenue generated from the sale of compost and recyclables accounts for around 10–15 per cent of total revenue. In Quy Nhon, cost-recovery is heavily dependent on collection fees. In months when payment of collection fees to the IRRRC is delayed, the facility may experience a temporary operational loss. The facility now has cash reserves, which help to provide a cushion in these cases.

Cost-recovery in Quy Nhon is maintained thanks to various initiatives led by facility managers, including:

- undertaking marketing campaigns for the compost produced in the facility, leading to improved sales of compost;
- establishing long-term organic waste collection contracts with hospitals and an educational facility, leading to increased revenue from reliable collection fees;
- establishing a demonstration garden to show the effects of composting on plant growth, leading to improved compost sales; and
- improving labour productivity through the use of a compost-sieving machine, leading to improved production of compost.

Beyond these initiatives, the local government has been particularly committed to the waste-to-resource initiative. It has launched community awareness-raising campaigns and public outreach programmes to support separation of waste at source and negotiated on behalf of the waste-to-resource initiative for improved contract terms with the hospitals and the educational facility.

### Requisite 3. Waste separation at source

Waste is generated the moment a person or organization decides that the material or object in question is no longer of use to them. This is the source of the waste. Separation of waste at source involves the categorization of waste into its various components within a household, business or organization that generates it. Typically, this involves separation into organic and inorganic waste. Sometimes waste is also separated into organic and various types of inorganic material, such as glass, metal, paper and plastic.

Source separation of waste is critical because it permits the acquisition of good-quality, clean and uncontaminated organic waste, which is needed for the production of quality compost in a waste-to-resource facility. Source separation also provides facilities with clean and uncontaminated recyclable materials, such as paper and plastics. Some recyclables, such as paper, are easily ruined if contaminated by wet waste. Thus, separating waste at source greatly improves the waste recovery process. This in turn contributes to cost-recovery because better-quality separated waste leads to better-quality compost and recyclable materials, which lead to greater sales.

Gaining access to separated waste, however, can be a challenge. In many cities, communities lack understanding on how and why to separate their waste. This is due to gaps in public education. It is often necessary to implement communication and outreach campaigns to inform communities and build their awareness and capacity for source separation. This can be a slow process that requires government support and sustained effort.



### **Box 6. Achieving waste separation at source in Quy Nhon, Viet Nam**

Every morning, Vo Thu puts her family's waste of the previous 24 hours in front of her house. In a white bag goes organic waste, including food scraps, and in a small plastic basket goes inorganic waste, such as paper and plastics. Mrs Vo's household is one of around 750 households that separate their waste in Nhon Ly, a seaside commune close to Quy Nhon.

Achieving waste separation at source has been slow and challenging. "People resist changing deep-rooted habits," explains Nguyen Linh, Programme Manager for Environment and Development in the Third World (ENDA), an NGO active in Viet Nam. ENDA initiated activities with the commune in mid-2012. "When we started, only 12 per cent of households in the commune would separate their waste," Ms Nguyen recalls. Over the next year, the proportion rose slowly to 16 per cent. ENDA and the commune government redoubled their outreach efforts, and the understanding of the community improved.

"To speed up behaviour change, we established a network of communicators that began to hold monthly meetings with the community as well as individual communes," says Ms Nguyen. Commune leaders also provided policy support, adopting waste separation at source as an official decision of the commune. A communication campaign was launched involving training courses for residents on separating waste properly. This was supported by public announcements from loud speakers and the dissemination of messages on panels, posters and brochures. Over time, the community began to understand the benefits of waste separation and changed their behaviour accordingly, in the absence of enforcement mechanisms from government.

By the end of 2013, 27 per cent of households were separating waste at source. With ongoing efforts, participation continued to rise. By the middle of 2014, 36 per cent of households were separating. "This is slow work," Ms Nguyen adds. "You have to be very persistent. But if you are, change comes. That's what we have learned. It takes time but you can't give up."

Source: Environment and Development Action in the Third World, Viet Nam.



## Requisite 4. Stakeholder engagement

Stakeholder engagement concerns the ability and desire of a broad range of people and organizations to engage, participate in and contribute to a waste-to-resource initiative. Beyond the government, stakeholders might be community groups, households, market associations, private sector waste collectors, NGOs, restaurants, hotels, informal workers and farmers.

Stakeholder engagement is important for several reasons. First, because waste-to-resource initiatives rely upon the proactive participation and contribution of a range of people. Their willingness and ability to engage will determine the degree to which they mobilize their time, knowledge and resources in support of the initiative. The more willing and able stakeholders are, the more they will contribute.

Second, different stakeholders have access to different types of resources, such as expert knowledge, community trust, political legitimacy or informal sector connections. Waste-to-resource managers must look to these different stakeholders to contribute their different resources to the needs of a waste-to-resource initiative.

Third, stakeholder engagement is critical because of the behaviour change needed. To acquire source-separated waste, for example, requires time, trust and persistence. Without strong engagement from stakeholders, behaviour change is hard to achieve.

Maintaining engagement among all stakeholders, however, is a challenge. Various mechanisms, such as frequent formal and informal meetings, clear objectives and communication and outreach programmes help to mobilize stakeholders and keep them engaged. Beyond these activities, stakeholders need to be reminded of the benefits that a waste-to-resource initiative will bring them, and they need to share in the vision and buy into the promise of sustainable waste management more generally.

### Box 7. Community engagement in Matale, Sri Lanka

The city of Matale, Sri Lanka has been pursuing waste-to-resource initiatives for several years and has dynamically mobilized a range of stakeholders through the lead of Sevanatha Urban Resource Centre, an NGO that, jointly with its social enterprise affiliate Micro Enriched Compost, has been working to advance community engagement in selected wards of the city.

“When I was invited to the temple to learn about waste, at first I was surprised,” points out Padmika Kulathunga, a teacher. “But I went anyway and actually it was very interesting. I learned a lot.” The messaging ignited Mrs Kulathunga’s inspiration and commitment. She became involved in ‘spreading the word’ in a series of events organized in the ward where she lives with her husband and two daughters.

“Every month we promote waste separation at source by mobile loudspeaker in all the wards of the town, and every three months we try to do an open house event,” says Dilan Kumara of Micro Enriched Compost. “Regularity is the most important thing. It helps to keep the community engaged.” These open house events involve inviting community members to a public place, such as the local temple, where they can learn about waste separation at source and good waste management practices. The open house events usually last a weekend. Residents are also mailed brochures.

As a result of the events and activities in her ward, Mrs Kulathunga now separates her household waste into two bags and hangs them out for the waste collection trucks on their daily rounds. “I will continue to separate waste because I can see the benefits,” she says. “The street is much cleaner now, and there are fewer rats because waste is cleared often. Also, it is very convenient.” Mrs Kulathunga has recommended source separation to her friends and sisters.

Source: ESCAP.

To achieve and sustain these four requisites, managers of waste-to-resource initiatives must deploy a range of activities, including strategic thinking, business modelling and community outreach. After several years of operational experience, ESCAP and its country partners have learned important lessons related to the management of waste-to-resource initiatives and have identified and tested diverse strategies for overcoming common challenges. From this process, good practices have emerged. These are explored in Part II: Lessons learned.









# PART II

## LESSONS LEARNED

- Building partnerships
- Improving awareness and changing behaviour
- Managing facilities and improving operations
- Creating an enabling environment for scaling up and replication





# Introduction

Part I highlighted the challenges and opportunities for improving solid waste management in developing countries in the Asia and Pacific region and the benefits of waste-to-resource initiatives. It also introduced the integrated resource recovery centre model developed by Waste Concern and promoted by ESCAP across the region. Part II presents the lessons learned from that ESCAP programme along with policy recommendations for the continued promotion of pro-poor and sustainable waste-to-resource initiatives in developing countries, particularly for secondary cities and small towns.

Part II breaks the lessons learned into four themes: partnerships; awareness raising and behaviour change; managing and operating IRRCs; and creating an enabling environment for scaling up and replication.

The first section explores the need for partnerships and offers lessons on how to establish and maintain good partnerships, which partners to engage and how to create constructive and collaborative initiatives. The focus of Part II then shifts to stakeholder engagement and raising awareness among the general public, with lessons on how to change the perception and behaviour of communities towards waste and what types of systems can support and sustain this change.

Part II then looks at what has been learned in terms of managing IRRCs as operational facilities. The focus is on how to manage facilities sustainably, including developing a sound business plan and determining key performance indicators as well as how to generate sustainable financial resources. The last section of Part II explores the lessons on creating an enabling environment for the scaling up and replication of waste-to-resource initiatives. This includes a reflection on what types of market regulation and policy support are useful and recommendations for the mobilization of national and international financing.

Each of the four sections concludes with a series of recommendations for policymakers and governments at the local and national levels. It is hoped that these recommendations will provide guidance on how to facilitate effective pro-poor and sustainable municipal solid waste management solutions.

# 1. Building partnerships

Successful waste-to-resource initiatives are built on the bedrock of effective partnerships. Partnership development particularly underpins the success of such critical components as community outreach, financial sustainability and policy support. This section outlines the role of different stakeholders and the resources they can bring into a partnership and highlights models of partnership in practice in five cities: Kushtia (Bangladesh), Kampot (Cambodia), Islamabad (Pakistan), Matale (Sri Lanka) and Quy Nhon (Viet Nam). It also presents a range of good practices and recommendations for strengthening partnerships.

## 1.1 The importance of partnership

**Partnerships with stakeholders are essential for sustainable initiatives.**

Waste-to-resource initiatives tend to be multisectoral and multifaceted, involving action from government bodies, community groups, households, businesses and individuals. For successful outcomes, waste-to-resource managers must engage with all stakeholders through both formal and informal partnerships.

In low- and middle-income cities, stable partnerships can maintain positive momentum even as political, economic and social conditions change. Instability can be detrimental to waste-to-resource initiatives, which require ongoing commitments from many stakeholders. If one stakeholder fails to deliver, other stakeholders are often adversely affected. Strong partnerships also help partners to confront and overcome the risk of change.

**Partnerships need to be based on trust and shared vision.** Strong partnerships evolve around a core of mutual interests and shared vision. This requires partners to identify a common need and understand how the waste-to-resource initiative will return shared benefits. Articulating mutual interests allows partners to subscribe to a vision for change and improvement, which they can then work towards realizing. In Quy Nhon, for example, the tourism industry is growing, and local government and industry leaders recognize that a clean and tidy Quy Nhon is more attractive to tourists.

For solid waste management to be effective, partners need to build trust, operate with transparency and be accountable to each other. Partners must also be committed to the idea and practice of partnership. When partners recognize that they are ‘in this together’, progress can be made. Such an attitude tends to



engender enduring partnerships. Partners also need to recognize that partnership means the sharing of risks and benefits generated through the project. This is an extremely important dimension of partnership, and risks and benefits should be clearly understood by all partners before the partnership agreement is forged.

**Partnerships with different levels of government are needed.** Of the many partnerships that waste-to-resource initiatives rely upon, those with local, provincial and national governments are the most critical. This is because without government commitment, initiatives often fail (see Part I section 4.1 on government commitment).

Different levels of government provide different forms of support, depending on the regulatory, policy, funding and technical resources a government agency can draw upon. In Viet Nam, for example, waste collection fees are set by the provincial government, but the municipal government is mandated to manage solid waste within towns and cities. Thus, dealing with regulatory constraints requires engagement and collaboration of higher levels of government. As a result, waste-to-resource managers and government agencies at different levels must work together.

## 1.2 Developing new models for partnerships

**Partnership arrangements should align with local conditions and specific needs.** Local conditions greatly affect the capacity, characteristics and performance of waste-to-resource initiatives. Each city has a unique profile of actors, challenges, drivers of change and institutional and policy set-up. Decisions around partnership arrangements must consider the local context carefully to ensure appropriateness.

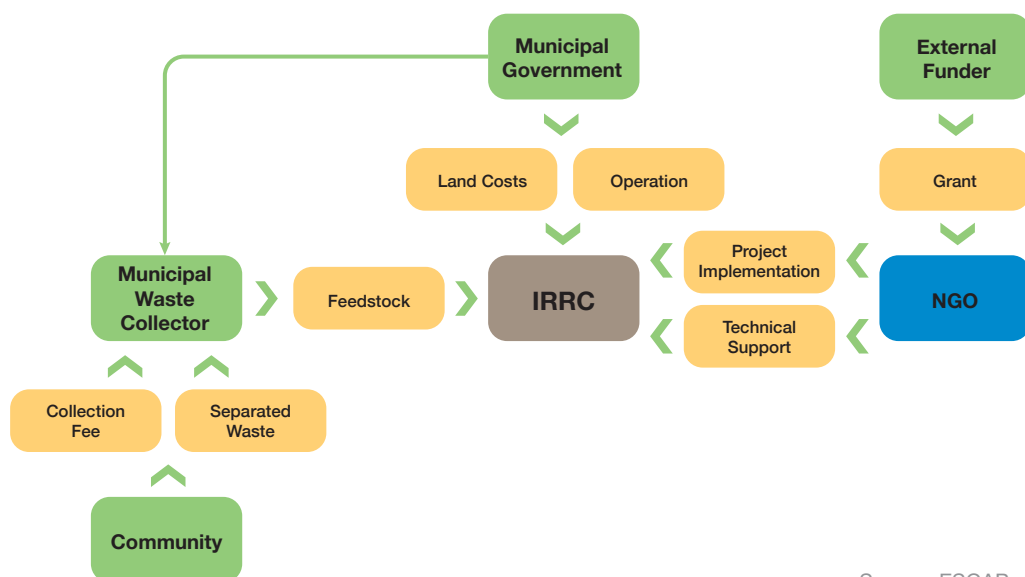
Arranging partners so that synergies are maximized is a critical component of the early work required to establish a waste-to-resource initiative in a new city. Such partnership arrangements should derive from the institutional landscape already in place. At the same time, partnership arrangements should be regularly reviewed to ensure continued relevancy.

Based on the experiences in establishing partnerships in the various beneficiary cities of the ESCAP programme, the following highlights five partnership arrangements. Each arrangement reflects different realities in a city and the relative strengths of different types of actors and partners. While each city presents its own specific conditions, the five models are broadly representative of five 'types' of partnership arrangements.

## Kushtia model

In Bangladesh, the Kushtia model is led by the **municipal government**, which owns and operates the IRRC and collects and delivers waste to the facility (Figure 6). When the Kushtia IRRC was established in 2008, it only produced compost. Due to ongoing sanitation issues, the IRRC facility was converted in 2012 to accommodate the co-composting of organic and human waste (faecal sludge)—the first in Bangladesh. Under this model, the waste-to-resource initiative is integrated into the existing municipal solid waste management system. Because it is led by the municipality, lower transportation and disposal costs can be achieved. However, the model may suffer from financial constraints due to the low priority often accorded by local governments to solid waste management. Similarly, operating efficiency and marketing potential may not be fully optimized.

**Figure 6. The Kushtia model**



Source: ESCAP.

In Kushtia, several partners have made essential contributions. The Local Government Engineering Department, a central government body, covered the construction cost of modifying the existing facility in 2012, including the addition of drying beds for the faecal sludge and the purchasing of equipment for clearing septic tanks and pit latrines. ESCAP provided funds for the construction of a cocopeat filter, essential for the processing of waste water. The Kushtia municipal authority provided the land on which the facility was built and have operated the facility since it opened, with technical support from Waste Concern. The Kushtia municipal authority also runs a waste collection and sanitation service in the city.

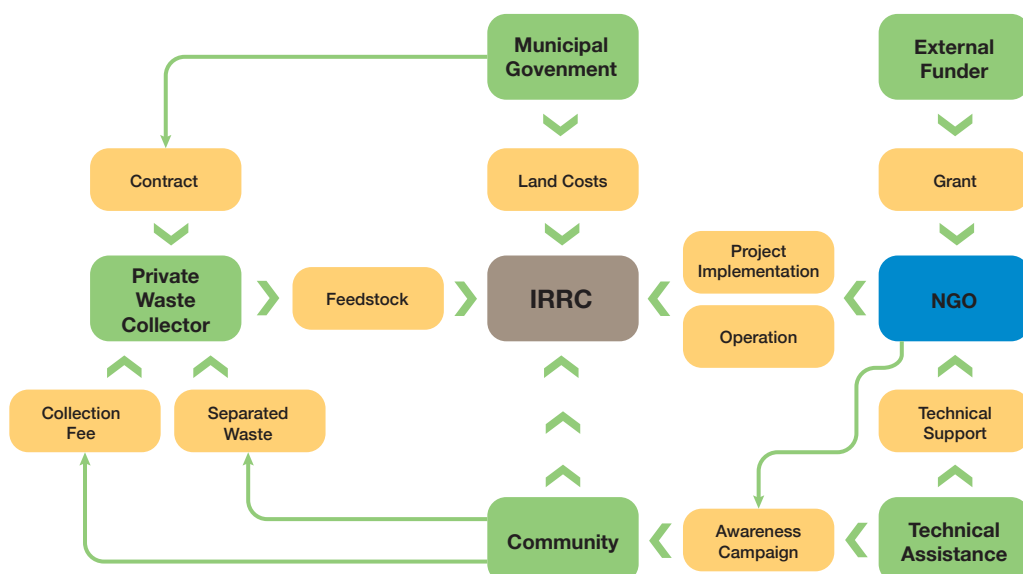
Households wanting to have their pit latrine or septic tank serviced pay the municipality around BDT350 (\$4.50). Under new regulation, the municipality is permitted to charge households 12 per cent of the land value for the provision of basic services. This enables the financial sustainability of waste collection and delivery to the IRRC.

## Kampot model

In Cambodia, the Kampot model is an **NGO-led** approach (Figure 7). The Community Sanitation and Recycling Organization (CSARO), a local NGO that also operates in Phnom Penh, established the IRRC in Kampot in 2012. The facility transforms organic waste into compost and on-sells recyclable materials. It also hosts a small demonstration garden that uses compost produced in the facility as fertilizer. This model has the benefit of high-levels of community engagement because the NGO can typically generate community trust. It also facilitates the introduction of additional funds and know-how from the NGO.

ESCAP provided the funds for the construction of the facility, and the Kampot municipality authority provided the land on which it was built. CSARO operates the facility. Workers are mainly drawn from urban poor communities and organized as a self-help group. The facility continues to experience difficulties in obtaining sufficient amounts of separated organic waste, which poses a challenge to the financial stability of operations. CSARO has initiated a range of community outreach activities aimed at supporting waste separation at source.

**Figure 7. The Kampot model**



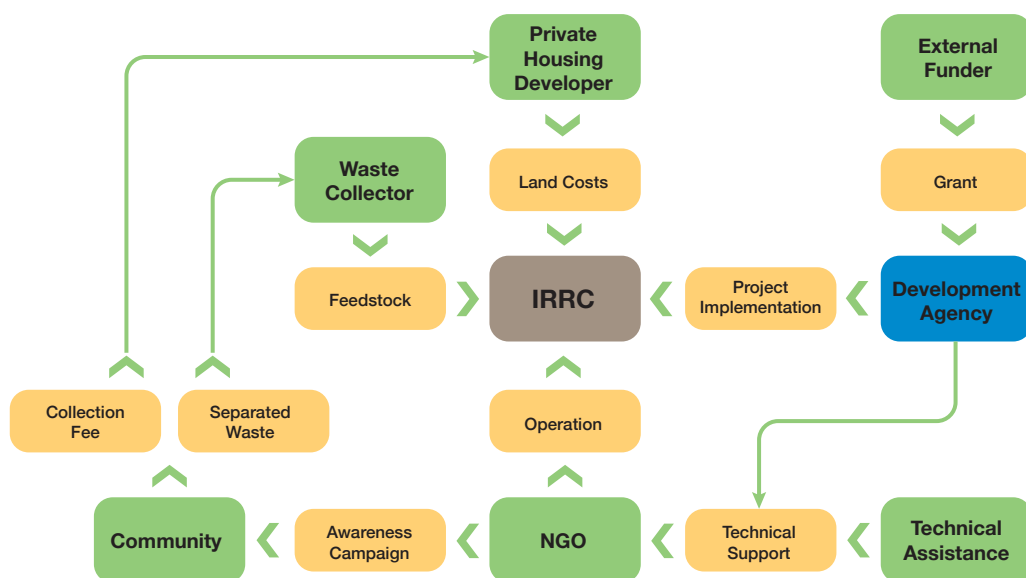
Source: ESCAP.

For waste collection, the municipal authority has contracted a private operator, Global Action for Environmental Awareness (GAEA), which collects waste from the main market in the city and delivers it to the IRRC. This waste, however, is often mixed and of poor quality due to poor coordination between the market authority and GAEA. Efforts are ongoing to improve this. In addition, in an attempt to acquire greater quantities of separated waste, CSARO has started pilot activities for primary waste collection in some areas of the city that are underserved in this regard. For example, CSARO uses waste picker groups to collect organic waste along with recyclables.

## Islamabad model

In Pakistan, the **private sector** leads the Islamabad model (Figure 8). The Islamabad IRRC was established in 2015 in a high-growth area called Sector G15, the development of which has been assigned by the Capital Development Authority of Islamabad to a not-for-profit private land and housing developer, the Jammu and Kashmir Cooperative Housing Society. There is no direct municipal or national government involvement. Under this model, the municipal burden of solid waste management is offset through private sector participation. Clear contracts are required to ensure reliability. The model relies upon an entrepreneurial approach and is likely to generate employment and business within the community.

**Figure 8. The Islamabad model**



Source: ESCAP.

The Islamabad model involves activity and contribution from all partners. Through UN-Habitat, ESCAP provided funds for the construction of the facility, and the Jammu and Kashmir Cooperative Housing Society provided the land on which the facility was built. A local social enterprise, Dr Akhtar Hameed Khan Memorial Trust, operates the facility and undertakes community outreach education on waste separation. The Jammu and Kashmir Cooperative Housing Society pays the Dr Akhtar Hameed Khan Memorial Trust a collection fee for every household served, which is levied to each household monthly as part of a common services fee. The Dr Akhtar Hameed Khan Memorial Trust undertakes collection of recyclable and separated organic waste within the area (Sector G15) and processes this waste in the facility. The Jammu and Kashmir Cooperative Housing Society in return pays the Trust a collection fee of PKR250 (\$2.40) per house.

#### Box 8. Developing the Islamabad model



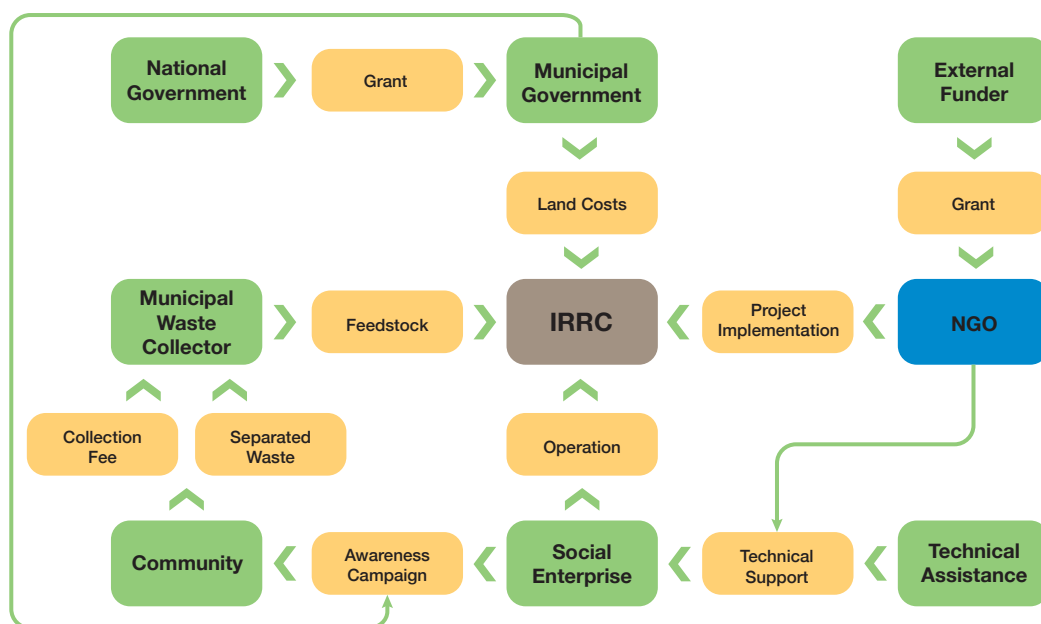
**SUMAIRA GUL** is Programme Manager at the Dr Akhtar Hameed Khan Memorial Trust, the social enterprise that operates the waste-to-resource facility in Islamabad.

“We developed this model because the private sector is strongly engaged in the development of Islamabad,” says Mrs Gul. “We have taken a strong business focus as part of our role as a social enterprise, and we liaise closely with private developer Jammu and Kashmir Cooperative Housing Society.”

## Matale model

In Sri Lanka, the Matale model is based on a **public-private partnership** in which the municipality and a social enterprise closely engage (Figure 9). The first IRRC in Matale was built in 2007. Two other facilities were built in 2009 and 2011, respectively. Further expansion is planned in 2015. This model was also adapted to local conditions in Ratnapura, Sri Lanka. The Matale model requires that full cost recovery is obtained at least. Ideally, a profit is made. This demands a reliable and skilled partner with a good sense of entrepreneurship.

**Figure 9. The Matale model**



Source: ESCAP.

In Matale, ESCAP and the Government's Central Environment Authority provided funds for the construction of the three facilities. The Matale Municipal Council provided the land. A local social enterprise, Micro Enriched Compost, operates the facilities, and the municipal authority provides some of the workers. The municipality, in partnership with Sevanatha Urban Resource Centre, an NGO, conducts community outreach education on waste separation. Waste collection is managed by the municipality government, which delivers separated organic waste to the IRRC.





training on waste separation. The community group owns a waste collection vehicle that it uses to collect source-separated waste in Nhon Phu ward, which generates waste collection fees ranging between VND6,000 and VND19,000 (\$.30 and \$.90) per household per month and which enables IRRC to achieve cost recovery.

#### Box 9. Developing the Quy Nhon model



**NGUYỄN THỊ HOÀI LINH** is Program Manager with Environment and Development Action and deeply involved with the establishment of the Quy Nhon model. “We have worked with community groups, commune leaders and local residents to develop partnerships around the waste-to-resource initiative,” she explains. Community groups now run the facility and the project almost completely by themselves. “It’s about empowering the community to take charge of managing waste, and it’s about facilitating their capacity for change and development,” she says.

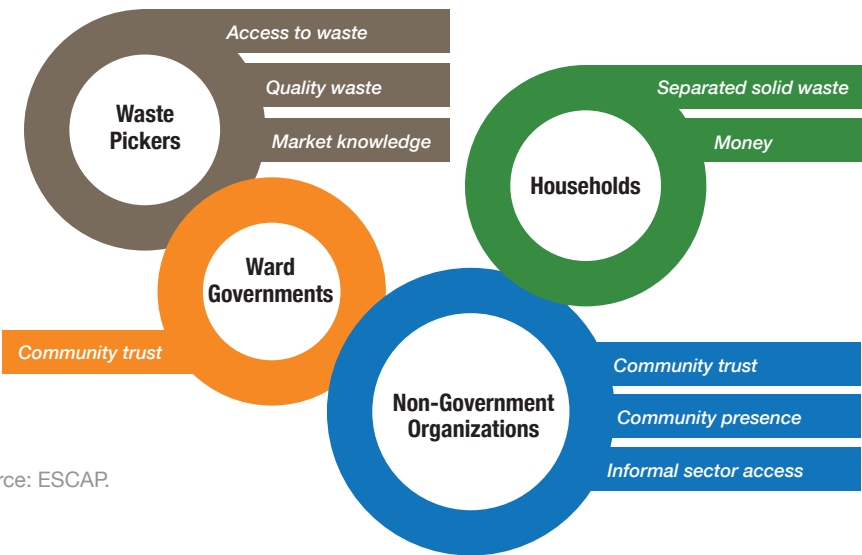
# 1.3 Understanding partner contributions and resources

**Different partners can contribute different resources to the initiative.** Because different stakeholders can access, control and deploy different types of resources, complementarity needs to be considered early in the decision-making process. Deploying complementary resources helps to build strong partnerships. Thus, early analysis of various stakeholders and their resources is beneficial and facilitates constructive partnerships in which each partner recognizes the others as contributing equally.

At the same time, it is important to assess and allocate risk according to the ability of partners to best handle them. For example, the operator of the plant should be responsible for efficient operations, but the responsibility for delivering source-separated waste to the facility should be with the partners who transport the waste and who can set up and enforce a waste separation system (such as the municipal authority).

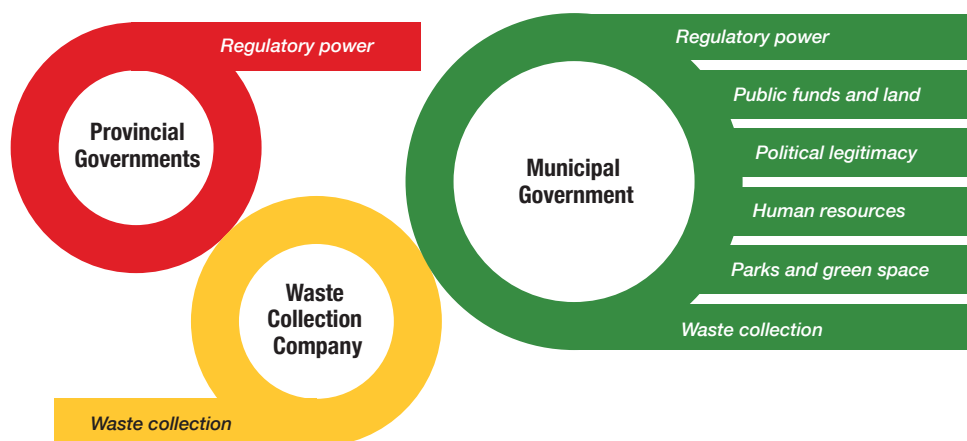
A ‘resource’ can be both tangible and intangible. Land is a resource, as is the trust of a community. A municipal government can contribute land, regulatory power, technical knowledge and public funds to a waste-to-resource initiative. NGOs can mobilize community trust and deploy informal sector experience. Households and markets generate and sort essential organic waste and are often willing to pay to have this waste removed from their premises. All of these resources are valuable, and many are essential to a sustainable initiative.

**Figure 11. Community partners and their resources**



Source: ESCAP.

**Figure 12. Municipal and provincial partners and their resources**



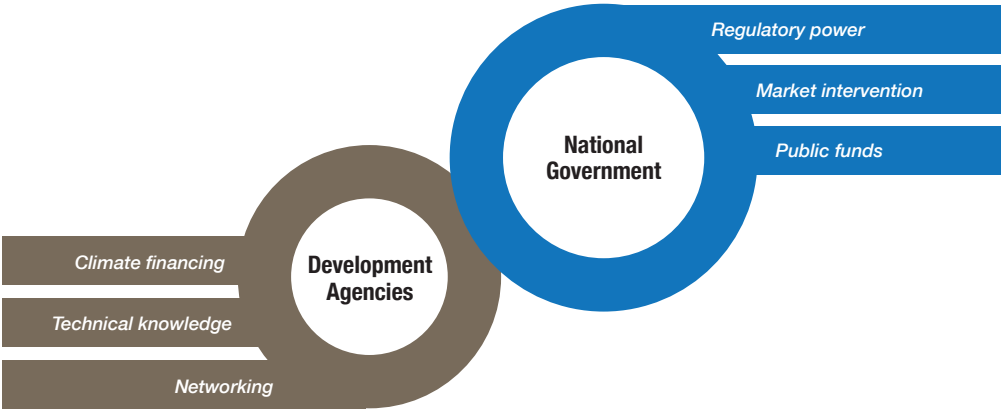
Source: ESCAP.

#### Box 10. Meet the mayor of Matale, Sri Lanka



**HILMY MOHAMMAD** has been mayor of Matale, Sri Lanka for several years. “From the beginning, we have contributed a lot to the IRRC project. We wanted it to be a success!” says Mayor Hilmy. “We found and gave free land for the IRRC to be built. We also contributed workers from our own payroll to work in the IRRC and worked with partners for community awareness.” This involvement has greatly helped to support the IRRC operations. “This was a priority for us. Of course, our budget, resources and time were limited, but we wanted to make it a success. We wanted Matale to become a model for Sri Lanka, and it has,” adds Mayor Hilmy.

**Figure 13. National and international partners and their resources**



Source: ESCAP.

**Box 11. Meet international technical experts in Dhaka, Bangladesh**



**IFTEKHAR ENAYETULLAH** and **ABU HASNAT MD. MAQSOOD SINHA** are the co-founders of Waste Concern, an NGO based in Dhaka that specializes in waste-to-resource initiatives. “We have been working across Asia to support local operations,” says Mr Enayetullah. “Many organizations and governments do not have the right technical knowledge to implement waste-to-resource initiatives. We can contribute that,” adds Mr Sinha.

# 1.4 Lessons learned for building partnerships

To build partnerships for waste-to-resource initiatives, national and local governments have achieved successful outcomes through the following activities, which contributed to improving political backing to local initiatives and stabilizing local partnerships.

- ***Building off the existing local context.*** Successful waste-to-resource initiatives first explore local conditions and, actors, as well as waste-related behaviours and mechanisms present within the local community, and seek to make the most of possible opportunities. The activities of the informal sector, for example, should be considered in any strategy. Waste-to-resource initiatives need to be designed to optimize the local context.
- ***Establishing the correct partnership structure.*** Local government needs to support the construction of a partnership for the waste-to-resource initiative that is aligned with local conditions and requirements. Many waste-to-resource facilities operate as concessions from the local government, involving a build–operate–transfer agreement, wherein a third party operates the facility for a set period before transferring operations to the local government.
- ***Guiding partners and strengthening partnerships.*** Successful waste-to-resource initiatives are supported by a proactive and visionary local government. This is dependent upon leadership from local government and willingness to guide partners, establish a shared vision for change and encourage compliance and stakeholder engagement.
- ***Supporting IRRC operations by advocating for required policy change at the national and provincial levels.*** To support waste-to-resource initiatives, municipal governments have advocated for higher-level policy change. In some cases, such policy has been managed by a provincial or national government. Municipalities need to engage with relevant government entities, local stakeholders, technical experts and waste-to-resource managers for appropriate policy change.
- ***Supporting a regular platform for interaction between partners and stakeholders.*** It has often been useful for local governments to establish a platform for multi-stakeholder dialogue at the local level. This allows partners to engage in the monitoring of a project's progress and address issues as they arise. This mechanism, which may be as simple as a monthly or quarterly meeting, needs to be flexible enough to respond to changing circumstances and needs.





## 2. Improving awareness and changing behaviour

Awareness raising, information sharing, capacity development and community engagement are essential for the wider social, political and economic changes required for waste-to-resource initiatives to succeed. This work, which broadly seeks to restructure the relationship that different stakeholders have with waste, is greatly facilitated through good partnerships with these stakeholders. The lessons highlighted in this section revolve around the need for sustained effort for real change and the types of change required and how to achieve them in a sustainable way. The section also presents some strategies and good practices for engaging with stakeholders on awareness raising and behaviour change.

### 2.1 The importance of valuing waste

**Waste must be viewed as a valuable resource.** Too often, waste is seen as having no value. It is regarded as something for the landfill, something to be burned or thrown away. Yet, waste is an incredible resource that can be reused and recycled. It can be sold in local, national and international markets. A fundamental objective of waste-to-resource initiatives is to support a change in perception.

**Changes in mind sets are essential.** Successful waste-to-resource initiatives engender and depend upon a wide and powerful change in the public's perception of waste as a resource. Such a change is difficult but vital to achieve. The role of the IRRC is to maximize the value of waste, but the process is dependent upon the shifting of community systems and social and political values.

Part of this shift involves an emphasis on preventing waste in the first place (see Part I, Figure 3 on moving towards waste minimization and recovery).

Waste-to-resource initiatives should also focus on encouraging the reuse of materials, recycling and value recovery. The notion of 'throwing out' and 'throwing away' has to be challenged and remodelled around new norms and values of material use. The way people relate to waste materials must change.





**NEAK SOUVANNARY** is the governor of Kampot, a small town in southern Cambodia. “We have been supporting a waste-to-resource approach for a few years now, and this has been challenging,” he says. The city government has employed various strategies, each of which were met with some resistance from the public. “We would like to become a cleaner, greener city, but it is hard and takes time,” he adds. He also notes that things are slowly changing. Pilot projects in a few communities have been successful. “We want to scale up. We want the whole city thinking about waste in a different way,” he says. “We need to see its value.”

## 2.2 Advancing behaviour change and source separation

**Source separation begins with changing individual actions.** Waste separation at source involves households, markets, hotels, restaurants and other producers of waste dividing their waste into various components, such as organic waste and recyclable inorganic material. This is essential for successful waste-to-resource initiatives. Without waste separation at source, waste will reach a facility in a mixed state, which reduces the quality and quantity of organic waste that can be utilized to produce compost, biogas, refuse-derived fuel or other products. It also leads to damaged and dirtied recyclable waste; for example, when paper becomes wet it disintegrates and plastics need to be cleaned.

Successful waste-to-resource initiatives are built around community engagement with waste separation at source. This requires that individuals change their behaviour and mind sets. Families, domestic workers, shop owners, market vendors and cooks, among others, must be informed and educated on the need for and practice of source separation. Only when individuals are willing to change their behaviour can source separation succeed. Engaging children can be particularly effective. This can be done, for example, through outreach to schools (see the Box 14 on separating waste in Samaki market in Kampot, Cambodia). This method is effective partly because children can introduce new practices to their families and their community and also because the habits children develop today will likely stay with them as adults.

#### Box 13. Meet a homeowner in Matale, Sri Lanka



**PADMIKA KULATHUNGA** lives in Matale, Sri Lanka. “I am a mother and a homeowner,” says Mrs Kulathunga, 50, who lives with her husband and three daughters. “Every day when I cook, I separate the organic waste from the inorganic waste. I’m also teaching my daughters this, as now they are growing up and can cook, too.” Mrs Kulathunga places the household’s organic waste into a plastic bag that is then hung from a hook on the fence of her property for the waste collector. “If I’m home, I’ll give the waste directly to the workers. It’s always nice to say hello, and sometimes they also have news.”

**The promotion of separation of waste at source should not be done through a one-off project but be pursued as a long-term programme.** Changing behaviour takes time, patience and sustained engagement. To achieve waste separation at source, waste-to-resource managers need to focus on community outreach and delivering awareness-raising and capacity-building campaigns to households, markets and commercial units. This is not easy and results are not seen overnight because mind sets need to be altered. Nonetheless, if waste-to-resource managers and policymakers understand the long-term nature of behaviour change and are committed to it, good results can be achieved.

Options for community outreach include:

- Forming networks of communicators using residents in a community. These communicators already know the community and have relationships with families and individuals, which make persuading them to change potentially easier. Communicators can be trained in the principles of waste separation and asked to encourage others in their community to do the same.
- Utilizing existing community groups, such as women's and youth groups, to verbally disseminate the principles of waste separation and the idea of deriving valuable resources from waste.
- Utilizing public health officers and community development teams established within municipal governments. Such teams can be deployed to inform communities of improved waste management techniques as part of their work routine.
- Using loudspeakers, public address systems, brochures, posters and flyers to raise the awareness of communities on the need for waste separation.
- Organizing special days and events that community members can attend. These might take place in a temple, a park or community centre and involve a combination of training and communication.
- Organizing local 'waste recycling days' to encourage broad change and promote recycling and sustainable waste management.

Along with encouraging waste separation at source, outreach campaigns should legitimize collection fees levied for waste. This requires that a waste-to-resource initiative gain the trust and support of a community. Investing in household- and community-level relationships is important for building that trust. As well, communities and households must learn to regard waste separation at source as convenient, easy and beneficial.

**New behaviour needs to be supported by appropriate infrastructure.** The commitment of households, markets and commercial units to waste separation is lost if they perceive that their efforts are in vain. This may happen if poorly informed waste collection teams remix waste after collection or if waste-to-resource facilities do not adequately handle separate waste streams and revert to mixed dumping. As a result, waste collection carts, trucks, bins and other infrastructure must be able to maintain separate waste types. This means that collection teams must either use two separate carts (one for organic, one for inorganic waste) or have carts with internal partitions. Waste collection trucks with internal partitions can be useful.

Investing in this infrastructure is worth it. Pushcarts with internal divisions can be made at low cost and with simple designs to suit local conditions. Baskets, bins and containers can all be acquired and distributed as needed. Such investment greatly improves the quality of separated waste arriving at a waste-to-resource facility, and it incentivizes communities and helps to sustain their engagement over the long term.



#### Box 14. Separating waste in Samaki market, Kampot, Cambodia



It is 5 o'clock in the evening and the Samaki market is closing. From the shadowed interior of this fresh produce market, the largest in Kampot, comes a steady stream of fruit, meat and vegetable vendors. "When we first started here, all waste was mixed," says Heng Yon Kora, Executive Director of the Community Sanitation and Recycling Organization, the NGO that manages Kampot's waste-to-resource initiative.

Since then, repeated community-based waste separation campaigns have been launched, new billboards and banners have been put up to promote waste separation, and two large container bins have been placed at the back of the market. The green container is for organic waste and the orange container is for inorganic and mixed waste.

"We've worked with teams of local students who have come to the market to explain waste separation to the vendors," says Mr Heng. The community outreach programme, which began in mid-2013, teaches children about recycling and waste separation, and then takes them into the community to talk up the change that is needed and why. "I was pretty nervous at first, but after one or two tries it got better," says Chanmony Thida, 15, when asked how she felt when approaching the vendors. "I think it made me braver," adds her classmate, Phon Sovannara, 16.



Nong Chi has been selling vegetables in the Samaki market for many years. In 2013, she began separating her vegetable, plastic and paper waste. "I separate my waste during the quiet times, when there are less customers," she says. "Before I was told about composting by the students, I'd never heard of waste separation." Kong Sehay, the vendor working next to Mrs Nong, also separates her waste. "We need to keep the market clean," she says. "If your stall is clean, you get more customers because they think it looks better. All vendors should be separating their waste—it's just good for business!"

Source: ESCAP.



**Informal sector engagement helps to achieve wider community change.** The informal sector has an integral role in waste collection and recycling in many cities in low- and middle-income countries. Engaging this sector to support waste separation at source and having a broader programme of waste recovery can generate important benefits, especially in terms of community change. The informal sector can be engaged through the establishment of community-based waste collector associations, which provide a more formal structure and directive to informal waste pickers. Such groups can serve residential communities by collecting organic and recyclable waste for a waste-to-resource initiative.

Engaging the informal sector, however, can be challenging. Many informal waste pickers and waste picker groups do not want to be formalized, preferring the flexibility and autonomy of their informality. When waste-to-resource initiatives attempt to engage these groups, it must be done in a way that embraces their livelihoods and opportunities. Successful engagement depends upon permitting working arrangements that reserve the original flexibility of waste pickers but yet provide incentives that maintain a sense of autonomy and self-interest.

In Kampot, for example, waste pickers are paid to collect source-separated organic waste. In addition, they can keep recyclable inorganic material they find.



## 2.3 Lessons learned for improving awareness and changing behaviour

To support awareness raising and behaviour change, national and local governments have found success through a range of strategies, tactics and policies, as the following outlines.

**Strengthen community outreach programmes for waste separation by:**

- ***Supporting waste separation at source campaigns.*** In partnership with other stakeholders in a waste-to-resource initiative, it is useful for a municipal authority to mobilize its public communication channels and teams in support of waste separation at source. This has included door-to-door communication by municipal public information teams in Sri Lanka as well as radios, loudspeakers and social media in Viet Nam and Cambodia. The celebration of a local recycling day should be considered and has been effectively implemented in Quy Nhon, Viet Nam.
- ***Supporting informal sector engagement for waste separation.*** In many low- and middle-income cities, waste pickers informally undertake waste separation activities. It is beneficial for local governments to support the engagement of these workers through the framework of the waste-to-resource initiative.
- ***Establishing incentives and disincentives for waste separation at source.*** The introduction of incentives and disincentives that support waste separation at source are very effective. They typically require action from the municipal or provincial government. Such incentives may include a 'pay-as-you-throw' fee system, tiered fees (households pay less for collection when their waste is separated) and penalties for non-compliance (such as 'no-separation, no collection').
- ***Ensuring that adequate waste collection infrastructure is in place for separated waste.*** Behaviour change for source separation among a community requires modified systems and infrastructure. The municipality should provide either regulation or investment.



## Engage supporting sectors for promoting the 3R principles by:

- ***Integrating the 3R principles into educational policy.*** Education is an important means of achieving waste separation at source and behaviour change more generally around the 3Rs. Policymakers have supported the preparation of modules on waste management and recycling to be included in national or local school curricula and supported by school management practices through the use of differentiated rubbish bins in schools.

## Support the work of the informal sector for waste-to-resources by:

- ***Recasting the traditional employer-employee relationship.*** Although it is a precarious livelihood, informal waste pickers and waste picker groups typically enjoy a high degree of freedom and autonomy—they work when they want to work. As a result, engaging informal waste pickers is best achieved when it avoids a traditional employer–employee relationship, which can lead to negative outcomes and poor performance. Waste pickers need to be permitted some flexibility and freedom in terms of working times, routes and other parameters. This has been successfully achieved in Kampot, Cambodia.
- ***Deploying incentives for waste separation.*** Informal workers tend to operate according to self-interest. Thus, engaging them in waste-to-resource initiatives works best when a degree of self-interest is maintained. Incentives are useful in this context and have been adopted in Kampot, Cambodia, such as permitting waste pickers to collect and sell recyclable materials found during their organic waste collection routes.







# 3. Managing facilities and improving operations

Facilities management and operational performance are critical components of any waste-to-resource initiative that aspires to long-term sustainability. Without sound management, the facility will fail. This section features a range of lessons on management and good business practices, such as correct business planning, human resource management and performance monitoring. It advocates for the establishment of key performance indicators to allow facility managers to better understand operations and the best use of resources. The section also explores some of the common challenges related to the financial management of facilities and provides a range of strategies for improving financial sustainability.

## 3.1 The importance of a sound business approach

**A business plan, job descriptions and sound accounting are fundamental.**

Waste-to-resource facilities should operate as a business to the extent possible. Such an approach greatly facilitates cost-recovery, thereby allowing the facility to maintain its operations over the long term. This requires that facility managers prepare a business plan.

The business plan should draw on results of surveys conducted among a community or city regarding the amount and composition of waste generated and collected, waste-related behaviour and willingness to pay as well as research on markets for resources to be produced from waste. The business plan needs to be realistic about operational expenditures and income-generating activities over the medium term (three to five years) and make calculations based on best-available data and local business experience to ensure cost-recovery. The preparation of the business plan should result in a better understanding of the economic benefits of implementing a waste-to-resource initiative. It may also be important to understand the amount of support needed from the local government for ensuring profitability. In addition, workers in waste-to-resource facilities need to understand their roles and specific duties. These duties should be outlined in clear job descriptions.

Approaching waste-to-resource facilities as businesses also requires that business managers adopt sound monitoring and accounting processes. Too often waste-to-resource initiatives in low- and middle-income cities fail to adopt correct accounting practices, which can contribute to their failure, and/or facility managers are not adequately informed of their operating expenses and revenue sources. With improved accounting, managers can make more-informed decisions.

**Key performance indicators need to be established and monitored.** Effective management requires the monitoring of operations. For this, data need to be systematically collected. Such data should include the amount and type of waste received at the facility, the amount of waste rejected, the amount of compost or biogas produced and the time it took and the amount sold, the volume of recyclables sold and other elements of operations. Similarly, the composting process requires careful monitoring to ensure that quality compost is produced. This includes monitoring the temperature of the compost pile, its moisture content and gas levels.

Such monitoring allows facility managers to establish and check key performance indicators (KPIs). Time and motion studies can provide useful guidance for establishing the KPIs. These may change over time, as new elements are added to facility operations. The monitoring of KPIs should take place at least monthly, with some facilities also establishing daily KPIs and monitoring systems to ensure efficient day-to-day performance. This practice will also contribute to the transparency of the operations and is important for claiming greenhouse gas emission reductions through the United Nations Framework Convention on Climate Change-approved protocols.

## 3.2 Achieving financial sustainability over the long term

**Diversifying revenue sources builds financial resilience.** To be sustainable over the long term, waste-to-resource initiatives must develop a robust portfolio of revenue sources. Diversification of revenue sources greatly increases the financial resilience of operations.

Common sources of revenue for waste-to-resource initiatives have included:

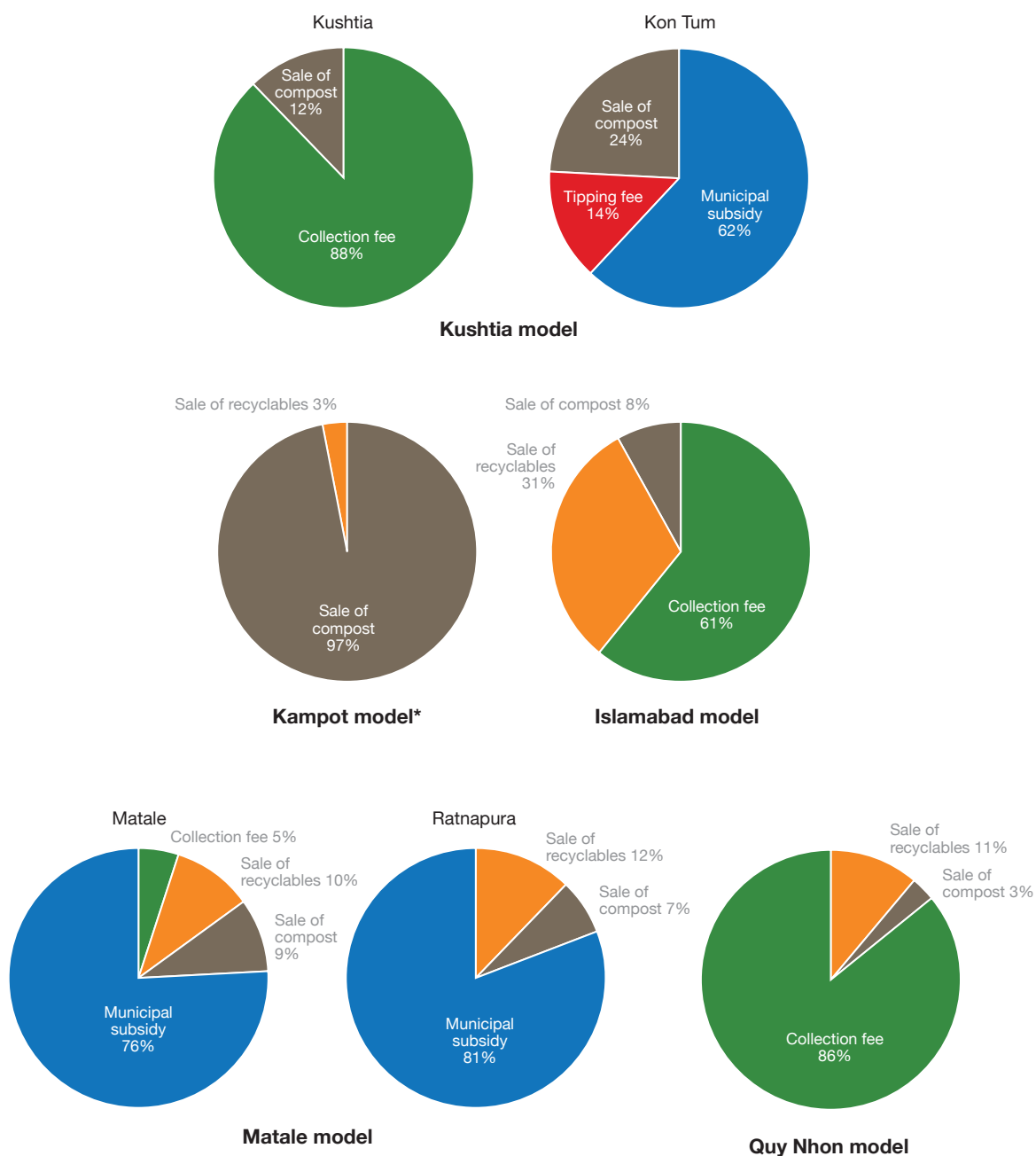
- **Sale of compost, recyclable materials and other products** of the waste-to-resource facility. Recyclable materials can be sold to the recycling industry. Compost may be sold to local residents for gardening, to commercial farmers and to the municipality for use in parks. Biogas may be used as a heating fuel or converted into electricity.
- **Fees for services rendered** to the community, commercial establishments or the municipality. Typically, these services are either for waste collection (collection fee) or waste treatment (tipping or gate fee).
- **In-kind support** extended to the waste-to-resource initiative from the local government. This might involve the local government paying for electricity or water charges incurred by the facility or the provision of labour to the facility at no-cost to the initiative. This support also can include a subsidy disbursed from the local, provincial or national government to offset costs incurred in the facility. Such subsidies can take many forms, depending on local financing procedures and regulations.
- **International financing** linked to climate change mitigation mechanisms. These mechanisms monetize the climate change mitigation benefits of waste-to-resource processes and can generate revenue for waste-to-resource initiatives.

The selection of revenue sources will depend on the type of policies and regulations in place, the degree of support that local government and other stakeholders are willing to extend and the degree of community engagement, among other factors. As Figure 14 demonstrates, diversification of revenue sources is required because revenue from the sale of compost, recyclables and other products from the facility are rarely sufficient to cover costs.

**Collection and tipping fees are usually required to achieve cost-recovery.**

Waste-to-resource facilities that achieve operational cost-recovery usually do so by increasing the revenue derived from collection and tipping (also called gate) fees. Some waste-to-resource operators deliver small-scale waste collection services to households, who pay for the service. Some operators deliver larger-scale services to an entire city and are paid by the municipality. Other operators, by treating organic waste collected and delivered by a third party, provide an essential service to the local government who pays them per tonne of waste treated. However the fees are structured, they are essential for cost-recovery and should be prioritized accordingly by waste-to-resource managers.

**Figure 14. Average share of revenue, by source for waste-to-resource facilities under various partnership models**



Note: \* In Kampot, compost fetches a high price on the local market. Under the business plan for the facility, compost is the main source of revenue. However, with the facility operating below capacity, compost production does not yet allow for cost recovery.

Source: ESCAP, using operational data generated in the facilities in 2014.



### Box 15. Strategies for improved financial resilience in Quy Nhon, Viet Nam



At first it was difficult to break even. The IRRC in Quy Nhon, Viet Nam had been running for a year but expenses continued to exceed revenue. “We were concerned that unless we found some way to increase our income, we would not be able to continue,” says Ngo Huy Liem, Executive Director of Environment and Development in Action. “So we began to try different options. We had to get creative, and we had to connect with our partners and stakeholders to find viable solutions.”

Among the strategies tried, some looked outwards to new clients and buyers, and others looked inwards at operational efficiency and quality production. These strategies permitted the facility to maintain a positive cash flow for more than two years, operating independently of external financial support. For all strategies, the collaboration and support of local government leaders was vital.

Strategies included:

- **Providing primary waste collection to households** in the community. Approximately 800 households pay between \$.30 and \$.90 per month to the waste-to-resource initiative for collection of separated waste.
- **Providing primary waste collection to hospitals and education facilities** in the city. A single contract can generate between \$140 and \$230 per month.
- **Marketing compost within the community** using demonstration gardens and workshops with farmers and other compost users. This helps to ensure a steady base of compost buyers.
- **Maintaining a good compost sales price**, in part due to the high-quality compost production and to community outreach initiatives. The sale price of compost produced in the waste-to-resource facility is twice as high as the sale price of compost produced elsewhere in the province.
- **Incentivizing facility staff for high performance**, particularly in terms of waste sorting and processing within the facility. Incentives for the workers include profits derived from the sale of recyclables and garden produce.

Source: ENDA.

**Improving quality helps to open markets.** Revenues increase when waste-to-resource facilities improve the quality of their products. This is the case both for compost products and recyclables. Recyclables need to be cleaned, compacted, sometimes shredded and packaged. In many cities, a market already exists for recyclables. But compost is often unknown and poorly marketed. Chemical products dominate the fertilizer market. This means that waste-to-resource facilities that produce compost must work extra hard to convince and maintain buyers. Improving compost quality helps gain new buyers and maintain existing buyers. Several factors contribute to compost quality. Waste separation at source is vital for ensuring clean, non-contaminated raw organic matter for composting. The composting process must be monitored closely to ensure that the chemical, microbial and moisture content are all correct. Certification by government bodies that the compost meets national standards also helps to demonstrate quality to buyers (Box 16).



## Box 16. Developing quality standards for compost in Bangladesh



“Because we produce compost from both organic and human waste, quality standards are critical for us,” says Anwar Ali, the mayor of Kushtia, a small city in Bangladesh. Kushtia is the first city in the country to adopt the practice of co-composting (see Box 17). “The co-composting facility is run by the municipality,” explains Mayor Ali, “and we work hard to ensure that compost produced there meets national quality standards.”

Before the introduction of the Organic Fertilizer Standard in 2008, some unethical producers in Bangladesh sold simple garden soil as organic fertilizer, tricking consumers and undermining the value of compost in the market. Product quality is an important factor influencing the uptake of compost by the market. The consistent production of high-quality compost builds product loyalty and trust among farmers, home gardeners and other users.

The Organic Fertilizer Standard specifies quality requirements against a number of criteria, including colour, smell, foreign matter, degree of maturing, nutrient content, heavy metal content, pathogens and acidity/alkalinity (pH). Under the Organic Fertilizer Standard, compost producers must acquire and maintain two separate licences. The first is a license to produce. It is granted to the organization if the compost it produces meets the quality standards. For this, the organization submits a sample of its compost for laboratory testing by the Ministry of Agriculture. The second is a license to distribute and market and is granted to organizations if the application of their compost results in a crop yield higher than a reference yield acquired with the use of chemical fertilizer. Organizations that have both licenses are able to use the term ‘government approved’ on their compost packaging.

As a result of the government standard, the quality of compost produced in Bangladesh has greatly improved, and the compost sector overall has been standardized and formalized. This has enhanced the confidence and trust of farmers and other compost consumers. By the end of 2014, 40 companies were producing compost in accordance with the quality standards.

Source: ESCAP and Waste Concern.

### 3.3 Lessons learned for management and operations

To support the management and operations of waste-to-resource initiatives, national and local governments have successfully utilized a range of strategies, tactics and policies, as the following outlines.

#### **Contribute resources to support waste-to-resource initiatives by:**

- ***Allocating land in suitable locations for the construction of the facility.*** Land constitutes an important capital cost. Municipal governments, as landowners in most cities, can provide critical support by providing the land for waste-to-resource initiatives.
- ***If relevant, supporting waste-to-resource operations by contributing human resources.*** To help reduce the operational costs incurred by NGOs, social enterprises or community groups, municipal governments have contributed human resources, either for technical support or manual labour. The parameters (duration, frequency, type, etc.) of this support may be negotiated as required. In addition, municipal governments have offset charges for municipal utilities over which they have influence, such as water and electricity. This has been successful in Matale and Ratnapura, Sri Lanka.

#### **Encourage sound financial management and support revenue diversification by:**

- ***Supporting revenues derived from waste collection fees.*** Collection fees constitute an important source of revenue for waste-to-resource operations. Municipalities have supported this component by ensuring that fees are adequate, correctly collected and disbursed. Municipality authorities have also supported the awarding of waste collection contracts for large public establishments, such as hospitals.
- ***Stimulating the local compost market.*** To boost the uptake of compost use, it has proved effective for a local government to promote the value of compost among local farmers through targeted programmes and initiatives. Additionally, given the parks, gardens and green spaces maintained by most municipalities, the city constitutes a potentially important buyer of compost. In Kon Tum, for example, the municipality's environmental department buys almost all the compost produced by the waste-to-resource facility for use within the city.



- **Encouraging a diverse range of financial mechanisms.** Numerous options exist as potential revenue sources for waste-to-resource initiatives, including tipping fees, feed-in tariffs for waste-to-energy initiatives, tax holidays, reduction in import duties and sales taxes and climate change financing. Municipal governments should support the selection and implementation of appropriate financial mechanisms. The support (financial, technical, regulatory, etc.) of the national government may be necessary for some mechanisms. For example, it is typically beyond the scope of a municipal government to offer a tax holiday or feed-in tariff.





## 4. Creating an enabling environment for scaling up and replication

A well-managed waste-to-resource facility is one that is sustainable. Such facilities can be scaled up (their processing capacity can be increased) or they can be replicated (new facilities built in other parts of the city or country). Scaling up and replication are the outcome of successful pilot projects and should be the ultimate goal of waste-to-resource initiatives. This section explores how scaling up and replication can function and also addresses common challenges. It offers lessons on viable platforms for replication, including at the local and national levels, and discusses the national and local policy environment most conducive to replication.

### 4.1 The importance of an enabling environment

**Scaling up is a long term goal requiring shifts in policy and behaviour.** The most important pre-condition for scaling up waste-to-resource operations is a readiness for change. Scaling up means that more and more communities, businesses and government bodies will be engaged and expected to adopt new practices. These key stakeholders need to be prepared to commit to long-term change before success will be achieved. Change should be guided by a systematic approach that expands from a single community to the rest of the city or society.

Large-scale behaviour change requires an enabling environment, which comprises supporting policy, values and attitudes as well as a receptive market for the sale of products processed by the waste-to-resource facility. Local policy must be adapted to support waste separation at source, separated waste collection and transport, and the needed practices of reducing, reusing and recycling (3R). Beyond the municipality or province, changes to national policy should also be sought. National waste management guidelines, strategies, policies and plans should be underpinned by the 3R principles. Because behaviour change is largely a product of education, the approach, practice and philosophy of the 3Rs should be integrated into national education policy, curricula and school infrastructure and routines.

**Scaling up should be modular and incremental.** The IRRRC is a small-scale, decentralized, community-based, waste-to-resource model usually servicing a specific ward, commune or community. It is thus reliant on the community it serves. To expand the waste-to-resource initiative to other communities within a city, new IRRRCs can be built. In this way, expansion can be modular and incremental (community-by-community, city-by-city). In Matale, for example, the first IRRRC was built in 2007 to process 3 tonnes of waste per day. In 2009, a second facility was built and a third in 2011. The total capacity across all plants was nine tonnes in 2015, and the local and national government have plans for further expansion.

Incremental replication has several benefits. First, it means that operators, government bodies and communities are engaged in an ongoing learning process as new methods and practices are introduced, adopted and refined by all stakeholders. Second, it reduces the risk of failure because new facilities are built only once pilot facilities are operating well and a degree of success has been obtained. Third, as new facilities are built, the overall resilience, flexibility and robustness of a city's waste-to-resource system increases.

**Engaging markets can support the sale of biogas, compost and other products.** In some countries, chemical fertilizer is subsidized heavily by the national government to increase food production. Reducing the retail price of chemical fertilizer through subsidy tends to exert downward pressure on compost prices also because the products are linked to the market. Rectifying market distortions within the fertilizer industry can greatly improve the competitiveness of compost in the market. In other countries, chemical fertilizer is not subsidized, but compost is undervalued in markets because buyers do not understand its real value. Following research in Bangladesh agricultural yield can be increased by 30 per cent by adopting a regime that combines chemical and organic fertilizer, as compared with using only chemical fertilizer. In both cases, waste-to-resource initiatives can benefit from an improved national market for compost. Similarly, national energy markets are often distorted by subsidies. This can make it challenging for waste-to-resource facilities to sell biogas on local markets, where it has to compete in price against subsidized gases.

## 4.2 Strategies for advancing policy change and replication

**Policy change is best achieved following a successful pilot project.** To support policy change, policymakers can draw on successfully piloted waste-to-resource initiatives. Findings, lessons and documented experiences from the field are particularly useful and help to ensure that new or revised policies are in line with local conditions and realities. Piloted initiatives quickly develop a wealth of information, options and strategies, and the managers of pilot initiatives are usually pleased to share findings with policymakers. Similarly, community groups engaged in waste-to-resource practices are also usually willing to discuss their experiences.



### Box 17. From pilot testing to national policy in Bangladesh



The co-composting facility in Kushtia, a small town in Bangladesh, combines organic waste, such as fruit and vegetable scraps, with human waste collected from septic tanks in the city. This produces a high-quality organic fertilizer, sold mainly to rice farmers in the surrounding Kushtia District, a large producer of rice. Many towns and cities in Bangladesh suffer from poor sanitation and large quantities of organic waste. As a result, co-composting is an attractive idea for the sustainable management of human waste. The Kushtia facility was established in 2012 and was the first in Bangladesh to practise co-composting.

The pilot project has led to important policy changes, based on the findings and experiences it has generated:

- The National Sanitation Strategy, 2005 was revised in 2014 because of the experiences with the Kushtia facility. In the 2005 strategy, responsibility for municipal sanitation was assigned to municipal councils. However, there was limited technical information on how to undertake this responsibility. Following a review of successful pilot initiatives in Bangladesh, including the Kushtia project, the 2005 strategy was revised. It now incorporates principles and technical information on sustainable faecal sludge management, nutrient recycling and the co-composting of waste—all of which are important methods pioneered in Kushtia. As a result, the new strategy provides far more specific information to municipalities on how to achieve sustainable sanitation and directly support co-composting as a viable technique.
- The National Tax Schedule, 1977 set tax rates for different entities, including the tax rate that municipalities can levy on residents for basic services, such as waste collection and sanitation. In 2014, a new tax schedule was approved. Previously, tax rates were too low for municipalities to manage sanitation needs appropriately. Under the new schedule, municipalities are authorized to increase the sanitation tax on buildings and land—as a result of experiences gained in Kushtia as part of the co-composting project. This facilitates the improvement of sanitation services, including faecal sludge management and other sustainable practices.

Pilot projects help to generate detailed, practical and technical experience that can be incorporated into national policy. This facilitates the operationalizing of national objectives and goals. In the case of Kushtia, the experiences in co-composting as well as broader implications, such as fiscal design, have been instrumental to broader change.

Source: ESCAP and Waste Concern.

**National programmes and financing are especially useful for replication.**

Progress and efficacy in replicating waste-to-resource initiatives are greatly enhanced when the initiative is supported through national programmes. In particular, by incorporating or transforming a waste-to-resource initiative into a national programme, national policy and financing can be mobilized in support. Several types of national programmes can act as vehicles for the replication of waste-to-resource initiatives. These include solid waste management programmes, sustainable urban development programmes and public health programmes. Programmes may either be pre-existing or new. For pre-existing programmes, the incorporation of waste-to-resource principles, approaches and models may require a change of phase.

**Box 18. Scaling up waste-to-resource initiatives in Sri Lanka**

When the first IRRC was piloted in Sri Lanka in 2007, no one imagined it would be adopted into a national programme six years later. “We began to pilot the IRRC model in Matale because the local government was interested and the need was great,” says Jayaratne Kananke Arachchilage, President of Sevanatha Urban Resource Centre, an NGO based in Colombo. “At that time, the IRRC was totally new here. The national Government was committed to different strategies for dealing with municipal solid waste. That has all changed,” he says.

The Pilisaru National Solid Waste Management Programme is Sri Lanka’s largest endeavour for sustainable waste management and seeks to improve the reuse of natural and recyclable materials across the country. Under the first phase of the project (2008–2014), waste-to-resource facilities were established in a number of towns and cities but using different techniques and processes to those used in the IRRC model. Following recognized successes in the piloted IRRCs, the Central Environment Authority announced in 2015 that the Pilisaru Programme would adopt the IRRC model to improve waste-to-resource practices across the country.

After the adoption of the IRRC model into the Pilisaru Programme, funding was made available at the national level to support replication. Under the programme there are plans to expand the facilities in Matale and Ratnapura as well as convert existing facilities in other cities into IRRCs. The adoption of the IRRC model stemmed from the sustained engagement by facility operators and partners with the Central Environment Authority, strong support from local government and positive results for the cities involved.

Source: ESCAP.



### **International climate change financing can be leveraged for replication.**

Because waste-to-resource initiatives reduce the emission of methane, a greenhouse gas, they can be considered climate change mitigation projects. As such, they are eligible to receive financing from international climate change mitigation mechanisms. Such financing, especially when linked to a national programme, can greatly increase opportunities for replication of a waste-to-resource initiative.

In particular, climate change mitigation financing can be sought via nationally appropriate mitigation actions (NAMAs), a mechanism designed to provide developing countries with support for climate change. NAMAs can help countries implement policies and targets they may already have in place. This has been the case, for example, in Viet Nam. Additionally, NAMAs for the waste sector typically combine greenhouse gas emission reductions with strong co-benefits. Funding is also available for low-emission development strategies. Both mechanisms can link well with waste-to-resource initiatives seeking replication at the national level.

#### **Box 19. Leveraging climate change financing for waste in Viet Nam**

To replicate waste-to-resource initiatives in Viet Nam, the Government has been working with ESCAP to develop a nationally appropriate mitigation action (NAMA). “We expect that this NAMA can stimulate cities in Viet Nam in adopting waste management practices that are more sustainable and climate friendly,” says Tran Thuc, Vice-Chair of the Viet Nam Panel on Climate Change and former Director General of the Vietnam Institute of Meteorology, Hydrology and Environment, a research institute affiliated with the Ministry of Natural Resources and Environment.

Viet Nam is highly committed to addressing climate change and is pursuing strategies for both adaptation and mitigation. Following good outcomes of the waste-to-resource initiatives in Quy Nhon and Kontum, the Government is exploring options and support for replicating this model at the national level. “We are also hoping for the support of international donors in making this programme a reality, especially in building the capacity of local governments and in unlocking investment, both foreign and national, for ‘waste-to-resource’ initiatives,” says Mr Tran.

Source: ESCAP.

## 4.3 Lessons learned for enabling and scaling up waste-to-resource initiatives

National and local governments have successfully created an enabling environment and scaled up waste-to-resource initiatives by implementing a range of strategies, as the following outlines.

### **Build a supportive policy environment by:**

- ***Ensuring sustainable solid waste management is a national priority.*** National waste policy should support waste-to-resource initiatives by adopting the 3R principles and objectives. Sustainable solid waste management needs to be seen as a priority within broader socioeconomic development policy.
- ***Exploring climate change financing options.*** International funding is made available especially to low- and middle-income countries to pursue climate change mitigation projects and programmes. Because waste-to-resource initiatives reduce methane emissions, policymakers in Pakistan, Sri Lanka and Viet Nam have utilized climate change financing as a viable funding source to scale up operations. Other governments could explore this option.

### **Prioritize compost quality improvement by:**

- ***Establishing quality standards for organic fertilizer at the national level.*** The establishment of minimum quality standards for specific products helps to secure the market and reassures consumers. To support the market, consumer choice and compost production, policymakers should put in place minimum standards for organic fertilizer that are aligned with international criteria and national needs. In Bangladesh, the Government has greatly supported compost production through the adoption of national quality standards.

- ***Ensuring compliance of all compost producers through regular inspection.*** An essential component of such standards involves inspection of compost products. This should be carried out regularly by the producer and as an obligation for the marketing of products. National standards should indicate the regularity of testing, and a relevant government body could be assigned for oversight.
- ***Promoting certification and the use of certified organic fertilizer.*** As a result of inspection, compliant producers should receive certification. Certification should include a specified period of validity and permit the use of a government insignia on compost packaging to indicate the quality.

**Gear national markets to support waste-to-resource products by:**

- ***Reducing market distortions against compost.*** Many national governments maintain subsidy regimes for chemical fertilizers. These subsidies force down the price of other fertilizers, including organic fertilizer, like compost. Policymakers need to review and correct market distortions created through subsidies to chemical fertilizers to level the field for compost products to compete.
- ***Reducing market distortions against biogas and electricity.*** National subsidies for fuels, such as liquid petroleum gas (LPG) and butane, common cooking gases and electricity, also distort the market for biogas and electricity produced from biogas. Policymakers should review and correct market distortions created through subsidies for LPG and butane gas to also level the field for biogas to compete.

These lessons and recommendations are based on the experience of ESCAP and a range of national, provincial and local governments as well as NGOs, social entrepreneurs, community groups and other actors in eight cities across the Asia-Pacific region. The specific background, context, activities and findings from each city are presented in Part III in a series of eight fact sheets.



# PART III

## CITY PROFILES

- Kushtia, Bangladesh
- Battambang, Cambodia
- Kampot, Cambodia
- Islamabad, Pakistan
- Matale, Sri Lanka
- Ratnapura, Sri Lanka
- Kon Tum, Viet Nam
- Quy Nhon, Viet Nam







# Introduction

Part I of this publication introduced the challenges and opportunities of municipal solid waste management in developing countries in the Asia–Pacific region and highlighted the benefits of waste-to-resource initiatives. Part II presented experiences of ESCAP, Waste Concern and other partners in setting up and managing waste-to-resource initiatives in eight cities and the lessons learned from those experiences, followed by policy recommendations.

Now Part III profiles those eight cities in more detail. Each profile begins with a brief overview of the city and its waste-to-resource initiative as well as the broader urban development landscape and the waste management context. This includes data on waste generation and collection rates as well as information on the city's waste policy.

Each profile then provides further information on the waste-to-resource initiative, including discussion of the primary contributions from different partners and the various activities pursued under the initiative in terms of awareness raising, community outreach, policy change, facility management and financial sustainability.

The profiles sum up the results and impact of the waste-to-resource initiative. This entails the overall operational performance, community mobilization and the broader impact of the initiative on local policy and practice of solid waste management in each city. Some profiles conclude with reference of future activities to further improve results.



可回收物  
Recyclable

# Kushtia, Bangladesh



## City overview

### Population

102,988 (2015)

### Total waste generated per day

40 tonnes

### Waste generated per capita per day

0.39 kg

### Waste-to-resource facility established

Compost plant (2008) and co-compost plant (2012)

### Capacity of waste-to-resource facility

4 tonnes per day

### Operator

Kushtia Municipality

### Local partners

Local Government Engineering Department, Waste Concern

Source: Waste Concern.

# Introduction

Kushtia is a small city and capital of Kushtia District, in north-west Bangladesh. Due to fertile, flat alluvial soil in the delta of the Gorai and Kaliganga Rivers, the district is rich in rice and tobacco plantations. Kushtia city provides the market and distribution node for their crops. In addition to agriculture, education is a central economic activity for Kushtia city, with a number of universities and research and cultural institutions located there. The western railway line divides the city.

Approximately 40 tonnes of solid waste is generated in the city each day, 20–25 tonnes of which the municipality collects. The city's solid waste is around 80 per cent organic. Additionally, the city's residents generate some 180 cubic metres of faecal sludge each day. The municipality collects both faecal sludge and solid waste, making co-composting an appropriate technique for resource recovery in Kushtia. Co-composting involves mixing and composting faecal sludge and organic waste together under aerobic, thermophilic conditions.

Prior to the project, faecal sludge was collected by vacuum trucks from septic tanks and pit latrines across the city and released directly into local waterways, which heavily polluted the ecosystem. The city lacked a clear alternative to such practices, with no formal or environmentally sound faecal sludge disposal system in place. The co-composting facility changed that situation.





## Promoting the IRRC model in Kushtia

The co-composting IRRC project was initiated in 2012 through a partnership between ESCAP, Waste Concern, the Local Government Engineering Department (LGED) and the Kushtia Municipality. This involved adapting and expanding an existing composting plant that had been set up in 2008 through a partnership between the Institute for Global Environmental Strategies (IGES) and the United Nations Centre for Regional Development (UNCRD).

The co-composting project depended on contributions from different partners. ESCAP provided the funds for the construction of the cocopeat filter system, through which waste water is filtered prior to release. LGED provided the funds for the construction of the new plant, the faecal sludge drying beds and the purchase of vacuum pump trucks for the removal of faecal sludge from septic tanks and pit latrines. Land for the project was provided by the municipal authority under the original project with IGES and UNCRD. Waste Concern contributed technical assistance to the municipality on the design and operation of the plant.

Under this scheme, collected sludge is transported to the treatment facility at the IRRC. The liquid faecal sludge is poured into a sludge tank, from where it is passes into the sludge drying bed. When the drying bed is full, the sludge dries over a period of 7–12 days. The percolate (liquid) that is produced during the drying process is transferred to a percolate tank and then filtered through the cocopeat unit. After filtration, the water is high in nutrients but compliant with national wastewater quality standards. As a result, it can be safely used on agricultural land for irrigation.

The revenue streams derive from the collection fees and the sale of compost and recyclables in the local market. To collect faecal sludge from a pit latrine, the Kushtia Municipality charges BDT350 (\$4.50) per latrine. To collect faecal sludge from a larger septic tank, the municipality charges BDT500 (\$6.43). The municipal authority covers the cost of the workers and management staff as well as the truck fuel required for the collection process. The collection fees offset the plant's operational costs.



## Results and impact

The project has achieved good results in a number of important areas. First, the amount of waste disposed through open dumping has reduced. The IRRC receives 2–3.5 tonnes of organic waste per day and 2–6 cubic metres of faecal sludge per day, equivalent to the volume from one to four households' septic tanks or pit latrines per day. The Kushtia Municipality services around 85 per cent of the city's households using the vacuum trucks; otherwise, approximately 15 per cent of households either call in workers to clean their pit latrine or do it themselves.

Second, the compost produced is of high quality. It complies with government standards and has cleared the first stage of licensing (see Box 11). As stipulated by these standards, a second stage of field testing, over a period of 9–12 months, is required before commercial production and marketing of the compost is permitted.

Third, the financial management of the operation has been successful, mainly due to strong support from the municipal authority. In addition, the Ministry of Local Government in late 2014 approved the application of a 12 per cent property tax in municipalities where faecal sludge collection takes place. This now greatly facilitates the cost-recovery of operations, including within the IRRC.

Fourth, the project has led to a rise in awareness within the local government on the importance of waste as a valuable resource. A range of on-the-job training has been delivered to relevant staff of the Kushtia Municipality. This training has covered different aspects of faecal sludge management, sanitation and conservation. Critically, the mayor of Kushtia Municipality is hugely supportive of the project and regularly monitors activities at the IRRC and within the broader waste collection operations. This political commitment has been vital for the project's success.

And fifth, the project has demonstrated that co-composting is a viable and affordable technique that can be adopted in other cities. Importantly, the capital costs of co-composting projects are much lower than those of conventional reticulated sewer systems, which greatly increases the attractiveness of co-composting as a solution to Bangladesh's sanitation challenges, particularly in small and medium-sized towns. To further promote this concept, however, widespread demonstration and expanded national government support are required.

# Battambang, Cambodia



## City overview

Population	
180,000 (2008)	
Total waste generated per day	Waste generated per capita per day
90 tonnes	0.6 kg
Waste-to-resource programme established	2012
Focus of programme	Source separation at community level
Programme lead	Cambodia Education and Waste Management Organization
Local partners	
Battambang Municipality, Battambang Province, Cintri	

Source: CSARO.

# Introduction

Battambang is the capital of Battambang Province in the north-west of Cambodia. It is a commercial hub and popular tourist destination. The city faces a range of challenges related to improper waste management, flooding and pollution. At the same time, population growth, rising per capita income and changes in consumption habits are increasing the amount of waste generated. There is limited waste management capacity locally and limited environmental awareness.

Within the city, three parties have solid waste management responsibilities: the provincial government of Battambang has an advisory role and decision-making powers; the municipality is tasked with implementing local policies; and Cintri, a private company, manages waste collection. Cintri, however, lacks the capacity and resources to cover all areas of the city and currently collects waste from only around 25 per cent of households and businesses. As a result, most households dispose of their solid waste by burning, burying or dumping into rivers, waterways or open spaces. Additionally, collection rates are hindered by the reluctance of many households to pay the \$.50–\$1 that Cintri charges as a monthly waste collection fee. Other households are difficult to access due to narrow or poorly maintained roads. In some communities, low-hanging power lines pose a significant risk to the waste collection vehicles, which further impedes proper waste collection.

An estimated 350–400 informal waste workers are active in Battambang. Some of the workers use pushcarts and motorized carts to collect and buy recyclable material for onward sale to recycling shops. These waste workers tend to earn around \$5–\$10 per day. They sell to approximately 20 shops across Battambang, where recyclable waste is collected, stored, packaged and transferred. On average, 2 tonnes of waste is processed daily in this manner. Scavenging for recyclables also takes place at the city's main dumpsite, although the quality of the materials retrieved is poor. Approximately 50 people earn their living by scavenging at the dumpsite, subsisting on an income of about \$1–\$1.25 per day.

## Promoting waste separation in Battambang

The Cambodia Education and Waste Management Organization (COMPED) launched a composting facility in Battambang to take advantage of the potential of recycling organic waste. The plant is located on land owned by the municipality. It has the capacity to process 10 tonnes of organic waste per day but over 2010-2012 tended to treat only 1.5-5 tonnes per day due to poor understanding or awareness of source separation among the general public.

An awareness-raising programme on source separation was launched in 2012. This involved a partnership between ESCAP and COMPED (building off a larger programme led by the Institute for Global Environmental Strategies) and targeted three fresh produce markets: Psa Thom Battambang, Psa Thmey Makara and Psa Boeung Chuk. The waste separation programme aimed to educate market vendors, market workers, market association members and some households on the need for waste separation at source.



## Results and impact

As a result of the programme, the rate of waste separation increased, at least in one of the markets. The programme found the most success in Psa Boeung Chuk market, with 35 per cent of vendors separating their waste within a year's time. The market cleaning team facilitated waste separation by collecting separated waste from vendors and transporting it to the Cintri collection point. Cintri also modified its waste collection truck that serviced the market by introducing an internal partition to maintain the separation of waste types.

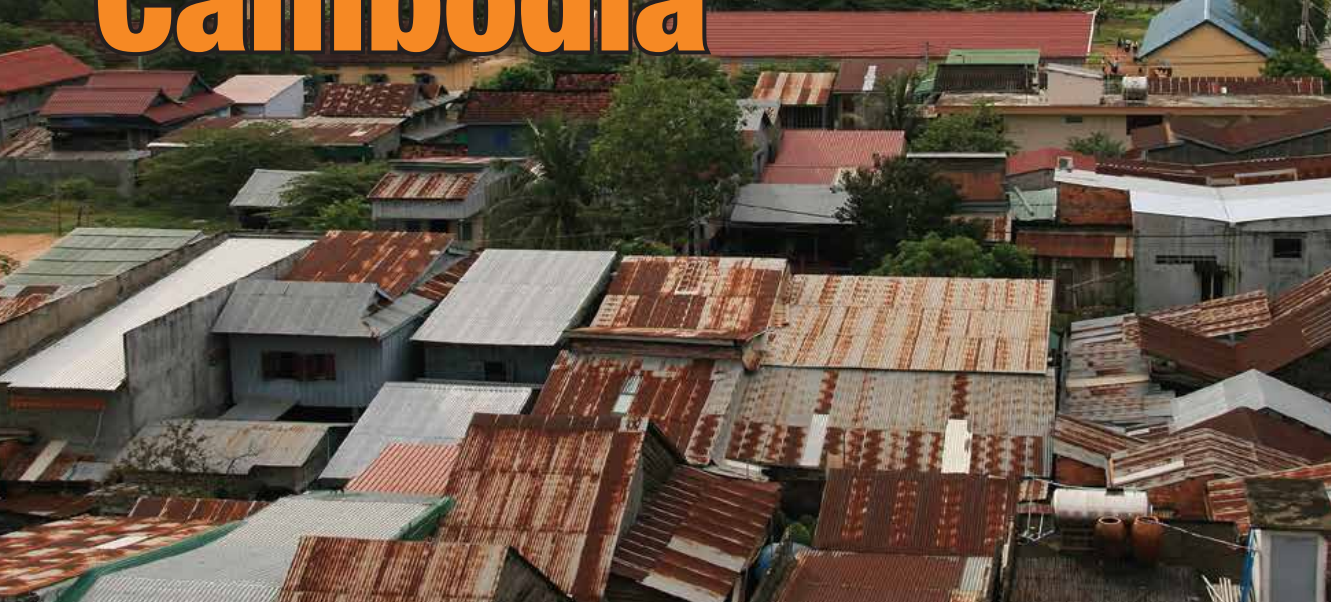
Less successful outcomes, however, were recorded in the other two markets (Psa Thom Battambang and Psa Thmey Makara) for several reasons:

- The market management and market cleaners did not fully cooperate. Consequently, waste that was separated by the vendors was often 're-mixed' by the market cleaners during transportation to the Cintri collection point. Hence, the vendors quickly lost interest and ceased to separate.
- In both markets, only two workers were appointed by the market management to collect separated waste. This was insufficient for such a job.
- Market vendors also demonstrated some resistance to the programme. Vendors in both markets already paid a waste collection fee to the market's management authority. The additional task of waste separation by the vendor was not reflected in the fee (by decreasing the fee for those vendors who separated) and thus there was little financial incentive to comply.
- More than 40 bins were distributed by COMPED across the three markets. But in the two markets where the programme failed, the bins were not used for capturing separated waste. Instead, because the market cleaners did not provide adequate collection of separated waste, the COMPED bins were used for mixed waste.

These experiences underscore the role and importance of market management and market cleaners. To establish an effective collection and transfer system for separated waste in fresh produce markets, market managers and cleaners need to understand (and accept) their roles. Often, awareness-raising campaigns concentrate only on vendors. The Battambang experience demonstrates that without clear buy-in and commitment from waste collectors within a relevant market, a waste-to-resource programme will not succeed.



# Kampot, Cambodia



## City overview

Population	
51,851 (2015)	
Total waste generated per day	Waste generated per capita per day
32–35 tonnes (2015)	0.6 kg (2015)
Waste-to-resource facility established	2012
Capacity of waste-to-resource facility	3 tonnes per day
Operator	Community Sanitation and Recycling Organization
Local partners	
Kampot Municipality, Kampot Province	

Source: CSARO.

# Introduction

Kampot is a small town on the edge of the Teuk Chhou River in southern Cambodia. The area's production of black and white pepper, durian and fish sauce is a primary source of revenue, along with the local tourism industry. The town faces a number of challenges regarding sanitation, water supply and waste management. As a result of the growing tourism industry, town cleanliness is increasingly important and acts as a strong incentive for the local government to support waste separation and improved waste management.

The town generates around 32–35 tonnes of solid waste per day. Approximately 60 per cent of the waste from households, restaurants, hotels and shops is organic. The percentage of organic waste generated at the large central Samaki market is higher, at approximately 80 per cent (see Box 14).

Three parties have solid waste management responsibilities in the town: the provincial government of Kampot has an advisory role and decision-making powers; the municipal authority is tasked with implementing local policies; and Global Action for Environment Awareness (GAEA), a private company, manages waste collection. Due to insufficient financing and limited human resources, GAEA collects from only 36 per cent of Kampot's households. As a result, a significant amount of waste is burned or disposed of in the street and open spaces, into waterways or at illegal dumpsites.

The informal sector is particularly active in waste management in Kampot, with more than 30 waste pickers operating in the town, most of whom are female and earning \$2–\$3.50 per day.



## Promoting the IRRC model in Kampot

Following support from the Ministry of Interior and the Ministry of Environment, both of which urged the provincial government to improve solid waste management in Kampot, a 3-tonne-capacity IRRC was established in 2012. This involved a partnership between ESCAP, the Community Sanitation and Recycling Organization (CSARO), Kampot Municipality and Kampot Province.

ESCAP provided the funds to cover construction of the facility. The municipal authority provided the land on which to build it and some policy support. The local waste collector, GAEA, which has a long-term agreement with the municipal authority for waste collection, was tasked with collecting and delivering separated waste to the IRRC.

CSARO operates the facility and provides capacity-building and awareness-raising information at the community level. This has involved a range of activities, including campaigns using posters and leaflets, workshops and community meetings to inform the public of the project and the need for waste separation at source. The initiative also has targeted school children, teachers and school managers. CSARO has engaged the informal waste collectors and facilitated the organization of a self-help group among them who now operate the waste-to-resource facility under CSARO management and collect waste in some communities.

A mid-term plan to promote source separation in the city was established through joint efforts between the government bodies, CSARO and ESCAP. This plan targets markets, small businesses, hotels and households for waste separation. It also provides clear guidance on waste separation, collection and transportation for each target group.





## Results and impact

The project has had mixed results. The IRRC operates well below capacity, processing between 0.2 and 0.8 tonnes of organic waste per day. Most of the organic waste derives from the Samaki market and some communities where households practise waste separation at source. The price of compost is between \$170 and \$200 per tonne, which is a good price. Yet, little compost is produced or sold (an average of 0.1 tonne of compost is sold per month), which severely limits revenue for the facility.

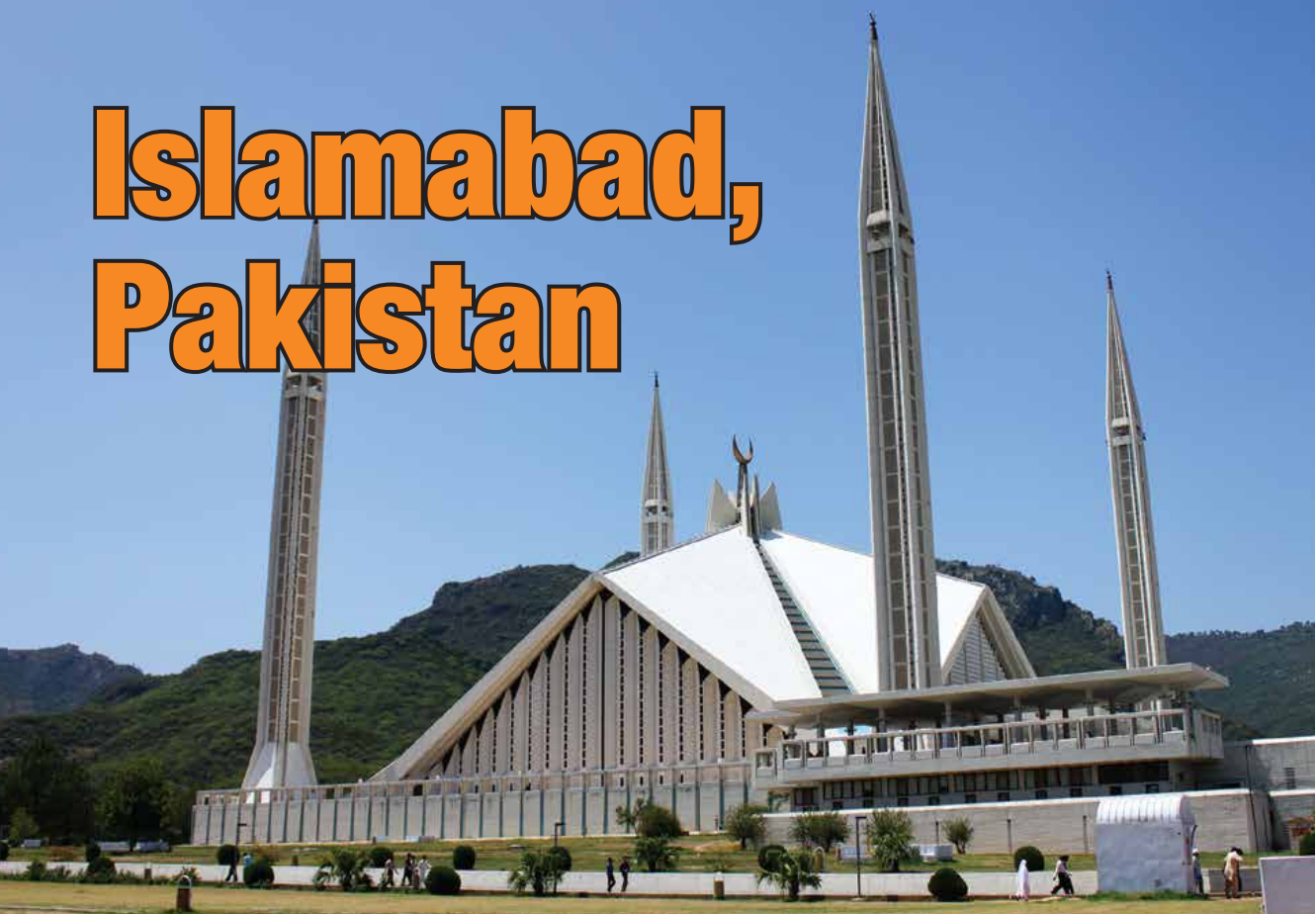
GAEA has demonstrated weak commitment, and the provincial and municipal governments have not put in place adequate incentives or regulation to enforce coordination with the project. Part of the issue is financial constraint. The bulk of GAEA's income derives from collection fees gathered from market authorities, public institutions and commercial entities (restaurants, hotels and other businesses), while the collection fees from households are low, at \$1–\$1.50 per month.

Nonetheless, there has been a strong increase in understanding the need for and practise of waste separation at source. Early in 2012, only 2 per cent of the waste generated in Samaki market was separated by the vendors. By 2015, some 40–50 per cent of waste was separated, an increase attributed to various engagement strategies by a range of actors.

Similarly, some success has been found with the informal sector waste pickers who have become more organized. The waste pickers operate the IRRC and collect waste from communities in exchange for reliable salaries, protective clothing and other benefits —representing an important step in the quasi-formalization of the sector.



# Islamabad, Pakistan



## City overview

Population	
2 million (2011)	
Total waste generated per day	Waste generated per capita per day
800–1,000 tonnes	0.4–0.5 kg
Waste-to-resource facility established	2015
Capacity of waste-to-resource facility	3 tonnes
Operator	Dr Akhtar Hameed Khan Memorial Trust
Local partners	
Jammu and Kashmir Cooperative Housing Society, UN-Habitat Pakistan	

Source: ESCAP and UN-Habitat Pakistan.



# Introduction

Islamabad is the capital of Pakistan, where national government, diplomatic services and a growing communications and information technologies sector are concentrated. The city is a planned capital, with its design and construction largely dating to the early 1960s. However, while providing a sound base, the city's master plan has been only partially implemented; the city suffers from unregulated development, a lack of appropriate housing, traffic congestion and detrimental solid waste and environmental issues.

An increasing amount of solid waste is generated in the city, rising from around 500–600 tonnes per day in 2004 to around 800–1,000 tonnes per day in 2011. Between 60 and 65 per cent of this waste is organic, and 20–30 per cent of it is recyclable. The Capital Development Authority (CDA) has overall responsibility for the provision of public health services in Islamabad, including adequate sanitation and solid waste management services within its territorial limits. The CDA collects solid waste from across the city, and oversees private initiatives operating in many neighbourhoods, or 'sectors' as they are called. While coverage is patchy, the majority (up to 80 per cent) of households in the city are willing to pay for improved waste collection. Similarly, around 80 per cent are willing to separate waste at source. With many of the city's neighbourhoods (sectors) developing rapidly, the need for improved sustainable solid waste management initiatives is also quickly growing.

The CDA does not yet have a comprehensive solid waste management plan for Islamabad, nor is there a local incinerator or sanitary landfill. Most waste is dumped at a local dumpsite. Islamabad benefits from the work of informal waste pickers, many of whom are Afghan settlers. There are also more organized and well-established supply chains involving waste pickers and junk dealers. Waste pickers usually collect paper, plastic, glass, ceramics and metal and earn around \$1.50 per day, with children waste pickers earning around \$1.

## Promoting the IRRC model in Islamabad

The high percentage of organic waste in Islamabad is an opportunity for composting. Chemical fertilizer is expensive in Pakistan, which makes composting an even more attractive option for sustainable, cost-effective solid waste management. This, in combination with high willingness from households to modify their waste management practice, means that a strengthened waste-to-resource approach should be pursued.

Following a review of viable sites to initiate a waste-to-resource facility, the largely residential (high-income neighbourhood) Sector G15 was chosen. A private, not-for-profit developer, the Jammu and Kashmir Cooperative Housing Society, was awarded responsibility to develop the sector, providing basic services, some infrastructure and housing.

In 2014, ESCAP, UN-Habitat Pakistan, the Jammu and Kashmir Cooperative Housing Society and the Dr Akhtar Hameed Khan Memorial Trust (AHKMT) initiated the waste-to-resource project in Sector G15. The project is designed to pilot the IRRC model and test its viability for replication in other sectors in Islamabad and other cities in Pakistan more generally. Uniquely, this waste-to-resource initiative has minimal government involvement. Rather, it is led by the two private sector organizations, the Jammu and Kashmir Cooperative Housing Society and AHKMT.

Construction of the IRRC began in early 2015. The facility will be operational by the third quarter of the year and will process waste generated by households, shops and markets in Sector G15. The Jammu and Kashmir Cooperative Housing Society provided land for the site of the IRRC. It also awarded waste collection and operation of the IRRC to the AHKMT, which is a local social enterprise. Waste collection will be undertaken by E-guard, a waste collection organization and model that the AHKMT has successfully developed and refined in other urban communities.

Based on its business plan, AHKMT expects to collect waste from 1,000 households over the first year of operations, expanding up to 2,520 households by the fifth year. Staff from AHKMT have been trained in the operation of an IRRC. Community outreach programmes, which began prior to the completion of the IRRC, have involved awareness-raising initiatives, training workshops and a range of other pilot initiatives. Households have responded well, and waste separation within households has begun.

Financing of the operations of the Islamabad waste-to-resource facility involves a flow of funds between the two main private sector actors. First, the AHKMT collects waste within Sector G15. For this service the Jammu and Kashmir Cooperative Housing Society pays them a collection fee. The Housing Society, in turn, charges all households and businesses in Sector G15 a basic services fee which covers a range of services including water provision, sanitation and waste management. The AHKMT revenue also includes funds generated through the sale of compost and recyclable materials. These three revenue sources are expected to more than cover operational expenditure. The AHKMT shares 25 per cent of its profit with the Jammu and Kashmir Cooperative Housing Society.

Even prior to the IRRRC opening, other municipalities and organizations working in Pakistan expressed a high degree of interest in the model. Several city governments from other provinces are exploring options for the development of a pilot IRRRC within their respective jurisdiction and are willing to commit budget, land and other resources. The IRRRC model is expected to be replicated widely within the country. A range of development partners, including United Nations agencies and multilateral donors, also have expressed interest in replicating the model in the country.



# Matale, Sri Lanka



## City overview

### Population

50,300 (2015)

### Total waste generated per day

30–32 tonnes

### Waste generated per capita per day

0.6 kg

### Waste-to-resource facility established

Three facilities, established in 2007, 2009 and 2011

### Capacity of waste-to-resource facility

9 tonnes across all facilities

### Operator

Micro Enriched Compost

### Local partners

Sevanatha Urban Resource Centre, Matale Municipal Council,  
Central Environmental Authority

Source: ESCAP and Sevanatha Urban Resource Centre.



# Introduction

Matale is a medium-sized town in central Sri Lanka, with an annual population growth rate of 1.5 per cent in 2015. The city is surrounded by large plantations and is famous for its spice gardens. In addition to agriculture, the city's main economic activities include tourism and trade. Population growth, urban expansion and economic development in Matale have created regulatory and management challenges. The city's development plan tends to be partially implemented, in part due to limited technical capacity among government officers.

The city struggles with a number of challenges linked to solid waste management, which is a core responsibility of the Matale Municipal Council. Approximately 30–32 tonnes of waste are generated per day in the city. Despite attempts from the Municipal Council to curb waste-generation rates, they continue to increase by 1-2 per cent per year. Waste collection tends to be low, although 20 per cent of the municipal budget is spent on solid waste management. Collecting 1 tonne of waste costs around \$30. The municipal waste collectors cover 60 per cent of the city. The most common method of waste disposal is open dumping at a municipal dumpsite, where disposal costs \$3 per tonne for ground management costs. Because the dumpsite is almost full, the city is looking for a new site. The informal sector has an important role in Matale's waste management, collecting 2.5 tonnes of recyclable inorganic waste per day.

In response the Municipal Council developed an Action Plan Towards a Zero-Waste City to guide Matale towards a more sustainable waste management approach. Programmes of waste separation at source have been established to support this ambition. The role of an IRRC has been central to the city's new vision.





## Promoting the IRRC model in Matale

Around 71 per cent of Matale's municipal solid waste is organic, and some 10 per cent is recyclable inorganic material. As a result, composting of the organic fragment of the city's waste stream is advantageous. With financial assistance from ESCAP, the first IRRC facility was set up in Matale in 2007. The Matale Municipal Council provided land for the facility, together with regulatory and financial support, including the payment of salaries of some IRRC workers as well as its electricity and water charges.

Sevanatha Urban Resource Centre, a local NGO, has managed the project since its inception. To improve the facility's business performance, Sevanatha established Micro Enriched Compost, a social enterprise, to operate the facility and undertake business planning and associated functions. Waste Concern provided technical support. A second IRRC was established in 2009, this time financed by the Central Environmental Authority through the Pilisaru Programme, on land provided by the Municipal Council and with the same arrangement of partners. The Municipal Council provided more land for a third facility that was set up in 2011, again with funding from ESCAP. Total processing capacity of the three IRRCs is now up to 9 tonnes per day. A 3-tonne expansion of these facilities is planned for late 2015 with government funds.

To support these facilities, the Matale Municipal Council has initiated a range of outreach and awareness-raising activities in partnership with Sevanatha. These have targeted households, community groups, school children and local institutions with information on the need for and practice of separation of waste at source.

Even though the IRRC facilities have encountered several challenges linked to operational constraints, insufficient regulatory support from the municipal authority and financial limitations, performance has improved gradually. Financial support from the local government for the operating costs continues to be a critical factor in that improvement. The Micro Enriched Compost undertakes waste collection in one ward in Matale, through which it generates around 5 per cent of its revenue (see figure 14). As a result, the local government needs to provide a range of support for the facilities to achieve cost-recovery. The Municipal Council plans to implement its zero-waste programme across Matale and continue to address community awareness of sustainable waste management.

## Results and impact

In 2015, the three IRRCs processed an average of 135 tonnes of organic waste per month, with daily intake ranging from 6 to 9 tonnes. The waste is converted to compost, with the IRRCs producing an average of 2.6 tonnes of compost per month. Compost sells at around LKR11,113 (\$80) per tonne. Principal buyers include local farmers, the Department of Agriculture and nursery operators. Additionally, the facilities process and sell an average of 7.7 tonnes of recyclable inorganic material per month.

The amount of waste sent to landfill has reduced by 6–9 tonnes per day, or 30–50 per cent per day of the total amount collected and landfilled previously. Consequently, the amount of waste recovered and recycled in the city increased fourfold between 2008 and 2015. Thanks to the community awareness programmes, there has been a major shift in the public's understanding of the importance of waste separation at source. In 2008, for instance, only 10 per cent of households separated their waste; in 2015, 60 per cent of households separated their waste.

In 2014, the Central Environmental Authority announced it was adopting the IIRC approach as the principal model for its national solid waste management programme. This came following years of engagement by the Central Environmental Authority on the pilot projects in Matale. Under the programme, the authority will build new IRRCs across Sri Lanka and convert existing composting facilities into IRRCs. This demonstrates both the effectiveness of the model to the Sri Lankan context and the potential for uptake and replication if pilot projects achieve positive results and good performance. It also shows that incremental expansion in a pilot city and strategic engagement with national government bodies can yield important and long-term benefits for sustainable waste management.



# Ratnapura, Sri Lanka



## City overview

### Population

54,000 (2015)

### Total waste generated per day

30–32 tonnes

### Waste generated per capita per day

0.55–0.6 kg

### Waste-to-resource facility established

2012

### Capacity of waste-to-resource facility

5 tonnes

### Operator

Micro Enriched Compost

### Local partners

Sevanatha Urban Resource Centre, Ratnapura Municipal Council,  
Central Environmental Authority

Source: ESCAP and Sevanatha Urban Resource Centre.

# Introduction

Ratnapura is a medium-sized town in south-central Sri Lanka, with an economy built around the gemstone trade and, increasingly, tourism. Rice, fruit, tea and rubber plantations surround the town and generate important revenues for the municipality. The town, however, suffers from growing traffic congestion, environmental pollution, flooding, landslides and unregulated urban growth.

Solid waste management and sanitation issues are also a rapidly growing challenge. Around 30–32 tonnes of municipal solid waste are generated in the town per day, of which 75 per cent is organic. The municipal authority is responsible for solid waste collection and disposal. Despite a significant increase in the local budget allocation for solid waste management over recent years, municipal waste collection services cover only 60 per cent of the town, and waste disposal practices largely rely upon open dumping. The town lacks a solid waste management plan. Improvements in solid waste management are also hampered by limited capacity within the municipality and limited community participation. Until 2012, all waste generated in the town was dumped, with the exception of what was collected by waste pickers.

The financial sustainability of municipal waste collection is undermined by the absence of a collection fee. High labour and transportation costs make solid waste collection expensive, averaging \$27 per tonne. As a result and to advance cleanliness and environmental sustainability, the municipality is seeking to implement policies based on the practices of reducing, reusing and recycling (the 3R principles), including waste separation at source, home composting and high community engagement.





## Promoting the IRRC model in Ratnapura

In 2012, the Ratnapura Municipal Council, ESCAP, Waste Concern and Sevanatha Urban Resource Centre, an NGO, established a 5-tonne IRRC. Since opening, it has been operated by Micro Enriched Compost, a social enterprise launched by Sevanatha. Following the success of initiatives in Matale, the Matale model (see Figure 9) was adapted to local conditions in Ratnapura. ESCAP provided the funds for the construction of the IRRC, with designs for the plant and technical assistance provided by Waste Concern. The municipal authority provided the land, and Sevanatha, in partnership, with Micro Enriched Compost and the municipal authority undertook community outreach and awareness-raising programmes. The municipal authority also supports the facility's ongoing operations by offsetting the cost of workers, electricity and water.

A range of community outreach initiatives has been deployed:

- *Door-to-door awareness-raising programmes*—These have focused on source separation and entailed health and community development staff from the municipality visiting households to inform residents of waste separation at source and the waste-to-resource initiative more generally.
- *School outreach programmes*— These have involved Sevanatha and municipality staff liaising with local schools to inform students and teachers of the importance of recycling, source separation and environmental sustainability.
- *Loudspeaker announcements*—These have involved loudspeakers mounted on municipal trucks that tour communities to remind them to practise waste separation at source.

The municipal authority has taken an active role in these initiatives, contributing municipal staff, equipment, time and financial resources. In addition, municipal vehicles are used for waste collection and transportation of waste to the IRRC facility. The municipal authority intends to continue the community outreach initiatives over the next several years.



## Results and impact

As of 2015, the IRRC processed an average of 3 tonnes of waste per day and had yet to reach its full capacity (at 5 tonnes). This constituted some 10 per cent of the total daily solid waste generated in Ratnapura and some 17 per cent of the total waste collected. The main sources of waste include households, shops and fresh produce markets, with waste picked up by the municipal collection service and delivered to the IRRC.

With this daily feed of organic waste, the facility produces approximately 100 kg of compost per day. Compost sells at around LKR11,473 (\$85) per tonne. The main compost buyers are local farmers, the Municipal Department of Agriculture, tea plantation owners, local nursery operators and home gardeners. The facility also processes and recovers around 1.7 tonnes of recyclable inorganic materials per month, which are sold for around LKR24,000 (\$180) per tonne. The relatively low retail price of compost and the absence of collection fees make the municipal subsidy necessary, which accounts for nearly 80 per cent of the facility's total revenue.

When the project launched in 2012, waste was not separated at source anywhere in the city. By 2015, 10 per cent of the city's total waste was separated (some 3 tonnes daily). This also reflects a reduction in the amount of waste landfilled daily, which continues to decline as the amount of waste processed by the IRRC increases. This balance is expected to improve with the expansion of the facility in early 2016. The Central Environmental Authority, under the Pilisaru Programme, which is Sri Lanka's national solid waste management programme, is preparing a 5-tonne expansion of the facility, taking its total daily processing capacity to 10 tonnes, or one third of the total waste generated in the city and approximately 50 per cent of the total waste collected.





# Kon Tum, Viet Nam

## City overview

### Population

155,000 (2015)

### Total waste generated per day

75 tonnes

### Waste generated per capita per day

0.5 kg

### Waste-to-resource facility established

2012

### Capacity of waste-to-resource facility

5 tonnes

### Operator

Urban Environment Company (URENCO)

### Local partners

Municipal People's Committee, Provincial People's Committee, Environment and Development in Action Vietnam

Source: ESCAP and ENDA Vietnam.

# Introduction

Kon Tum is a riverside town and the capital of Kon Tum Province in the highlands of Viet Nam. Surrounded by rich and diverse flora and fauna, it is popular with tourists, and tourism remains central to the local economy. Economic growth in Kon Tum Province is closely linked to the agricultural and forestry sector, relying on such products as coffee, rubber, pepper, cashew, pulp and wood. Kon Tum is the central trading town and distribution hub in the province. The provincial government set an economic growth rate target for the town of 11–16 per cent over the next five years, driven largely by industrial development.

In 2015, the town had an average population growth rate of around 3 per cent. Approximately 75 tonnes of solid waste was generated in the city each day, having risen from 55 tonnes per day in 2011. Around 62 per cent of the municipal solid waste is organic. Most waste is disposed through landfilling, but the municipal landfill facility is almost full and alternative waste treatment methods are needed. Waste collection is undertaken by Urban Environment Company (URENCO), a state-owned company linked to the Municipal People's Committee. Collection in 2010 covered some 60–75 per cent of the town. URENCO receives a fee for collecting solid waste, at approximately \$1 per household per month, from around 50 per cent of the households in the town. Almost 90 per cent of URENCO's operating expenses, however, are subsidized by the local government.

The town has not developed a solid waste management plan. The national government is urging the town and provincial governments to develop and implement strategies and policies based on the 3R principles and aligned with the national strategy for integrated solid waste management. In 2014, the provincial government stipulated that by 2020, 90 per cent of Kon Tum's municipal solid waste had to be collected and that 85 per cent of the collected waste had to be reused or recycled.

There are around 60 waste pickers in Kon Tum and 30 more operating at the dumpsite. Sixteen of the waste pickers trade recycled materials, and seven of them work in junk shops. Junk shops sell collected materials to local industrial parks for processing. Plastic bottles, carton boxes and metal are all priority materials for recycling. Waste pickers generate an average monthly income of \$50–\$100.

## Promoting the IRRC model in Kon Tum

The first waste-to-resource facility, an IRRC, was established in 2012. ESCAP provided funding for its construction, while Waste Concern provided the designs for the plant and technical assistance and the municipal government provided the land and liaised with URENCO for waste collection and delivery and operation of the facility. Environment and Development in Action (ENDA) Vietnam, an NGO, provided capacity-building and technical support, especially to the municipal bodies, and for outreach activities with local communities.

Community outreach depended on engagement from the local government, especially at the commune level. Yet, government commitment in Kon Tum was limited, and some leaders resisted piloting a waste separation initiative in their commune. Ultimately, three wards agreed to pilot the initiative, and Quang Trung ward in particular achieved good results, mainly due to good capacity within its ward and commune leadership and sustained outreach to residents.

Outreach in all wards was built around the establishment of a network of communicators, drawn from the local community. ENDA supported this network of communicators through training and capacity building on waste separation at source. In addition, study tours for the communicators were arranged with local government to strengthen the awareness-raising efforts and increase their understanding of what was to be achieved and why. Brochures and banners with information on waste separation at source were also developed and distributed around participating communes.

However, the city must also compete with alternative uses of organic material. For example, pig farmers began towards the end of 2014 to collect separated organic waste from households in Quang Trung ward. The farmers used the waste as feed for their pigs. Despite pressure from URENCO and the municipal government to desist, the farmers continued to appropriate waste separated for the waste-to-resource initiative, and the initiative was forced to withdraw. In addition, around 20 per cent of participating households began to use separated waste for in-house composting.



## Results and impact

In early 2015, the waste-to-resource facility processed an average of 650–680 kg of organic waste per day, producing approximately 1.3 tonnes of compost per month. Almost all compost produced in the facility is sold directly to URENCO for application in the town's parks, groves and other green spaces. Rubber and coffee plantation owners are also clients. Compost sells at around VND1.2 million (\$53) per tonne.

The waste-to-resource initiative has had limited impact in Kon Tum. For the reasons cited, the operations of the facility are still working towards financial sustainability. Kon Tum's collection fees remain among the lowest in the country (the collection fee in Kon Tum is half that charged in Quy Nhon, for example). As a result, URENCO cannot cover the costs of operations or the cost of collecting separated waste. Increasing waste collection fees is within the purview of the provincial government, although officials have been adamant against raising fees.





# Quy Nhon, Viet Nam



## City overview

Population	
300,000 (2012)	
Total waste generated per day	Waste generated per capita per day
216 tonnes	0.7 kg
Waste-to-resource facility established	2007
Capacity of waste-to-resource facility	2 tonnes
Operator	City Environment Company (CITENCO)
Local partners	
Municipal People's Committee, Provincial People's Committee, Environment and Development in Action Vietnam	

Source: ESCAP and ENDA Vietnam.

# Introduction

Quy Nhon is a port city and the capital of Viet Nam's Binh Dinh Province. Its economy has historically revolved around agriculture and fishing. Tourism, industry and shipping have become more important in recent time. Tourism in particular, driven by the allure of the beaches, lakes, mountains and historic monuments, is a growing source of revenue and a motivation for municipal cleanliness and attractiveness.

Rapid population growth, rising incomes and changes in consumption patterns have led to issues of solid waste management. In 2009, the provincial government approved a master plan for solid waste management for the city. This included a number of strategies, policies and initiatives for improving solid waste management in Quy Nhon based predominantly on the 3R principles. The city has a large-scale sanitary landfill and compost facility.

In 2012, around 216 tonnes of waste were generated in the city, of which 71 per cent was organic. The City Environment Company (CITENCO), an agency owned by the Binh Dinh provincial government, manages the collection of waste. Although CITENCO charges a collection fee, it covers only 31 per cent of operational costs; the rest is subsidized by the municipal authority. Informal waste pickers complement formal waste collection by gathering plastic bottles and carton boxes to sell to junk shops. There are approximately 200 waste pickers in the city, 98 per cent of whom are women, with an additional 60 waste pickers at the city's landfill. Waste pickers earn an average monthly income of \$50–\$100.



## Promoting the IRRC model in Quy Nhon

The first waste-to-resource initiative was piloted in Quy Nhon in 2007, when a 2-tonne IRRC was built with funding from ESCAP on land provided by the municipal government. The facility was built in Nhon Phu ward, on the outskirts of Quy Nhon city, using designs provided by Waste Concern. Since its construction, it has been under the management of an assigned agricultural cooperative group in Nhon Phu ward. In 2011 and with funds again from ESCAP, the facility was upgraded to better withstand the frequent storms to which the coast is subjected and to thus improve its overall waste-sorting and compost-production capacity.

Throughout this process, Environment and Development in Action (ENDA) Vietnam, an NGO, has been providing technical assistance to facility operators, local government officers and communities. These have included study tours to Sri Lanka and Bangladesh and training workshops on waste separation at source, communication and outreach, project monitoring and management.

Along with operating the Nhon Phu facility, the community group also undertakes waste collection. Their service provides the facility with essential revenue to offset its operational expenses. In December 2013, thanks to strong compost sales and collection fees, the facility's financial operation broken even. Since then, financial sustainability has been maintained through several important interventions founded on strong partnership between the community management team, ENDA and the municipal government. These have included:

- The municipal government requiring CITENCO to transport, free of charge, a minimum of 21 tonnes of rejected waste per month from the IRRC to the landfill site.
- The municipal government negotiating, on behalf of the IRRC, to obtain waste collection contracts with local establishments, such as hospitals and an educational facility.
- The municipal government, ENDA and the community management team establishing a revolving fund to provide transportation allowances to local communicators to offset their outreach-related expenses.

In addition, the municipal government and ENDA have worked closely with communities to distribute communication materials, including banners and brochures, establish a 'recycling day' each year and conduct a range of other communication activities to improve the awareness of families, businesses and other stakeholders on waste separation at source.

## Results and impact

As of 2015, the Nhon Phu IRRC processed around 1.2 tonnes of waste per day, of which it extracted around 300 kg of organic waste per day. From this, the facility produced around 1 tonne of compost per month, which it sold for around VND1.2 million (\$53) per tonne.

The success of the Nhon Phu waste-to-resource facility has led to direct changes in the operation of the Long My Sanitary Landfill and Composting Facility, a 250-tonne-per-day-capacity facility owned and operated by the municipal government. Over 2013–2015, the municipal government began expanding waste separation at source programmes that were originally developed and piloted for the Nhon Phu facility. As a result, the volume of organic waste being treated in the plant expanded from 20 tonnes per day to 34 tonnes per day in only six months. By expanding into two additional wards over 2015, and with future expansions planned, the city intends to gradually take waste separation at source citywide to support the Long My facility.

Waste separation at source is now practised by 30 per cent of households and 75 per cent of non-households in Nhon Phu. As the municipality expands the waste separation programmes into new wards, this percentage will increase. Good results have been achieved due to the training and communication efforts targeting local communities, markets and shops as well as the impact of incentive for separation: among participating wards, if waste is not separated at source, CITENCO will not collect it. This incentive has greatly accelerated community action and participation in waste separation. Community engagement remains central to the success of the Quy Nhon project.





A waste crisis is emerging in the Asia and Pacific region, fuelled by rising quantities of waste, on the one hand, and poor regulation and management, on the other. This crisis threatens to overwhelm the resources and capacity of local governments and communities alike. Within this crisis, however, is a significant and largely untapped opportunity for transformative change. The waste-to-resource approach promotes a paradigm shift in the management of solid waste. Under this approach, rather than view waste as a problem and burden, it is seen as a valuable resource, one that can be managed to produce sustainable benefits for a range of actors. However, to make the most of this opportunity, a paradigm shift is required.

'Valuing Waste, Transforming Cities' provides guidance, lessons and recommendations on how to accomplish this shift. It explores a low-cost, low-technology, community-based and decentralized waste-to-resource model called the 'integrated resource recovery centre'. The publication articulates key lessons learned by ESCAP and its partners in establishing integrated resource recovery centres across cities in Asia and the Pacific since 2009. These lessons are grouped around four important areas for waste-to-resource initiatives: (i) partnerships; (ii) awareness raising and behaviour change; (iii) facilities management and operational performance; and (iv) replication and scaling up.



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