



Towards Zero Waste:

a catalyst for delivering the Sustainable Development Goals

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Thinkbikes

Contents

Introduction	4
Goal 1 End Poverty	7
Goal 2 End Hunger.....	9
Goal 3 Good Health and Well-being	11
Goal 4 Quality Education	13
Goal 5 Gender Equality	15
Goal 6 Clean Water and Sanitation.....	17
Goal 7 Affordable and Clean Energy	19
Goal 8 Decent Work and Economic Growth	21
Goal 9 Industry, Innovation and Infrastructure	23
Goal 10 Reduced Inequalities	25
Goal 11 Sustainable Cities and Communities	27
Goal 12 Responsible Consumption and Production	29
Goal 13 Climate Action.....	31
Goal 14 Life Below Water	33
Goal 15 Life on Land	35
Goal 16 Peace, Justice and Strong Institutions.....	37
Goal 17 Partnerships for the Goals	39
References	41

Introduction

In 2015 all United Nations Member States adopted the 2030 Agenda for Sustainable Development, a “shared blueprint for peace and prosperity for people and the planet, now and in the future” (United Nations General Assembly [UNGA] 2015). At its core are 17 interlinked global goals – the Sustainable Development Goals – which are intended to be achieved by 2030.

The Sustainable Development Goals recognise that ending poverty, hunger and other inequalities cannot be achieved in isolation to protecting the environment, which is threatened by the triple planetary crisis of climate change, biodiversity loss, and pollution (Coimbre 2020).

The natural world is a system in which every action has repercussions on air, land and water – and the ecosystems on which life depends.

While this report was being written, the global population surpassed eight billion people, with each of us impacting on these natural systems (United Nations Department for Economic and Social Affairs [UN DESA] 2022).

Linear and unsustainable patterns of resource use are generating increasing quantities of waste¹, and efforts to reduce waste and find better alternatives to disposal are not keeping up with waste growth (Kaza, Siddarth and Sarur 2021).

In 2020, an estimated 2.24 billion metric tonnes of municipal solid waste was generated across the world, of which 13 per cent was recovered and the remaining 87 per cent – some 1.86 billion tonnes – was disposed. By 2050 the total amount of waste generated is expected to grow to 3.88 billion tonnes per year, a 73 per cent increase from 2020 (ibid.).

Where nations and communities lack the resources to manage waste safely, waste disposal largely takes the form of dumping in the environment or burning in the open. These widespread practices cause devastating and inter-related impacts on the terrestrial, aquatic and marine ecosystems upon which billions of lives depend.

Pollution from waste has equally disturbing effects on human health. Research suggests that between 400,000 and 1 million people in the global south die each year because of mismanaged waste-related diseases, including diarrhoea, malaria, heart disease and cancer (Williams, Gower, Green, Whitebread, Lenkiewicz and Schröder 2019).

Yet despite all of this, waste has rarely been prioritised as a development concern.

Waste management is a “wicked problem” characterised by multi-layered interdependencies, complex social dynamics and webs of stakeholders (Salvia, Zimmermann, Willan, Hale, Gitau and Muindi 2021). As a consequence, progress has been patchy and often dependent on key local stakeholders championing the issue.

Meanwhile, unnecessary single-use products, non-recyclable packaging and hazardous wastes without affordable recycling options create seemingly insurmountable challenges for communities, municipalities and governments.

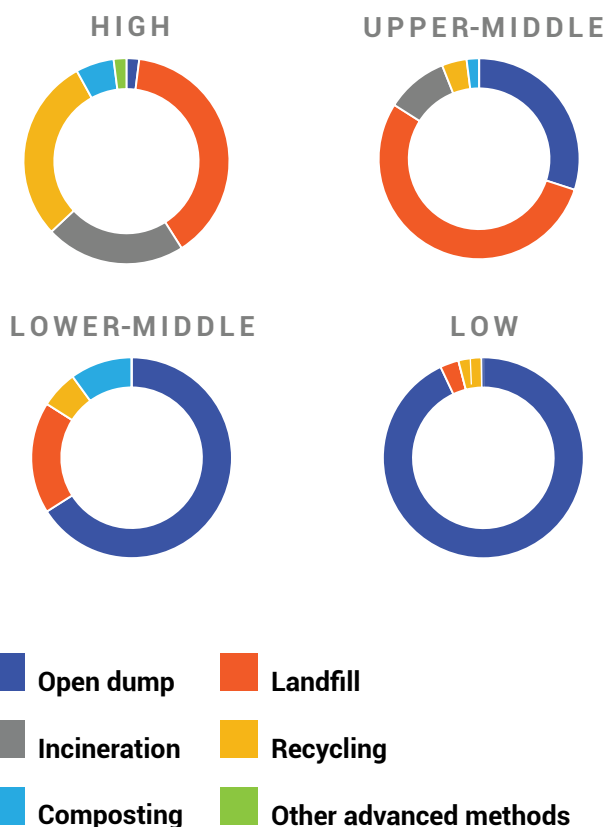


Figure i.1 Waste disposal methods by income (Source: Kaza et al. 2018)

¹ In this report, the term ‘waste’ refers to municipal solid waste, which includes residential, commercial, and institutional waste, as well as medical, hazardous and electronic wastes within municipal solid waste.

Multilateral environmental agreements have sought to address various concerns around waste, from the pollution it causes to its illegal transboundary trade, but implementation remains weak. INTERPOL and United Nations Environmental Programme (UNEP) have estimated that environmental crime is now the fourth most lucrative illegal business in the world (INTERPOL and UNEP 2016). In the meantime, problems from mismanaged waste are growing and raising grave concerns of social and environmental justice (Circle Economy 2022).

Within and among countries and communities, poorly managed waste exacerbates existing inequalities. It is often the most vulnerable who do not have access to waste collection services, and who also have waste disposal sites on their doorstep – contaminating drinking water, the air they breathe, and the food they eat (Gupta 2022; Rajapaksha and Karanurathna 2022; Leandro 2022). Women are disproportionately affected, suffering worse health outcomes from pollution, while being excluded from community-level decision-making and economic opportunities within the waste value chain (United Nations Environment Programme International Environmental Technology Centre (UNEP-IETC) and Grid-Arendal 2019).

UNEP proposes three key steps as a framework for action. One, establishing control over waste, two, implementing environmentally sound management of waste and three, moving towards circularity by considering waste as a secondary resource (Anderson 2022). UNEP-IETC is active in all areas, including through backing the Global Waste Initiative to reduce waste by 50 per cent by 2050, introduced by the COP 27 Presidency (COP27 2022).

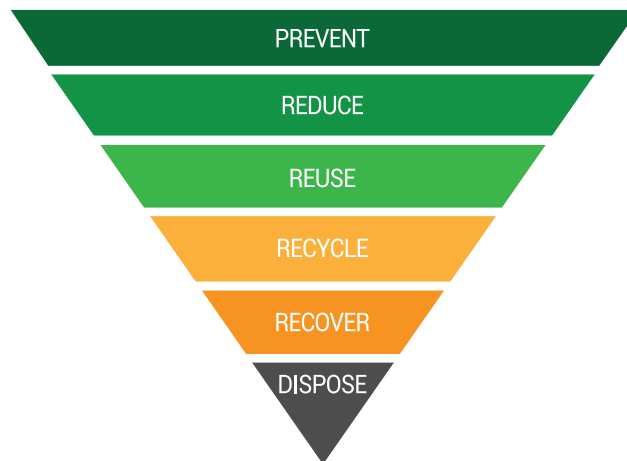
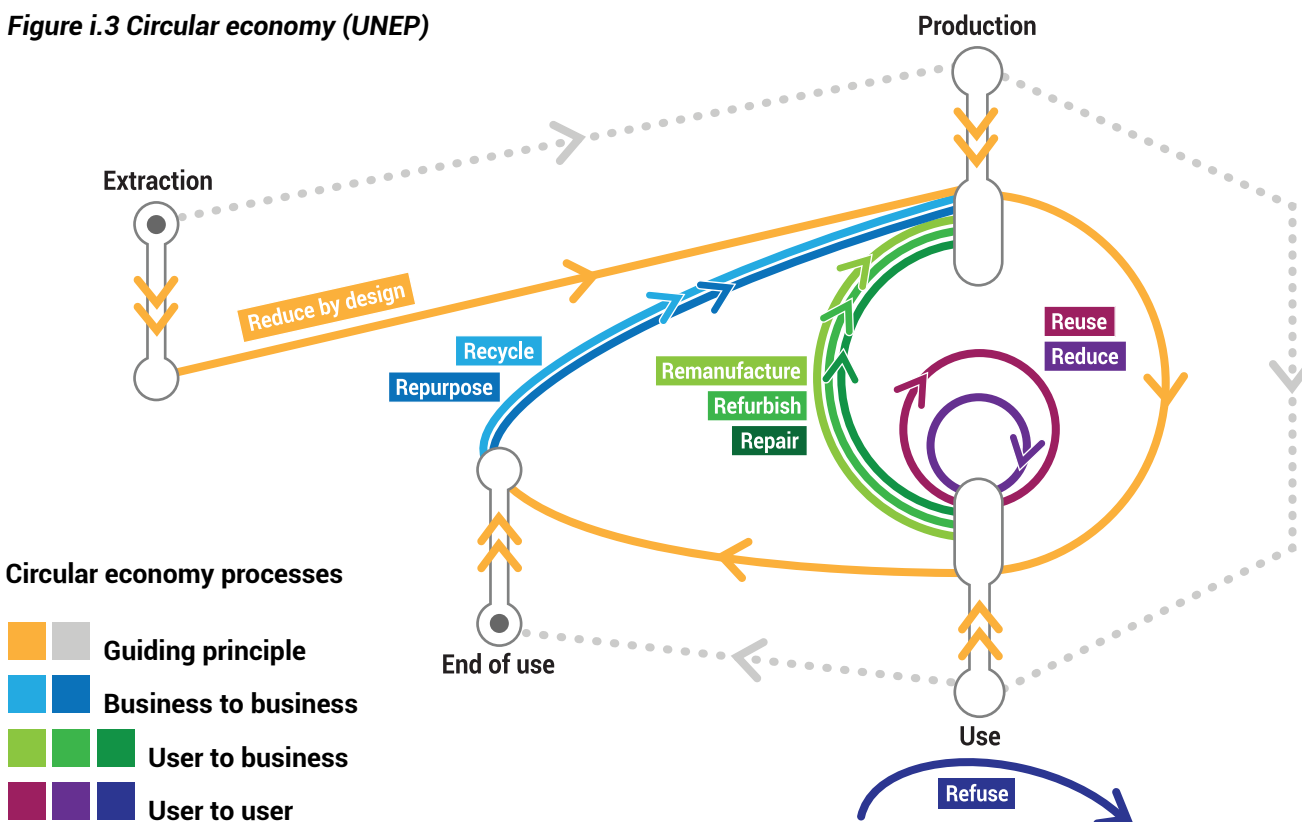


Figure i.2 Waste hierarchy

Concepts such as the 'waste hierarchy', based on a priority list of actions from waste reduction and reuse, through recycling and finally disposal, and a 'circular economy', the decoupling of economic growth from resource use and introducing regenerative materials cycles, are not new, but are perhaps finally being recognised for the power they have in staving off the triple planetary crisis. However, it is essential that as society moves towards more resource-efficient models, a just transition is delivered, securing everyone equal access to its benefits.

Figure i.3 Circular economy (UNEP)



Around the world, more than 15 million people earn their livelihood by collecting recyclable materials from streets and dumpsites. As resource scarcity looms and dominant global actors seek to shore up their access to resources, there is a risk that this existing, efficient, informal waste management workforce will lose access to the materials on which their livelihoods depend. A circular economy will not be fair by default, and so policymakers, businesses and civil society will need to take great effort to ensure that nobody is left behind.

If we can achieve this, the rewards will be immense.

Through new models of service delivery, innovations that turn low-value waste into high-value commodities, and a renewed respect for nature, we can deliver more liveable cities, clean water, healthier farms and abundant renewable energy. Nations and municipalities in the early stages of developing waste management systems have the opportunity to build inclusive and entrepreneurial zero waste economies, based upon high levels of resource recovery, with decent, dignified jobs and lower waste management costs for public authorities.

Sustainable waste management is crucial to delivering the Sustainable Development Goals. Prioritising waste reduction, recycling and safe disposal can address

some of the most pressing social, economic and environmental issues of our time.

UNEP is committed to ensuring that environmentally sound waste management is a key to achieving the Sustainable Development Goals, and at the same time recognises that waste management cuts across all the Goals. This report draws upon those links and makes policy recommendations on how to mainstream waste management into sustainable development efforts. Since the Goals are inter-related, themes have been discussed within the chapter of best fit, while links to other Goals have been highlighted.

Since the focus of this report is on countries in the global south, recommendations are based on the assumption that there will potentially be a limited level of technical capacity, constrained finance, and an underdeveloped regulatory environment. As such, the report highlights case studies and makes recommendations that are appropriate for these contexts.

This report is intended to contribute to the growing international discourse of how moving towards zero waste can help countries deliver sustainable development, in all its forms.



Figure i.4: The multiple positive impacts of improved waste management for sustainable development (Lenkiewicz 2016)

1 NO POVERTY



- Eradicate extreme poverty among vulnerable waste workers (1.1, 1.2, 1.3)
- Ensure universal access to basic services (1.4)
- Introduce pro-poor and gender-sensitive policy frameworks that enable waste work to become formalised (1.b)

While waste represents a cost to society, a great many vulnerable and marginalised people earn a livelihood by collecting materials and keeping them in use, through repair, upcycling or recycling (Kaza, Bhada-Tata and Woerden 2018; Bening, Kahlert and Asiedu 2022; GRID-Arendal 2022; Morais, Corder, Golev, Lawson and Ali 2022). Inclusive policies and systems are needed to protect these livelihoods, while professionalising the sector and providing routes to formalisation can boost national productivity (Dias 2020; Shinozaki 2022).

Repairing products can dramatically increase income. A waste picker in Chile explains: "If you sell an old cooker for scrap you will get 3,000 pesos [US\$ 5], but a repaired cooker will sell for 15,000 pesos [US\$ 25]." (Navarrete-Hernandez and Navarrete-Hernandez 2018). A thriving repair sector reduces waste and the environmental impacts of raw resource extraction.

Upcycling activities create higher value products from used materials, such as furniture from used tyres or clothing from woven pure water sachets. Upcycling enterprises create employment and prevent waste. They need help to build supply chain partnerships and unlock new market opportunities (Jayasinghe, Liyanage and Baillie 2021).

The recycling value chain begins with waste collectors, who bring recyclable materials such as metals, card and plastics to aggregators, who sort and sell larger quantities of clean materials to reprocessors. The entire value chain runs on low margins and is vulnerable to global price fluctuations (Kaza et al. 2018).

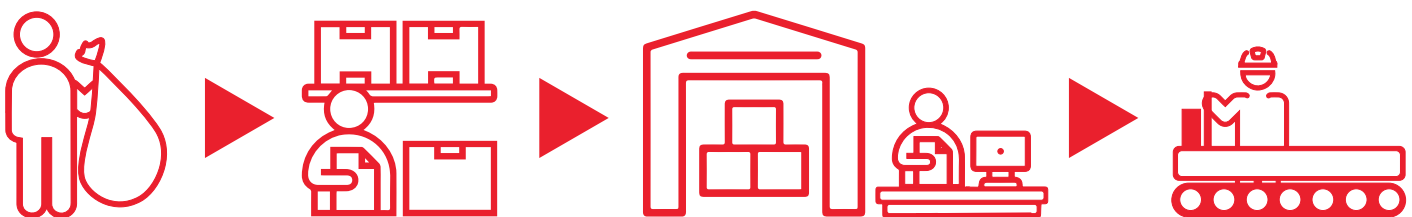
The recycling value chain helps cities to save money by performing most of the urban waste collection and transportation (GRID-Arendal 2022). Importantly, it provides livelihood opportunities for people with limited education or skills and who suffer from strong social stigma (Dias 2020; Bening et al. 2022; Morais et al. 2022).

How to alleviate poverty among waste workers

1. Recognise the economic value and livelihood opportunities within the repair, upcycling and recycling systems. Gather data to understand the environmental, social and financial benefits of existing services, including the public cost savings in reducing the need for collection, transportation and disposal (GRID-Arendal 2022).

2. Provide a clear, gradual and sympathetic route for waste workers to become registered, access social protections, and form associations (Department of Environment, Forestry and Fisheries 2020; Superintendencia de Servicios Públicos Domiciliarios 2021). Create policies that enable waste worker associations to access public sector contracts for waste management (Dias 2020).

Waste picker associations in Colombia increase their income through formalisation: Waste picker associations have had a clear route to becoming formal service providers in Colombia since 2016. The associations are required to receive training, maintain a database of service users, comply with standardised reporting requirements, and produce emergency plans, financial statements and georeferenced maps of the areas served.



Waste collectors gather recyclable materials from roadsides, households and dumpsites.

Aggregators with storage space buy the materials.

Larger aggregators buy and prepare materials by sorting, cleaning etc.

Processors convert material into usable secondary raw material for manufacturers.

Importantly, the policy allows waste picker associations to receive payment for the services provided in addition to the value of the recovered materials. As a result, the national recycling rate is growing at 5 per cent per month while improving income and working conditions for waste collectors (Parra and Abizaid 2021; Superintendencia de Servicios Públicos Domiciliarios 2021).

3. Improve working conditions by providing PPE, safe working spaces and access to transport, helping to increase efficiency and retain more value in the local economy.

Electric mobility helps waste pickers in Nigeria and Ecuador improve their income. Waste collectors traditionally use handcarts and diesel trucks, which are inefficient and unable to reach remote neighbourhoods. ThinkBikes in Lagos, Nigeria, and the waste management assembly of Quito, Ecuador, supply licensed waste collectors with electric cargo tricycles. Solar-ready, the tricycles are eliminating fuel costs and greenhouse gas emissions, improving the image of waste collectors and the recycling service they operate, and doubling the rate of material recovery and waste collector income (Olukokun 2022; Viteri 2022).



4. Aim for gender parity in all waste-related initiatives as well as along all levels of the value chain (see also SDG5), creating targeted opportunities for vulnerable women to maximise societal benefits (World Bank Group 2014; UNEP 2021a).

5. Support independent enterprise by offering business training, microcredit, streamlined routes to formalisation and access to suitable markets for all businesses managing secondary materials; remove barriers to formalisation to enable waste workers to move up the value chain, handle a greater quantity of materials, and generate a more reliable income stream (Ocean

Conservancy 2021; Shinozaki 2022).

Upcycling offers women a route out of poverty in Fiji and Nigeria. The Fusion hub in Fiji is a social enterprise that upcycles tyres, glass and plastic bottles and textiles into furniture and home décor pieces. The hub is preventing pollution and empowering single mothers who, due to limited involvement in the labour market, are at risk of poverty and hunger. The Fusion Hub runs two-week capacity training programmes to teach women from remote rural communities basic upcycling skills. Over 50 women have completed the programme and are working as suppliers to the Fusion Hub or as employees (Borgen Project 2021).

In Oyo State, Nigeria, Planet3R transforms pure water sachets into clothes, slippers, bags and mats by weaving them on a loom using traditional techniques. One of Planet3R's most popular products is a school bag, made from 250 water sachets. From small beginnings with one loom in the back of the house, today Planet3R has 22 looms, 10 sewing machines, an industrial sewing machine, and machines for embroidery and sewing leather. A further 60 looms are soon to be installed in the Planet3R factory in Ibadan, creating an additional 100 local jobs for women and youths (Lasisi 2022).



2 ZERO HUNGER



- Use surplus food to combat hunger and malnutrition, and use food waste to provide year-round animal feed (2.1, 2.2)
- Process food waste into compost to improve soil quality and improve agricultural resilience (2.3, 2.4)

One third of all the food produced worldwide is either lost due to supply chain failures or wasted at the retail level and from homes – enough to feed 1.26 billion hungry people every year (Food and Agriculture Organization 2019; UNEP 2021b). Meanwhile, food waste comprises over half of municipal waste in the Global South, causing problems with vermin and odour, filling dumpsites and releasing greenhouse gas emissions (Kaza et al. 2018).

Unavoidable and inedible food waste still has nutrient value, which can be used to replenish degraded soils and provide feed for livestock, contributing to food security and sustainable agriculture (Food and Agriculture Organization 2022a; Food and Agriculture Organization 2022b; Intergovernmental Panel on Climate Change [IPCC 2022]). Collecting food waste separately enables its value to be recovered, while protecting soils from heavy metals and plastics that are abundant in mixed waste.

Preventing food loss and waste helps to combat hunger. While agricultural cold chains can help preserve the integrity of food on its way to market, excess food from retail, canteens, restaurants and hotels can be redistributed to achieve environmental and social benefits.

Unavoidable and inedible food waste can be converted into compost to improve soils, reduce the amount of waste requiring disposal and prevent emissions of methane, a powerful greenhouse gas.

Almost all (95 per cent) of our food comes directly or indirectly from soils, yet over the last 40 years, around 30 per cent of the world's cropland has become unproductive (Food and Agriculture Organization 2018; Gilbert, Ricci-Jürgensen and Ramola 2020). Synthetic fertilisers help in the short term but gradually lead to further degradation and pollute water sources (see also [SDG6](#)); conversely, quality compost from separately collected biodegradable waste supports regenerative farming, agricultural resilience, and sustainable food production (Schröder and Raes 2021).

Since women make up around half of the agricultural labour force in the Global South, it is important to build capacity among both female and male farmers by providing access to information and technology, raising awareness and creating safe spaces to share practical knowledge (UNEP-IETC and GRID-Arendal 2019; UNEP 2020a).

High quality compost helps create market demand, which in turn enables composting systems to become financially self-sufficient and sustainable. This requires attention to the feedstock and the process:

- Food waste must be collected separately to other wastes to prevent contamination of soils and the food chain by heavy metals and plastics.
- A balance of nitrogen (food waste) and carbon (woody waste) is needed to produce healthy compost. It must be turned regularly to allow air in and be sheltered from the sun to prevent drying out.

Producing animal feed from food waste and food by-products improves sustainability (IPCC 2022). With the price of livestock feed increasing, there is a growing interest in the farming of insect biomass to produce alternative animal feeds (Ngotho 2022; Shumo, Osuga, Khamis, Tanga, Fiaboe, Subramanian, Ekesi, Van Huis and Borgemeista 2019). In particular, the larvae of black soldier fly, *Hermetia illucens*, can convert a variety of organic wastes into high-quality poultry, pig and fish feeds (Siddiqui, Ristow, Rahayu, Putra, Yuwono, Nisa', Mategeko, Smetana, Saki, Nawaz and Nagdalian 2022).

How to reduce food waste and combat hunger

1. Redistribute edible food by working with food service businesses and civil society.

Citizen action combats food waste and hunger in India: In 2014 on the streets of Delhi, India, the Robin Hood Army started collecting excess food from supply partners and distributing it to people in the community. Within 6 years the growing team of volunteers had served 112.5 million people across 401 cities in 13 countries, preventing 45 million tonnes of food waste (Robin Hood Army 2022).

2. Promote and support food waste collection schemes that return nutrients to the soil through compost. Estimate the greenhouse gas emissions from food waste in disposal sites and use this to inform policies that incentivise food waste collections (C40 Cities 2019).

Food waste feeds soils and fights food poverty in The Gambia and South Africa: In the capital of The Gambia, Banjul, Kanifing Municipal Council worked with market vendors to collect food waste and transfer it to nearby women's gardens. Equipped and trained, the women farmers transform the food waste into compost, improving soil health and crop yield, reducing demand for chemical fertilisers, and boosting income by selling excess compost (Kanifing Municipal Council 2021).

In the densely populated township of Diepsloot in Johannesburg, South Africa, 70 per cent of the 13,000 residents live under the poverty line (Joberg 2022) and open dumping of waste is commonplace. In 2017 two residents set up Boomba.mobi to collect food waste and sell compost to local gardeners and farmers. Affluent residents and shopping centres pay a collection fee, while lower-income households benefit from a subsidised service and can also barter their food waste for close-to-sell-by-date food from the local supermarkets (Shongwe 2022).

3. Develop national compost standards, training, guidance and certification to boost buyer confidence. Allocate sites for compost production and encourage its use by gardeners and farmers (Stehouwer, Cooperband, Rynk, Biala, Bonhotal, Antler, Lewandowski and Nichols 2022). Promote home composting.

Home composting proves popular in Chile: In 2017, the Chilean government launched its Reciclo Organicos (Recycle Organics) programme to promote the separate treatment of organic wastes, resulting in 15 composting initiatives, two biogas projects and five landfill gas recovery systems (see [SDG7](#)). Municipalities also provided home composters to residents, with demand for composters outstripping supply. Home composting reduces the costs of waste management, saves space at landfills and reduces greenhouse gas emissions, while providing residents with year-round compost (Programa Reciclo Organicos 2022).

4. Use food waste to grow alternative animal feeds such as black soldier fly larvae. Support pilot programmes, provide microfinance for small farmers and organise knowledge sharing and capacity building events to ensure the benefits are enjoyed by farmers at the grassroots (Caplin 2022).

Food waste feeds an aquaculture farm in Kenya: Hydro Victoria Fish Hatchery in Port Victoria, Kenya, is a private company co-owned by two Kenyan youths. The farm supplies fish to hotels and supermarkets, and juvenile fish to 1,000 aquaculture farmers in the Lake Victoria region. In 2020 high costs of feed and fertiliser in the region due to COVID-19 led the farm to diversify into black soldier fly farming to produce larvae, an alternative source of protein for fish, poultry and pig farmers. This circular economy programme, farming black soldier fly larvae as mini-livestock, has since recruited, trained and contracted 56 women and youths, producing over 250 kg (wet weight) of feed per month from organic waste generated at municipal markets and beaches (Juma 2022).



3 GOOD HEALTH AND WELL-BEING



- Reduce communicable and non-communicable diseases through reduced open dumping and burning of waste (3.3, 3.4)
- Reduce deaths and illnesses from hazardous chemicals and pollution, particularly among waste workers (3.9)

Pollution of air, land and freshwater sources from poorly managed waste causes widespread illness and deaths, particularly among vulnerable communities (Williams et al. 2019). Improving waste management can help prevent a wide range of diseases, as well as multigenerational risks and long-term health inequalities (Faiza, Hassan, Farhan, Edre and Rus 2019; McClelland, Kenney, Palacardo, Roberts, Luhende, Chua, Huang, Patel, Sanchez, and Kim 2022; Schmidt, Haider, Hussain, Safdar, Mustafa, Angelo, Williams, Gower and Hasan 2022; Sharma, Brahmabhatt and Panchal 2022).

People working in unregulated waste management environments are exposed to numerous health risks. These risks are particularly acute for people working at dumpsites, handling healthcare waste and dismantling e-waste unsafely (Zolnikov, Cruyinel, Lopez, Pezeshkian, Stoves-Tucker, Galato and Marques 2021; Sara, Bayazid and Quayyum 2022). Health consequences vary by gender and age, and these risks need to be better understood and managed to ensure waste workers have adequate protections, for their own benefit and that of the entire population (Strategic Approach to International Chemicals Management 2017; UNEP-IETC and GRID-Arendal 2019; Pachauri and Singh 2022).

Multiple health risks arise from poor municipal waste management practices, and it is estimated that between 400,000 and 1 million people in the Global South die each year from diseases related to mismanaged waste, including diarrhoea, malaria, heart disease and cancer (Williams et al. 2019). After clean water, improved waste management is the strongest protective factor against childhood diarrhoea (McClelland et al. 2022). By avoiding the open dumping and burning of waste, waste management services also help to prevent diseases such as typhoid and cholera, non-communicable diseases such as cancer and asthma, and birth defects among infants (Reinhart and Townsend 2018; Olatunji 2022).

Dumped waste attracts disease-spreading vermin and flies. It also blocks drainage channels where stagnant water acts as a breeding ground for mosquitoes that spread dengue, malaria and West Nile fever, with people

living in slums and settlements at greatest risk (Faiza et al. 2019; Schmidt et al. 2022; Sharma, Brahmabhatt and Panchal 2022).

Meanwhile, open burning of waste releases emissions that have been linked to a wide range of serious health impacts including increased likelihood of heart disease, cancer, asthma, emphysema, skin and eye diseases, nausea and headaches, and damage to the nervous, reproductive and digestive systems (Williams et al. 2019).

Where waste is collected, it is often disposed of at uncontrolled dumpsites. Contaminated water (leachate) from dumpsites can transfer pathogens, heavy metals and other hazardous compounds into fresh water sources, causing long-term environmental pollution and associated health impacts (Kuchelar and Sudarsan 2022; Thives, Ghisi, Júnior and Silva Vieira 2022) (see [SDG6](#)).

Waste in dumpsites can spontaneously combust, and many dumpsites around the world are smouldering continually (Chavan, Lakshmikanthan, Majunatha and Singh 2022). The smoke fills homes, schools and offices, and contaminants pollute soils and crops in nearby fields, adding further pathways of exposure (Vinti, Bauza, Clasen and Tudor 2023). Unstable dumpsites can also collapse, causing deaths and injuries among communities living on or near the site (Xiu, Wang, Qi, Li and Wang 2021).

How to reduce disease, illnesses and injuries from waste

1. Reduce the health risks from poor municipal waste management practices. Assess the health risks and impacts from waste dumping and burning, and work towards universal waste collection services. Where waste collection is provided, work to eliminate waste dumping and burning (Reinhart and Townsend 2018; McClelland et al. 2022; Olatunji 2022).

DIY waste collection prevents cholera in Cameroon: The unplanned neighbourhood of Nkolbikok in Cameroon's capital Yaoundé was experiencing fatal floods, cholera outbreaks and a high prevalence of childhood diarrhoea.

The low-lying wetland was mostly inaccessible to dustcarts and waste collectors, and the drains were blocked with waste. Today, residents contribute to and benefit from a community waste management service. Households pay US\$ 2 per month for waste collection, with disposal at government-approved points. The local municipality supplied PPE, wheelbarrows and boots for the local team who collect 21 tonnes per month, reducing dumping, improving local environmental health and creating sustainable jobs (Etoga 2022).

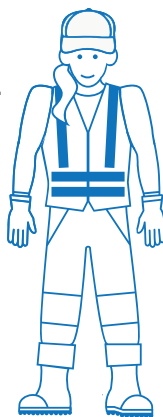
2. Reduce health risks from hazardous healthcare waste. Around 15 per cent of healthcare waste is considered hazardous material that may be infectious, toxic or radioactive (WHO 2018).



- Manage hazardous and general waste separately.
- Provide staff training and resources to manage waste safely.
- Consider cost-effective on-site treatment such as microwave systems that can be installed on a trailer and shared by several healthcare facilities (Petrikaite 2022).

Healthcare waste management in Nepal: At Tribhuvan University Teaching Hospital in Nepal, hospital staff have developed Standard Operating Procedures and monitoring for waste management. Through wastes segregation, the hazardous waste component fell from 92 per cent of waste to 34 per cent. The non-hazardous waste, which largely comprised plastic, glass, paper and metal, could then be recycled, and income from the sale of these materials increased almost six-fold (Hayashi 2022).

3. Prioritise the welfare of waste workers: People working with waste in informal settings – particularly at dumpsites – are extremely vulnerable to many occupational risks including hazards, infection and environmental contamination (Zolnikov et al. 2021; Sara et al. 2022), and women often suffer worse health outcomes than men (Pintas Marques, Zolnikov, Machado de Noronha, Angulo-Tuesta, Bashashi and Cruvinel 2021) (see [SDG5](#)).



- Regulate waste sites and ensure safety standards are adhered to.
- Provide well-ventilated and safe working spaces with male/female washrooms.
- Provide regular training on waste segregation, health and safety, the value of immunisation and the importance of Personal Protective Equipment (PPE).
- Provide a range of PPE options, pushcarts etc. to reduce injuries, and first aid kits at waste processing sites.
- Ensure women and vulnerable groups are included in capacity building efforts.
- Provide regular health check-ups, vaccinations and health insurance for waste workers.
- Provide comprehensive and accessible services offering medical and psychosocial support for survivors of gender-based violence that endanger the well-being of women and girls in the unregulated waste management environments (United Women 2018).



4 QUALITY EDUCATION



- Increase knowledge and skills to enable greater employment and entrepreneurship in waste management, recycling and circular economy activities (4.4)
- Eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples, and children in vulnerable situations (4.5)
- Share knowledge and skills to promote sustainable development (4.7)

The coming years will see a major transition from linear resource use (take-make-dispose) to one that values resources and is more circular, reducing carbon emissions, prioritising natural capital and driving up social value (Chartered Institution of Wastes Management 2021). To accommodate this shift, a wide range of new skills and knowledge will be needed across all societies.

Waste education can be taught from an early age and incorporated into school curricula (UNEP 2018a) and there are many replicable and scalable examples of such schemes. Meanwhile, those with direct responsibility for wastes management in their daily lives or working roles, are encouraged to access freely available online resources for knowledge sharing and capacity building.

Waste awareness in the school curriculum can positively impact attitudes and behaviours (Prasetyawan and Wasisto 2021). Some countries, such as Bolivia, Brazil, Costa Rica, Nicaragua and Venezuela have integrated waste management education into their national curricula at all levels (UNEP 2018a). Lessons can be made more relevant and empowering by aligning curricula with students' lived experiences (Srivastava, Gupta and Raveendran 2022). Meanwhile, concerted efforts to encourage both boys and girls into science, technology, engineering and maths can help rebalance the labour market and inspire more children to address growing waste management challenges (UN Women 2022a; World Economic Forum 2021).

Occupational education and training for waste management can often be found in courses on environmental management, geography and sustainable development. In addition, specialist curricula are also being developed for managing specific waste streams, such as electrical and electronic waste (e-waste).

Online resources for waste managers provide valuable learning opportunities where formal education opportunities are lacking. Ensuring that women and men and those historically left behind can access online material is crucial.

How to improve waste management knowledge and skills

1. Increase waste awareness among young people by introducing context-specific lessons that inform students about waste reduction and safe and sustainable waste management.

Schools programmes inspire change in the next generation: A UNESCO guide called [Trash hack](#) provides practical ideas and activities for teachers to engage with their students on how to better manage and recycle waste, as well as how to be more responsible producers and consumers. The fun and engaging lessons encourage young people to view 'trash' not just as the stuff we throw away, but as indicators of who we are and what we value. Although the programme is closed, the tool remains available in English, French, Spanish, Russian, Arabic and Chinese.

In Lahore, Pakistan, [Amal's Green School Programme](#) implements a range of programmes addressing waste generation and management. Programmes include awareness sessions, introduction of segregation of wastes, teacher training, student-led activity design, a behaviour change app and certification. In addition, participating schools implement a two-bin waste segregation system, with dry materials collected for recycling at Amal's Green Centre.

In Sao Paulo, Brazil, a schools programme by the [UN Climate Change and Clean Air Coalition](#) produced a handbook for schools on organic waste management. Aimed at teachers of children between 3 and 14 years old, the handbook covers a range of topics including organic waste generation in schools, and the potential of reducing waste and greenhouse gas emissions through organic waste recycling.

Elsewhere, children are leading their own educational campaigns, such as [Kids Against Plastic](#). Through free online resources, initiatives and the KAP Club (with a reward scheme, members only area and weekly online chats), Kids Against Plastic aims to inspire and empower others into action. To scale their impact, Kids Against Plastic created [Plastic Clever Schools](#), a growing

community of schools taking action to reduce the amount of single-use plastic they use.

By engaging with children first, the programme has seen greater success than previous efforts to primarily provide teacher resources. Since the children are driving the demand to become Plastic Clever, teachers are able to provide targeted lessons that respond directly to the children's interests. Plastic Clever Schools provides free resources for primary and secondary schools, including workbooks, lesson plans and worksheets.

2. Strengthen waste management knowledge by incorporating modules into higher education and adult education programmes. Ensure courses reflect national needs and offer practical learning experiences.

3. Build capacity among waste managers by encouraging all public sector and private sector stakeholders with responsibilities for waste management to access online learning resources to gain the knowledge and skills they need for their work. As much as possible, make special provisions for local women and historically marginalised

groups to gain access to the internet and educational materials (United Nations 2019).

Online knowledge banks share waste wisdom freely:

There are a number of high quality educational resources online, with free access for anyone wishing to learn more about waste management.

- *A bank of educational resources, case studies and tools: [Waste Wise Academy](#)*
- *Webinars on a wide range of waste topics: [Be Waste Wise](#)*
- *Online course for municipal waste management officers (6 hours): [United Nations Institute for Training and Research \(UNITAR\)](#)*
- *Online course on municipal waste (16 hours): [World Bank](#)*
- *Online course on municipal waste management in developing countries (22 hours): [Eawag](#)*
- *Community waste management toolkit: [WasteAid](#)*
- *The Waste Wise Cities Tool for municipal waste data collection: [UN-Habitat](#)*
- *Solid waste management guide for developing countries for public sector authorities in cities: [USAID](#)*



5 GENDER EQUALITY



- End discrimination and exploitation against women engaged in waste work (5.1, 5.2)
- Recognise gendered differences and promote shared responsibility towards household waste arisings and management (5.4)
- Promote gender equality and secure women's full and effective participation and opportunities for leadership in waste management in political, economic and public life (5.5, 5.a, 5.b, 5.c)

Studies from across the world have highlighted that waste production and management is not gender neutral (UNEP-IETC and GRID-Arendal 2019).

Women play a dominant role in domestic waste management and once aware of the health and community benefits, generally engage positively in efforts to reduce, reuse and separate materials for recycling (Hassan and Elsehry 2022; Ocean Conservancy 2019).

Outside the home, women are less likely to have influence over community-level decisions and public spending on waste management, and have less access to financial credit and business opportunities that would enable them to create better livelihoods higher up the value chain (Dias and Ogando 2015). Women working in the waste sector are vulnerable to discrimination and exploitation, and have worse financial and health outcomes than their male counterparts (Aidis and Khaled 2019).

Recognising the specific barriers and risks facing women, and ensuring their political and economic inclusion, can help to realise the potential women hold for transforming the waste management sector (Falth 2019; Singh 2022).

Within the household: women are usually responsible for buying food and other domestic products, cooking and cleaning. Recognising the influence of women's purchasing choices on waste generation can help society shift towards more sustainable consumption patterns (The Organization for Economic Cooperation and Development [OECD] 2020). Resource-efficient behaviours such as using food scraps to feed animals or using old clothes as cleaning rags also reduce waste at source. How people define "waste" varies by gender, age, income and geography and it is helpful to take this into account in policymaking and service provision (UNEP-IETC 2022).

Women are also usually responsible for waste

management at the household level (Hassan and Elsehry 2022), including separation, storage and disposal – all of which impact family and community health. When planning waste collection systems, it is important to recognise that women may prefer door-to-door waste collection services over communal waste collection points due to their multiple gender roles at home (UNEP-IETC 2022). Women of childbearing age may be exposed to smoke from burning waste in backyards or as a cooking fuel, impacting their own health and that of their unborn children and other young family members (Mouganie, Ajeeb and Hoekstra 2020).

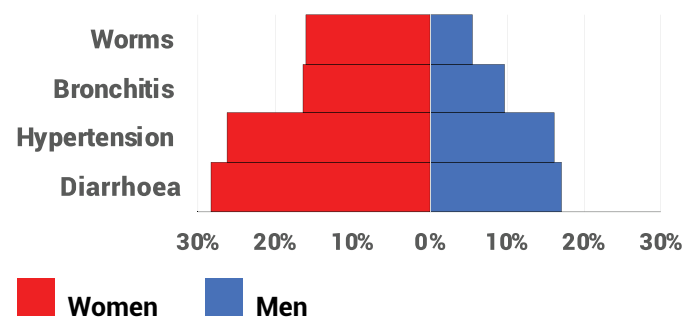


Figure 5.1: Gender differences in health outcomes of waste pickers at Estrutural dumpsite in Brasília, Brazil (after Pintas Marques et al. 2021)

Working with waste: Worldwide, men control access to landfills and dumpsites (Aidis and Khaled 2019). Women waste pickers are among the most vulnerable and suffer more harassment, extortion and sexual exploitation, as well as worse health and financial outcomes than their male counterparts (Aidis and Khaled 2019; Pintas Marques et al. 2021).

Within waste picker cooperatives, it is vital that women are represented in leadership roles and their needs and concerns recognised (Dias and Ogando 2015).

Moving up the value chain: Within the wider waste management sector, women are more likely to have unpaid or low-paid roles, and when waste systems become formalised it is often men who are appointed

to better-paid positions (UNEP-IETC and Grid-Arendal 2019). For example, women are more frequently found in street cleaning roles and participating in voluntary community clean-ups, but risk losing access to collected materials when roles are made formal (UNEP-IETC 2022). Further gender inequalities may stem from lower education, a lack of technical skills and a lack of financial capital (Dias and Ogando 2015), with women often unable to take time away from domestic duties to attend training (UNEP-IETC 2022).

Upper-level roles in the public and private sectors are dominated by men (UNEP-IETC and Grid-Arendal 2019), and women-owned enterprises are often focused on sorting materials. Such livelihoods may be at risk from automation, yet women lack the credit to purchase sorting machines themselves (ibid.). As the waste sector modernises and applies new technologies that may require greater education and training, it is essential that women are included in this process (Nakamura 2022).

Promoting gender equality through policy and procurement: Empowering women by tackling gender stereotypes, and providing access to higher-value roles and positions of public influence can help to transform the waste sector, improving not just the outcomes of women, but of the wider community and future generations.

How to achieve gender equality in waste management

1. Research women's waste knowledge, attitudes and practices, including gender-disaggregated data, and involve women in the creation of targeted information campaigns, recognising both women's and men's increasingly shared roles and responsibilities in the home (Hassan and Elsehry 2022; Nakamura 2022).

2. Protect the health and well-being of women working with waste. Recognise the specific risks and vulnerabilities experienced by women working with waste and develop policies, programmes and awareness to ensure their safe working and living conditions (Pintas Marques et al. 2021). Promote women's full and equal representation on waste picker cooperatives' boards and improve women's access to economic opportunities



(Dias and Ogando 2015). Monitor the impact of these strategies to inform future policies and interventions.

3. Develop evidence-based, gender-sensitive waste policies, programmes and budgeting. Understand women's practical and strategic needs, ensure women's full and equal representation and access to training, better-paid and upper-level roles. Provide access to finance and business support for women-led waste management enterprises and enable women leaders to influence budgetary dialogues and outcomes (Falth 2019; UNEP-IETC and Grid-Arendal 2019; Nakamura 2022; UNEP-IETC 2022; UN Women 2022b).

Pioneering gender mainstreaming in the SWM sector in Jordan: The United Nations Development Programme (UNDP) sought to enhance women's participation in the solid waste management sector in Irbid Governorate, Jordan. More than 600 women were trained in waste management business models, while gender-informed policy making was strengthened at local and national levels. Through the programme, the women established a range of waste reduction, reuse and recycling enterprises. Attitudes and behaviours towards waste also changed, and the areas now have very little uncollected waste as many more materials are recognised as resources (Al Majali 2022; UNDP 2021a; UNDP 2022).

Promoting Women's Engagement in Effective Solid Waste Management in Sri Lanka: A 2017 study in Sri Lanka found that waste was harming health and the environment, causing disputes between different communities. Yet despite women carrying the main burden of household work, they barely had a voice in deciding how to manage waste in the wider community. Research shows that politically empowered women show greater responsiveness to communal issues and needs, and are more able to cross ethnic, religious and social lines to increase collaboration with different social groups. A quota was set for female representation on local municipality boards, and women were empowered to engage in governance mechanisms. As a result, waste management systems and practices are improving, and communities have a greater ability to resolve waste-related conflicts (UN Sri Lanka 2021; Chrysalis 2022).

6 CLEAN WATER AND SANITATION



- Improve water quality and protect water-related ecosystems by reducing pollution and waste dumping (6.3, 6.6)
- Improve access to sanitation through co-management with organic waste (6.2, 6.b)

Access to water resources and sanitation are widely recognised human rights and vital for food security, health, poverty reduction, gender equality, economic growth and maintaining healthy ecosystems (Andreassen 2022). In fact, all aspects of life and sustainable development rely on clean and abundant fresh water (Leal Filho, Azul, Brandli, Lange Salvia and Wall 2022).

Freshwater sources – especially in the Global South – are increasingly being threatened by population growth, urbanisation, climate change and pollution from human activities, including solid waste disposal (UNEP 2018b). In fact, most freshwater bodies in the Global South have been polluted by waste (Bhat, Singh, Qadri, Dar and Dervash 2022).

Sources of water pollution from waste include waste disposed directly into water bodies, indirectly from runoff, and leachate from unregulated disposal sites. Waste makes water unsafe to drink and destroys natural habitats and the livelihoods that depend on them (Mor, Negi, and Ravindra 2018; Parvin and Tareq 2021; Ishaq, Said, Azman, Abdulwahab and Alfa 2022).

Rivers are commonly used for waste disposal by communities that do not have their waste collected (Ashraf and Jamwal 2022, Ghimire, Pokhrel, Pant, Gyawali and Koirala 2022). Today, the banks of many of the smallest streams and the greatest rivers are clogged with solid waste, much of it plastic, which does not break down easily or in an environmentally safe way (Damania et al. 2019). Plastic pollution in rivers is far more widespread than previously thought (Meijer et al. 2021), bringing with it the risk of entanglement, chemical pollution, pathogens and alien species (OECD 2022a) (see also [SDG14](#)).

For those living downstream and using the river for drinking water, fishing and recreational activities, this pollution brings a wide range of ecological and health

risks, and has been found to negatively impact economic growth in downstream regions by up to a third (Damania et al. 2019; Koudenoukpo et al. 2022).

In addition to indiscriminate dumping of waste in waterways, uncontrolled dumpsites are a common point source of groundwater pollution (Badmus, Ogungbemi, Enuiyin, Adeyeye and Ogunyemi 2022; Igboama, Hammed and Fatoba 2022; Ishaq et al. 2022). Leachate is the liquid that drains or 'leaches' from a landfill or dumpsite, comprised of both liquid wastes and moisture in solid wastes such as food, combined with rainwater percolating through the waste. It contains a wide range of pollutants, including pathogenic organisms, heavy metals, Persistent Organic Pollutants and emerging contaminants such as pharmaceuticals that can bioaccumulate in the food chain and harm human and environmental health (Ma, Zhou, Pan, Yang, Sun, Liu, Chen and Zhao 2022; Javahershenas, Nabizadeh, Alimohammadi and Mahvi 2022).

Once leachate is formed it migrates downward by pull of gravity until it reaches the groundwater system, polluting household wells, agricultural irrigation systems, and seasonal and permanent lakes and rivers (Javahershenas et al. 2022). Leachate can remain in rock, gravel and sand systems beneath a landfill for decades, continuing to pollute groundwater long after a site has been closed and even excavated (Olatunji 2022). The extent of this harm is unknown, as very little monitoring takes place, although the growing body of evidence points towards a fast-growing crisis (Mor et al. 2018; Parvin and Tareq 2021; Ishaq et al. 2022).

Simple and relatively low-cost leachate management systems can be retrofitted to existing dumpsites, enabling the leachate to be contained and pumped to a treatment plant. Depending on quantity and composition, leachate treatment may include evaporation, degradation by anaerobic bacteria or chemical and physical processes (Imtinan, Purwanto and Yulianto 2020).

For the greatest benefits, leachate management should be approached in coordination with landfill gas capture (see also [SDG7](#), [SDG9](#), and [SDG13](#)).

Organic waste management and container-based sanitation share many characteristics. Both food waste and faecal sludge have a high organic and moisture content and require frequent low-cost collections. These wastes can be collected and processed together to allow for more efficient planning and service delivery. Co-treatment can help achieve economies of scale to attract investors (United Nations Children's Fund [UNICEF] 2020; International Water and Sanitation Centre [IRC] 2020; de Vreede 2022). Examples of tried-and-tested co-treatment include making compost and animal feed via black soldier fly larvae (see [SDG2](#)) and producing charcoal briquettes or biogas to use for heat and energy ([SDG7](#)).

How to protect water sources from waste and improve sanitation

1. End the harmful practice of waste disposal in rivers and lakes. Monitor the quality of freshwater sources, identify populations that are exposed to polluted water and seek to understand its health, environmental and economic impacts (Damania, Desbureaux, Rodella, Russ and Zaveri 2019; Koudenoukpo, Odountan, Guo,

Céréghino, Chikou and Park 2022). Deliver awareness campaigns to discourage waste disposal in rivers and lakes; and promote waste collection and clean-ups around freshwater sites.

2. Protect freshwater sources from leachate pollution. Explore options for the diversion of food waste from disposal sites to reduce leachate; when selecting a site for a new landfill, undertake hydrogeological studies, select a site that is sufficiently isolated from groundwater sources, and install a leachate collection and treatment system (Imtinan et al. 2020).

3. Consider managing food waste and faecal sludge as a single waste stream. Support cooperation between sanitation and solid waste operations, and consider combining container-based sanitation services with food waste collection and treatment (UNICEF 2020; IRC 2020; de Vreede 2022).

Co-treating food waste and faecal sludge: Businesses on every continent are proving the viability of co-treatment of food waste and faecal sludge. Examples include SOIL in Haiti making a soil improver, and Regenorganics in Kenya and Agriprotein in South Africa farming black soldier fly larvae to make animal feed. Sanivation in Kenya makes biomass fuels from faecal sludge, while Sasifana in Ghana makes biogas to provide heat and electricity.



7 AFFORDABLE AND CLEAN ENERGY



- Ensure universal access to affordable, reliable and modern energy services and increase substantially the share of renewable energy by utilising significant sources of organic waste (7.1, 7.2)
- Promote investment in domestic biogas markets to expand the supply of modern and sustainable energy sources (7.a, 7.b)

Biodegradable waste, the most abundant form of waste in countries in the Global South (Kaza et al. 2018), is a freely available source of energy. In particular, biogas made from organic waste can be used for cooking, the generation of electricity and to power mini-grids (World Bank Group 2020). The development of biogas projects has been uneven across the world, as its success depends on policies that encourage its production and use (International Energy Agency 2020).

Since many biogas projects have been abandoned, the reasons for these failures need to be assessed and policies developed to support the growth of biogas markets to leverage its many benefits, from combatting energy poverty to reducing dependence on fossil fuels (Kalina, Ogwang and Tilley 2022). Within households, women are primary energy managers and therefore need access to sustainable modern energy. Advancing women's leadership in the energy industry is important to ensure gender dimensions are considered (UNEP 2017).

Biogas generated from organic waste provides a free source of renewable energy. Biogas is a methane-rich gas produced by micro-organisms as they break down biodegradable materials in the absence of oxygen (the same process occurs in cow stomachs, anaerobic digestion tanks and landfill sites). Released to the atmosphere, methane is a potent greenhouse gas driving climate change. However, if captured and used as a fuel, it can combat energy poverty and provide economic opportunity. Biogas can be made using food waste, faecal sludge, sewage, animal wastes and crop residues. The technology is entirely scalable, from a 25-litre kitchen-sized unit up to industrial units with capacity to process 100,000 tonnes per year.

Due to its multiple benefits for sustainable development, significant investments have been made on biogas projects in the Global South by governments, private investors and international aid agencies and donors. Yet,

despite the investments, biogas has not taken off, and countries are littered with failed and abandoned biogas projects (Kalina et al. 2022).

On-the-ground engagement with projects in both Malawi and South Africa suggested that owners who had better outcomes with biogas were those who sought it out for themselves, while owners who were more passive 'beneficiaries' generally experienced poor outcomes (ibid.). Local and national "home grown" biogas enterprises of all sizes offer a sustainable way to manage food waste, supply renewable energy and prevent greenhouse emissions, while supporting economic growth.

Thermal treatment technologies such as incineration, gasification and pyrolysis are more controversial, since they require a continuous source of waste and thereby reduce the incentives to reduce waste and move towards a zero-waste society (UNEP 2018c). These thermal treatment technologies rely on the energy released from highly calorific waste (plastics, cardboard, paper and textiles) to generate electricity. Since these are the materials that are most likely to be collected for recycling, destroying them can threaten the livelihoods of already vulnerable people.

Other key issues to consider include the need for good road networks and waste collection services, the high moisture content in mixed waste and the need for separate food waste collections, the possible lack of financial support and policies related to an energy recovery project, the absence of coordination between different governmental institutions, weak environmental regulation capacity, increased greenhouse gas emissions, low energy efficiency (unless coupled with heat recovery into a district heating system or similar), and hazardous waste generation from pollution abatement systems (Khan et al. 2022; Nguyen, Pham and Nguyen 2022).

Important questions therefore remain about the suitability of thermal treatment technologies for recovering energy from mixed waste, including its suitability in lower-income contexts and its role in a low-carbon future (Khan et al. 2022).

How to use organic waste as an affordable and sustainable energy supply

1. Understand and promote the potential of biogas to meet national energy needs. Assess the viability and sustainability impacts of using biogas to meet the energy needs of homes, schools and farms; work with the Ministry of Finance to help champion the uptake of biogas (Surendra, Takara, Hashimoto, Andrew, Khanal 2014; Ministério do Meio Ambiente do Brasil 2022; Osei-Marfo, Duncan, Barnie, Owusu, Awuah and de Vries. 2022).

National programmes promote biogas uptake: Since 1981 the Indian government has promoted family-sized biogas units to combat energy poverty and solve sanitation issues with biowaste and sewage disposal, with more than 5 million units installed (MNRE 2020). Other initiatives include 389 off-grid biogas power plants supplying 9MW electricity, and a target to build 5,000 compressed biogas plants by 2024 to supply 15 million tonnes of LNG to enable clean and affordable transport (PIB 2020). Meanwhile in Brazil, the Ministry of Environment is financing the installation of biodigesters in school grounds to treat food waste and sewage and produce cooking gas.

2. Support the development of a national biogas market. Support local biogas entrepreneurs with information on local government websites and social media about entrepreneurship development programmes, projects or events; prioritise domestic biogas technology providers over donations that may distort the local market (B-energy 2021).

Small enterprises combat energy poverty with biogas: In Ogun State, Nigeria, D-Olivette Enterprise builds a domestic biodigester called the Kitchen Box, which converts organic waste into biogas in a 25-100 litre contained unit. The biogas can be fed directly to a cooking stove giving 2.5 hours of clean-burning fuel per day, and the remaining solids can be used as fertiliser.

Housewives using the D-Olivette Kitchen Box are benefitting from access to cooking biogas, while saving money and avoiding inhaling firewood fumes; and in a community with 200 installations residents report cleaner ambient air and water, with less waste going to dumpsites. The Kitchen Box comes with detachable and durable 200 kg biogas bags to allow for storage or transport of fuel to other households, or from farms to residential areas (Adeyemi 2022).

3. Ensure proposed energy-from-waste technologies fit with local and national objectives. Carry out a full options appraisal for any waste treatment technology, including assessments of emissions to air, land and water and contributions to a zero-waste society (UNEP 2018c); consider the availability of local capacity to operate and regulate the facility.



8 DECENT WORK AND ECONOMIC GROWTH



- Increase gender-responsive employment and economic productivity through high-value added and labour-intensive waste management and recycling enterprises (8.1, 8.2, 8.5, 8.7)
- Promote decent job creation, entrepreneurship, creativity and innovation, and encourage the formalisation and growth of micro-, small- and medium-sized enterprises throughout the waste management value chain (8.3)
- Protect labour rights and promote safe and secure working environments for all waste workers including female waste workers (8.8)

The waste management and recycling sector is uniquely positioned to contribute towards Goal 8, which aims to improve global resource efficiency, decouple economic growth from environmental degradation, and provide safe and decent work opportunities for all. This is especially important for those groups that are often left furthest behind, consisting of the most vulnerable in society including the poorest women and men and other minority groups. These groups contribute the least to pollution and over-consumption but are the most impacted by climate change and environmental degradation (UNDP 2020).

Increasing consumption is leading to greater waste generation (Kaza et al. 2021; Barteková and Börkey 2022), as well as resource scarcity (World Economic Forum [WEF] 2019), which in turn drive growth in the waste management and recycling sector (Statista 2022). Governments are increasingly promoting circular economy models to secure access to secondary resources and drive sustainable development (OECD 2019; EU 2020; Koty 2021; Nguyen and Nguyen 2022).

Waste collection and recycling involves labour-intensive work recovering value from materials, encouraging innovation and entrepreneurship (Bella 2022; Guerra 2022; Kurniawan Othman, Hwang and Gikas 2022; Odebunmi 2022). Goal 8 also promotes the support of micro, small and medium-scale enterprises which dominate the waste management and recycling sector in the Global South, and the promotion of labour rights and safe work environments (dos Santos and Jacobi 2022), which are essential for a just transition to a circular economy.

Past decades have witnessed unprecedented growth in global demand for raw materials, and at current rates global material use is expected to more than double by 2060 (Barteková and Börkey 2022). As virgin resources become increasingly scarce, recycling will become more competitive compared to primary material extraction.

Ultimately, the recycling sector will outpace growth in mining (OECD 2019). Growth in the sector brings positive environmental benefits, with the per-kg environmental impacts of secondary materials estimated to be an order of magnitude lower than those of primary materials (ibid.).

Meanwhile, production (including the offshoring of polluting technologies) and consumption are shifting towards countries in the Global South (OECD 2019), and waste generation in these regions is projected to double – and in some cases triple – by 2050 (Kaza et al. 2021).

Worldwide, the waste management and recycling sector will play an increasingly important role in economic development through the adoption of new technologies and high-value added and labour-intensive activities, including the recovery of high-value components from organic waste and precious metals from electrical and electronic waste (e-waste).

Electrical and electronic equipment repair and recycling in the Global South is dominated by micro-, small and medium sized enterprises in the informal sector. The market brings significant environmental and economic benefits and has the potential to provide 350,000 jobs under decent conditions (International Labour Organization [ILO] 2019; WEF 2019). Unregulated and unsafe activities, however, raise concerns of workers' rights, child labour, precarious working conditions, a neglect of health and safety, and the need for rights-based and gender-responsive approaches (PREVENT-STEP 2022; UNEP-IETC and GRID-Arendal 2019). To protect these workers' rights and ensure a just transition to a circular economy, international regulations and standards are needed, along with actions to ensure decent work conditions throughout the supply chain.

Improving the management of used and waste electrical and electronic equipment takes time and requires an enabling policy environment to institutionalise and

professionalise informal recycling activities (PREVENT-STEP 2022; Parajuly, Kuehr, Awasthi, Fitzpatrick, Lepawsky, Smith, Widmer and Zeng 2019). It is therefore recommended that policymakers prioritise measures to strengthen and regulate this sector.

How to create decent job creation and protect labour rights in waste management

1. Recognise the potential value of the waste management and recycling sector (both informal and formal) to economic growth and employment, natural resource preservation and climate change mitigation (OECD 2019). Support growth in the sector with a focus on high value-added and labour-intensive enterprises.

Recovering value from broken rice in Thailand: Building a cooperative of rice farmers in rural Thailand, Rice Remedy purchases broken rice and rice waste at the same price as 'perfect' rice and turns it into a sustainable biomaterial for skincare products, medical applications (wound healing), food (jelly fibre), faux leather and textile fibre. The cooperative is preserving traditional farming methods, enabling the skills to be passed on to the next generation, and providing higher-skilled biotechnology jobs in local villages (Bella 2022).

2. Improve working conditions and environmental standards in waste management, and particularly e-waste management. Advocate for legislation on equal pay for equal work for both women and men, and safety from sexual harassment. Together with employers' and workers' organisations, develop and implement

coherent policies, strategies and measures for the sector to improve working conditions and provide health and social protections for workers and their families.

3. Support the professionalisation of enterprises, cooperatives and workers in the informal e-waste economy, and create an enabling environment for micro, small, medium and large enterprises within the e-waste value chain (ILO 2019).

A women's cooperative for e-waste recycling in Mexico: From 2007 to 2020, women's cooperative Retroworks de Mexico provided television and computer recycling, affordable computers for poor schools and local jobs for Mexican families in Mexico, via the best available environmental practices. The concept came from the perspective that rather than paying people in lower-income countries to work in extractive industries to make new goods that would soon be thrown away, it would be better to employ these people to repair the 20 per cent of used electricals and electronics that still work, and manually disassemble the rest to recover valuable materials for reuse. Manual dismantling is safer and less polluting than shredding, which is more commonplace in wealthier countries. Retroworks de Mexico produced electronics-grade copper, aluminium, heat sinks and circuit boards that were meticulously sorted, commanding much higher values than machine-shredded electronics; and proved that reuse, repair and recycling jobs belong around the world, and that emerging markets can be better at electronics reuse and recycling than wealthier nations (Ingenthron 2022, Good Point Recycling 2022).



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



- Develop quality, reliable, sustainable and resilient waste management and recycling infrastructure, with a focus on affordable and equitable access for all (9.1, 9.2, 9.a)
- Encourage innovation and domestic recycling technology development, increase access to financial services and their integration into value chains and markets (9.3, 9.5, 9.b)
- Upgrade waste management infrastructure with greater adoption of clean and environmentally sound technologies (9.4)

Plans to replace informal dumpsites and establish improved waste management and recycling infrastructure need to consider a range of local factors. For instance, large-scale centralised facilities may be suitable in places with good road networks but can prove impractical where transport infrastructure is lacking (International Road Foundation [IRF] 2018).

Striking the appropriate balance between centralised and decentralised systems presents an opportunity for innovation and local enterprise. Carefully planned participation from the private sector and civil society can achieve rapid improvements, cost-savings and reduced financial risks for governments and municipalities (European Bank for Reconstruction and Development [EBRD] 2018). To close gender gaps in employment, it is essential that women are engaged in decision-making positions concerning the planning, building and financing of waste management infrastructure (UNEP 2020a).

Investment from the private sector can encourage innovation and service improvements, with oversight and coordination by the public sector. Creating a competitive and enabling environment for the private sector, including small and medium sized enterprises, can boost a country's resource efficiency and economic growth (see [SDG8](#)). Public authorities can give confidence to the market by providing: waste data projections (see [SDG11](#)), demonstrated capacity to collect and deliver waste (through informal or formal service providers), pre-allocated sites or support in site selection, a stakeholder engagement forum, access to financial products including public-private financing and de-risking mechanisms, a transparent procurement process, clear permitting and regulatory policies (see [SDG16](#)), and support for integration into local value chains and markets.

The digitalisation of waste management services offers a range of benefits including improved data, increased transparency, reduced social and financial

risks throughout the value chain, and access to financial services (Adeniran, Shakantu and Ayesu-Koranteng 2022; D'Amico, Arbolina, Shi, Yigitcanlar and Ioppolo 2022; Ebekozien, Samsurijan, Aigbavboa and Malek 2022). A prime example of digitalisation in waste management is that of 'waste apps', which have enabled the formalisation of waste collectors and secured their financial inclusion, while making value chain transactions transparent, improving community relations, and helping government agencies reduce costs.

Decentralised waste management systems offer many benefits, reducing reliance on poor road networks (IRF 2018), and avoiding high transport costs and polluting vehicle emissions (CCAC 2020). Smaller systems that are closer to the communities generating the waste can increase citizen accountability, reducing waste arisings and improving separation of wastes at source. Decentralised systems open the playing field to a broader range of businesses, encouraging innovation, entrepreneurship, domestic technology development, greater resource efficiency and increased employment opportunities (Sambyal and Rathi 2020).

How to encourage national innovation and develop sustainable and resilient waste management infrastructure

1. Create an enabling environment to scale up financing and investment, and to support national waste management businesses. Promote cooperation between the private and public sectors to finance and de-risk waste management services, foster innovation, and collect data that can be used to inform waste management and circular economy strategies. Embrace digitalisation to improve service provision and the financial inclusion of waste collectors, making specific efforts to close the digital divide and secure the inclusion of women (International Telecommunication Union [ITU] 2021; UNEP 2019b; Maldonado 2022).

Waste apps improve services and offer financial inclusion for waste workers in Nigeria and Ecuador:

Local innovators are improving waste management by connecting households in real time to waste collectors, who also benefit from financial inclusion. The PAKAM app in Nigeria provides targeted education and community engagement, with users able to notify government agencies of dumped waste, blocked drains and choked waterbodies. Waste collector income has increased by 500 per cent, and recycling businesses are able to grow as they have reliable access to feedstock (Odebunmi 2022). The ReciVeci app in Ecuador has built trust between local waste collectors and the community. Waste collectors are paid by the hour, and recovery of recyclable materials has increased by 300 per cent. In addition, the app uses QR codes to track material recovery through the value chain, designed to meet the data needs of Extended Producer Responsibility systems (Guerra 2022, ReciVeci 2022).

2. Develop and implement a national roadmap to upgrade waste management infrastructure, ensuring existing waste workers retain access to recyclable materials. Where appropriate, promote decentralised waste management systems to reduce costs and promote entrepreneurship in recycling.

Decentralised waste management systems thrive in India: *Cities of all sizes in India are reaping the rewards of decentralised systems. Common features among the diverse cities of Panaji, Tiruchi, Panchgani, Ambikapur, Kochi, Alappuzha and Thiruvananthapuram include: source segregation of biodegradable waste, dry recyclables and non-recyclables; small-scale materials recovery facilities; significant efforts on community engagement; and strong waste worker welfare. Not only are these cities more efficient at waste reduction, but they were also able to strengthen the welfare of waste workers during the COVID pandemic (Sambyal and Rathi 2020).*

Promotes composting

Food waste is bulky, heavy, wet and odorous, so collections are challenging. Having a local repository for food waste makes it much easier to collect, and the local processing of compost can create jobs. Quality compost is then available locally, so people can save money on fuel and on chemical fertilisers.

Promotes recycling

When people can see the local economic and environmental benefits of separating materials for recycling, they are more likely to participate. Systems that employ local people are therefore best placed to promote recycling behaviour.

Promotes small-scale anaerobic digestion (biogas)

Small-scale anaerobic digestion provides free, off-grid, environmentally-friendly energy for cooking and lighting. There is no need to drive food waste long distances, and people can use the energy generated from their own waste.

Promotes accountability

Sending waste to a centralised waste facility enables the "out of sight, out of mind" mentality. Decentralised systems, however, encourage people to be more mindful of their waste generation, thereby promoting waste reduction and separation at source.

Effective for high density cities

Decentralised systems in cities reduce the impacts and costs of road transport, particularly where roads are congested. Having local facilities within neighbourhoods that can process small amounts of materials also prevents social inequalities and political problems caused by major waste sites.

Effective for remote/rural communities

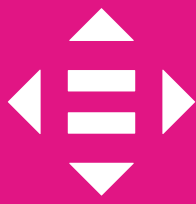
Remote and rural communities are often the last to be served. With decentralised waste management, communities can take control of their own services, create local employment and retain value within the local economy.

Encourages innovation

Since waste is managed at a more granular level, materials for which there is no local market become the focus of innovation. Entrepreneurial minds will find a way to turn waste into something of local value (e.g. charcoal briquettes, plastic paving tiles).

Figure 9.1: Benefits of decentralised waste management and recycling systems

10 REDUCED INEQUALITIES



- Reduce inequalities by providing universal access to waste management services (10.3)
- Ensure enhanced representation of developing countries in decision-making around global waste management practices to increase effectiveness, credibility, accountability and legitimacy (10.6)

Within countries and cities, unequal socio-economic conditions often mean lower-income communities lack access to waste management services and are more likely to be exposed to pollution from waste (Gupta 2022; Rajapaksha and Karanurathna 2022). At the domestic level, inequalities reflecting every day realities can be seen between the rich and poor as well as between women and men (UNDP 2020; UNEP 2021a).

Meanwhile, inequalities among countries takes place through illegal waste trafficking, often exacerbating the environmental problems caused by inadequate waste management systems in receiving countries (Parajuly and Fitzpatrick 2020).

Further inequalities exist between multinational companies and governments of countries in the Global South. Private profits from commerce drive higher waste management costs, and multinational companies are becoming increasingly influential over material value chains.

To address these inequalities, governments and municipalities will need to take an increasingly active role in determining how waste management is funded and delivered, and in ensuring a just transition to a circular economy.

The human right to a clean, healthy and sustainable environment was recognised by the United Nations General Assembly in August 2022. This basic human right will only be achieved when everyone has equal access to sound waste management, including those on the lowest incomes and in the most remote rural communities. Engaging with these citizens and setting up inclusive and participatory planning schemes can help to identify cost-effective and locally-appropriate solutions.

International inequalities in waste management have been exacerbated by the increase in non-recyclable

single-use products and packaging (especially plastics), and the transborder trade of materials for recycling. In 2021, the value of global plastics exports reached US\$ 1.2 trillion (a value larger than most national economies), and industrialised nations accounted for nearly 80 per cent of global plastic waste exports (United Nations Conference on Trade and Development [UNCTAD] 2022). An internationally legally binding instrument known as the Global Plastics Treaty is seeking to address the rapid increase in plastic pollution, with a final agreement expected by the end of 2024.

A key element of the Treaty negotiations concerns the legal recognition of the rights of waste collectors to maintain a role in the system. Campaigners are calling for a just transition (with a focus on both intragenerational and intergenerational justice) to be made mandatory in national laws and the Plastics Treaty to ensure it is universally implemented.

Technological developments may allow Global South countries to 'leapfrog' from open dumping and burning of waste to a more circular economic system that retains the value of resources for as long as possible, and minimises primary resource use, waste and emissions (Oberle, Domitrovich, Meyers and Weissberg 2016; International Resource Panel [IRP] and UNEP). However, a globalised economy with interdependent value chains means that decisions made in one country affect outcomes for people in other parts of the world. A circular economy, therefore, will not be socially just by default.

A just transition to a circular economy requires environmental challenges to be tackled in a way that promotes decent jobs and secure livelihoods for all women, men and marginalised groups who are often left furthest behind (OECD 2020). Significant political and economic imbalances therefore need to be addressed if the circular economy is to become an instrument

for achieving sustainable development for all (Circle Economy 2022).

Corporate involvement in materials recovery systems to meet recycled content pledges has grown rapidly in recent years. This new relationship has raised human rights concerns among waste collectors due to the significant imbalance of power, prompting the development of a set of principles to guide corporate engagement with the informal sector (Fair Circularity Initiative 2022; Shift 2022). These include recognition of the critical role and rights of informal waste sector workers, the need to engage with all stakeholders on an equal footing, and the need for local approaches tailored to local contexts.

Extended Producer Responsibility (EPR) systems can be a useful mechanism to fund waste management systems, shifting responsibility toward the producer and in doing so, encouraging product design that enables waste reduction and recycling (OECD 2022b). However, EPR approaches have been developed in high-income countries where waste collection systems are a public utility, whereas in low- and middle-income countries the majority of waste collection is market-based (Johannes, Kojima, Iwasaki and Edita 2021). Care must be taken, therefore, to ensure EPR policies do not distort the market and introduce new risks to the livelihoods of informal waste collectors (Amin, Strik and Leeuwen 2022; Talbott 2022).

How to address inequalities through sustainable waste management systems

1. Legally recognise the human right to a clean and healthy environment, and work towards universal access to sound waste management services. Seek to adopt initiatives that embed gender equality and rights-based approaches.

2. Retain government coordination and control over EPR models and ensure they benefit waste workers throughout the value chain. Assess any proposed new system to ensure a just transition to a circular economy. New systems need to be locally appropriate, serve national and local priorities, avoid cherry-picking of valuable materials, and involve representation of waste workers and local communities.

Good practice for incorporating the informal sector into EPR system design: EPR systems are administered by Producer Responsibility Organisations (PRO), which can be operated by the producers themselves, by a third party or by government. The PRO can help ensure a just transition to a circular economy by offering formalised and attractive terms and conditions for informal waste workers (either integrated as employees or as independent workers) with benefits including:

- Provision of Personal Protective Equipment (allowing workers to choose their own PPE)
- Training on work safety
- Regular income
- Financial inclusion
- Improved living standards and health protections
- Fair and regulated business practices
- Access to social security systems



11 SUSTAINABLE CITIES AND COMMUNITIES



- Ensure access for all to basic services and enhance inclusive and sustainable urbanisation (11.1, 11.3)
- Reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management (11.6)

Solid waste management is a basic utility service. Where open dumping and burning are the norm, air quality and living conditions become degraded leading to poor health and social discontent. Waste management is therefore a priority service in making cities and communities inclusive, safe, resilient and sustainable (Pal, Kolathayar and Ganni 2021).

Within the Sustainable Development Goals, target 11.6 explicitly calls for a reduction in the adverse per capita environmental impact of cities, including paying special attention to air quality and municipal and other waste management. Its indicators focus on improving waste collection and management and reducing air pollution from waste burning.

Waste prevention and activities that divert waste from disposal (such as those carried out by the informal sector) reduce the environmental and economic burden of waste and need to be prioritised. Collecting data on waste generation and management can provide municipal governments with the insights to make step-wise progress towards universal and safe waste management, improving air quality and environmental health and making cities more liveable (UN-Habitat 2017; UN-Habitat 2021; Whiteman, Webster and Wilson 2021).

It is important for women and men to access relevant training and information on waste management, ensuring increased participation and reduced inequalities. Gender sensitisation is also essential for addressing biases and encouraging equity and equality at work, particularly equal roles in making decisions (UNEP 2020a).

Solid waste management is “one of the greatest challenges of our time in a rapidly urbanising world”, according to Uhuru Kenyatta, President of Kenya (International Institute for Sustainable Development [IISD] 2018). The impacts of unmanaged waste are significant: waste accumulating in streets spreads

disease and blocks drains, while open burning of waste causes major air quality issues with multi-generational health impacts (see [SDG3](#)). In addition, municipal waste is becoming increasingly complex with plastics, electronics, single-use disposable products and medical waste causing specific and costly challenges.

Getting waste under control and shifting towards a circular economy therefore offers significant opportunities to improve living conditions, mitigate climate change, protect public health and conserve the local environment (Oteng-Ababio et al. 2018).

Simple and low-cost interventions such as promoting home composting of food and garden waste can reduce the burden of waste collection, while promoting refill services can help reduce the amount of packaging waste requiring management.

Waste data can be used to drive service improvements. The UN-Habitat Waste Wise Cities Tool (UN-Habitat 2021) guides municipalities through steps to collect waste data, including its generation, collection and management. The Tool also provides calculations for food waste, recycling, plastic leakage, greenhouse gas emissions and air pollution, and helps municipalities make good progress towards SDG indicator 11.6.1 (the proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated).

Knowledge-sharing initiatives such as C40 Cities and the African Clean Cities Platform provide helpful resources and opportunities for networking, and guides such as the toolkit *Making Waste Work* (WasteAid 2017) and *Best Practices for Solid Waste Management: A Guide for Decision-Makers in Developing Countries* (United States Environmental Protection Agency [USEPA] 2020) provide advice for improving waste management in small and large urban centres respectively.

Cost recovery is vital to ensure services can continue in the long term. Funds may be sourced from municipal budgets, national government subsidies, the private sector (e.g. through Extended Producer Responsibility systems, see [SDG10](#)), waste generators (households, businesses), importers and tourists. Advice for financing waste management can be found in What A Waste 2.0 (Kaza et al. 2018) and A Primer for Cities for Accessing Financing for Municipal Solid Waste Projects (International Solid Waste Association [ISWA] and the Climate Change and Clean Air Coalition [CCAC] 2017). Approaches for attracting private sector investment are discussed within this report in [SDG9](#), [SDG16](#) and [SDG17](#).

How to deliver sustainable waste management in cities and communities

1. Promote initiatives that reduce the amount of waste that needs collecting, such as home composting and zero-waste refill services.
2. Participate in knowledge-sharing initiatives, improve waste data collection and use data to inform national waste strategy and circular economy roadmaps.
3. Adopt a stepwise approach to improving waste management systems and leverage progress to attract investors. Explore a range of financing mechanisms for waste management services, including co-financing and cross-subsidising from businesses and importers.

Financial instruments for waste management cost recovery in Grenada: In the Caribbean island nation of Grenada, several regulatory mechanisms have been

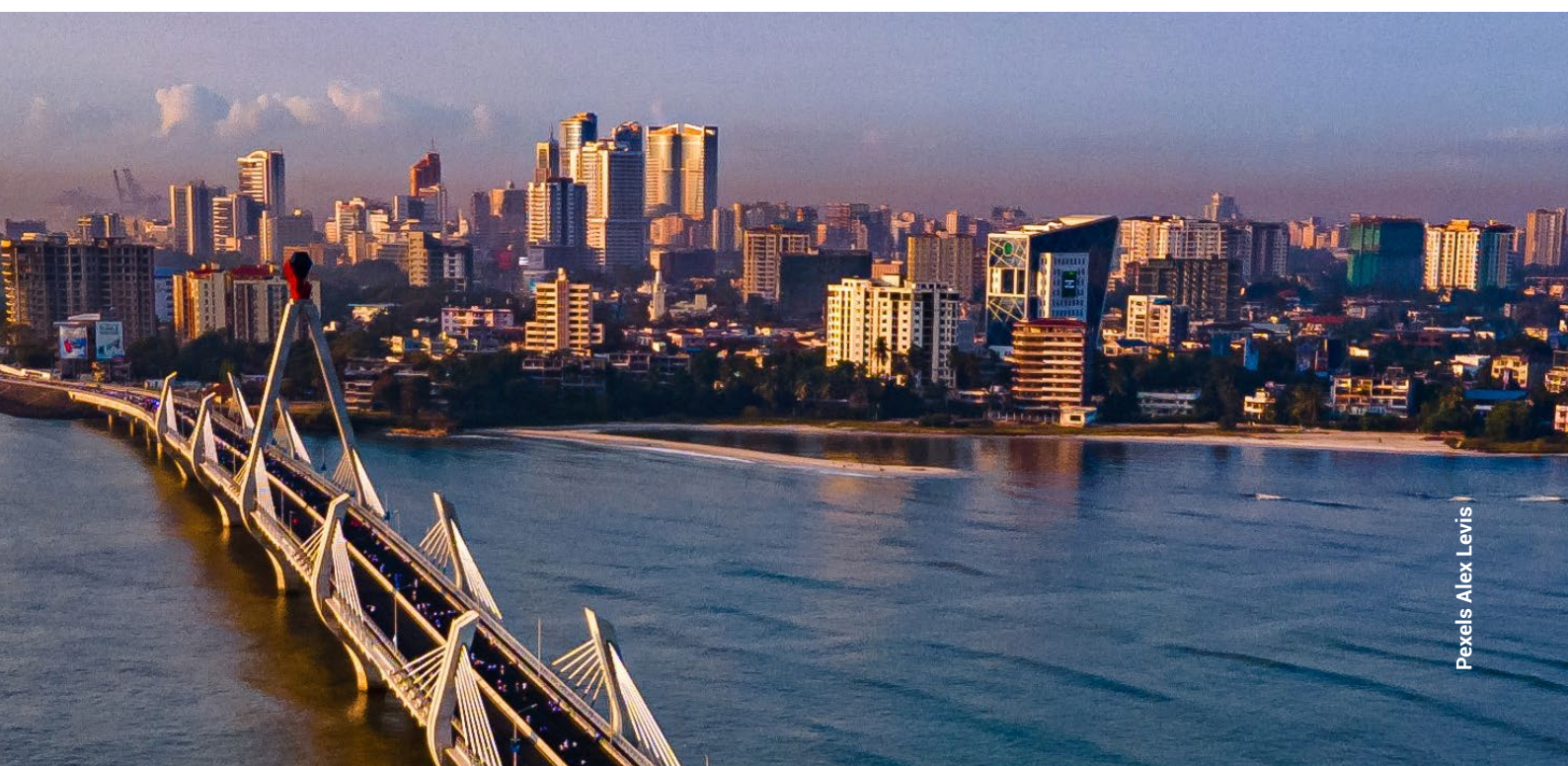
introduced to fund waste management activities. These mechanisms introduced a range of charges on householders, importers and tourists.

Households: The electricity consumption of the household determines the amount payable. Only households consuming more than 100 kW hours per month contribute, with fees ranging from US\$ 1.85 to US\$ 3.70 per month. Residents also pay a 2 per cent import tax on vehicles and 3 per cent on white goods.

Importers: The Environmental Levy Act establishes a US\$ 0.19 charge for imported plastic beverage containers, and US\$ 0.093 for glass and other materials, payable within 30 days. If the importer is able to prove that the beverage container was re-exported or disposed of in an acceptable manner, an 80 per cent refund can be redeemed, with the remaining 20 per cent being absorbed for general waste management services on the island.

Tourists: Any tourist arriving in the country by cruise ship or staying overnight is charged US\$ 1.50 entry fee.

The levy mechanisms have been successful in making Grenada the only country in the region with a profitable waste management system. More steps need to be taken to use the levies as tools to shift consumer consumption patterns in island settings, where access to land for final disposal is scarce and where creating markets for locally sourced recycled materials can decrease the impact on marine ecosystems (Deutsche Gesellschaft für Internationale Zusammenarbeit [GIZ] 2015; Inter-American Development Bank 2021).



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



- Reduce waste generation through policies and public behaviour change campaigns that promote sustainable consumption and production and improved waste segregation practices (12.1, 12.3, 12.4, 12.5, 12.8)
- Using public procurement to reduce waste and strengthen national markets for recycled goods (12.7)

Production and consumption patterns directly impact municipal waste generation. To reduce waste and prevent pollution, efforts will be needed by companies, governments and citizens.

National policies can have a strong influence on consumption and production patterns. Governments and municipalities can leverage their significant purchasing power to support sustainable enterprise, increase resource efficiency and create economic growth (Sönnichsen and Clement 2020; UNEP 2022a).

Sustainable consumption and production are essential to delivering on every multilateral agreement, from the Sustainable Development Goals to the Paris Agreement to the post-2020 Global Biodiversity Framework (UNEP 2022b). This chapter discusses tools and levers to bring about change within society, including behaviour change and sustainable public procurement.

Designing out waste is an urgent challenge, starting with unnecessary, non-recyclable single-use products and packaging. For instance, in the Philippines alone, some 60 billion non-recyclable sachets are sold every year, comprising 52 per cent of plastic litter in the environment (Manalo and Manalo 2022; GAIA 2020). Alternatives such as refill require innovation and investment, as well as consumer behaviour change.

Knowledge is not enough to change behaviours. People make decisions based on what they consider relevant, how they see the world, and what other people are doing (Drake 2022).



Understand what is driving current decisions



Assess and remove the barriers to change



Communicate positively to reinforce the benefits of the desired behaviour

Encouraging segregation of materials for recycling can be achieved using colourful bins with clear, positive messaging and bold images. Different channels can be used to reach people, including radio, posters, social media and in-person events. It is important to keep repeating messages: people need to hear something seven times on average before their behaviour changes (Hubbub 2022).

Addressing single-use plastic waste in the hospitality sector is a quick win. The return of tourists following the COVID-19 pandemic means the return of income as well as significant quantities of waste, which are particularly difficult for lower-income and small island destinations to manage. Single-use plastics including water bottles, disposable toiletries, plastic bags, bin liners, food packaging, cutlery and cups can all be eliminated from hotels, bringing significant positive benefits and cost-savings for host communities (Travel Without Plastic 2022).

Preventing food waste from the hospitality sector has a particularly strong business case. Plate waste is the most easily avoidable type of food waste generated in hospitality (Beretta and Hellweg 2019). Up to 92 per cent of plate waste could be prevented without reducing people's enjoyment (Papargyropoulou, Wright, Lozano, Steinberger, Padfield and Ujang 2016; Dolnicar 2020). A wide range of apps and online training are available to help food service businesses reduce waste.

Public procurement can drive change in consumption and production due to its enormous purchasing power. In the Global South, public spending accounts for up to 30 per cent of GDP (UNEP 2022a). When public bodies use their spending power to buy more sustainable goods and services, they encourage innovation, give clear direction to industry, and can help drive a just transition to a circular economy.

Public procurement policies can be used to promote waste reduction and recycling in a wide range of

Figure 12.1: Steps for achieving behaviour change

categories, including catering, cleaning, construction, electrical and electronic equipment, flooring, furniture, medical devices and equipment, outdoor play equipment, power and hand tools, textiles, tyres, vehicles and waste services.

Governments can also build capacity within the supply chain by raising awareness of environmental management systems and certifications, providing financial incentives to suppliers that offer environmental and social benefit in their products and services, and recognising companies that promote gender equality within their workforce and supply chains. Explicit procurement criteria need to be planned and agreed in advance, well-publicised, and applied through transparent procurement processes (United Nations Sustainable Development Goals [UNSDG] 2021).

How to promote sustainable consumption and production patterns

1. Promote zero-waste businesses, behaviours and policies. Assess priority items to be addressed, consider consumer behaviour, local norms and customs, and the characteristics of the population that will be impacted by the policy (such as independent traders). Recognise environmental trade-offs and risks of burden-shifting between environmental impacts. Offer support to businesses and organisations promoting environmentally-sound alternatives (UNEP 2021d; UNEP 2021e).

Refillable grocery service in India: Using a retrofitted Bajaj truck (tuktuk), Refillable's home refill service sells a range of household products, while sharing real-

time reports with brands backed up by sensors that can detect discrepancies (Muthukumar 2021). Each refill eliminates a bottle from being manufactured and becoming waste. Refillable is now introducing a low-cost refill model to the slum regions of Mumbai city, offering refills for Rs. 2, Rs. 5 and Rs. 10 as a zero-waste alternative to non-recyclable sachets (Refillable 2022).

2. Reduce waste from the hospitality sector. Work in partnership with tourism and hospitality stakeholders to identify and act on opportunities to reduce food waste and unnecessary single-use plastics. Encourage top-down commitment from management to ensure the sustainability of actions (Champions 12.3 2018; UNEP and World Travel and Tourism Council [WTTC] 2021).

Zero Food Waste Mauritius: A nine-month project across eight hotels and two corporate canteens found that by combining capacity building, food waste tracking, data analysis and a certification process The PLEDGE™ on Food Waste, businesses could reduce food waste, save costs and attract new customers. Over the course of the project, participating businesses achieved a 43 per cent average reduction in food waste per meal, equivalent to 125,132 meals saved. This reduced costs by a total of US\$ 209,717 and prevented 156.4 tonnes of CO2 emissions (Lephibert 2022).

3. Develop Sustainable Public Procurement Strategies to leverage the significant spending power of public bodies in the prevention of waste in the supply chain, and the promotion of local and national recycling markets (Sönnichsen and Clement 2020; Lord, Sovichea and Sokhai 2022; UNEP 2022a).



13 CLIMATE ACTION



- Recognise the climate impacts of waste and integrate measures to prevent emissions into national policies, strategies and planning (13.2)
- Strengthen the resilience of waste management infrastructure to climate-related hazards and natural disasters (13.1)
- Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalised communities (13.b)

Poorly managed waste generates a wide range of emissions that contribute to climate change. The most significant of these are methane from landfills and dumpsites, and black carbon and other emissions from the open burning of waste (Kaza et al. 2018; Reyna-Bensusan, Wilson, Davy, Fuller, Fowler and Smith 2019). Since both methane and black carbon are short-lived climate pollutants (Malley, Lefèvre, Kuylenstierna, Haeussling, S., Howard and Borgford-Parnell 2022), actions taken today to reduce emissions will have a rapid positive impact on climate cooling. However, without data to inform policy change, many challenges remain.

Meanwhile, sea-level rise and increasingly frequent and powerful extreme weather events threaten the integrity of waste disposal sites in vulnerable countries, heightening the risk of serious pollution incidents and putting livelihoods – and lives – further at risk (IPCC 2022).

The Intergovernmental Panel on Climate Change has identified waste management as one of the three sectors with the greatest potential to reduce temperature rise in the next 15-20 years.

Poor waste management practices release a range of emissions which contribute directly and significantly to climate change. The most significant of these emissions are methane (CH₄), released from the decay of biodegradable materials in landfills and dumpsites, and black carbon released from open burning of waste, which has a serious impact both on local air quality and the melting of polar ice caps.

Sustainable waste and resource management make a major contribution towards climate change mitigation. Waste prevention, recycling and recovery of waste (including the conversion of biodegradable waste into biogas) reduce the need for raw material extraction, including from oil wells, mines, intensive agriculture and forests – and the impacts of associated processing infrastructure.

Countries have a significant opportunity to reduce greenhouse gas emissions by scaling up domestic best practices in waste prevention and reduction strategies. There is also a clear opportunity for the contribution of the informal sector to be recognised in Nationally Determined Contributions (countries' self-defined national climate pledges under the Paris Agreement), considering their role in collecting and recovering materials and reducing waste.

Climate finance for waste management projects needs to be increased urgently to deliver the scale of waste management interventions needed to meet the Paris Agreement to limit global warming to 1.5°C or even 2°C. Very few climate finance programmes are waste-focussed, and much of the support available comprises capacity building and advice rather than finance. It is important to raise finance actors' awareness and capacity on the contribution of waste management to deliver on the climate agenda, and to integrate waste management as climate action into strategies and financing and investment decisions.

Even with a concerted increase, carbon finance revenues will only provide a small contribution to overall waste management costs and should be viewed as performance incentives rather than dedicated revenues. Further, specific efforts are needed to ensure that climate-related finance and technology mechanisms for improved waste management involve local women, youth, and marginalised communities, who are often left behind.

Climate change adaptation measures are essential to protect waste management infrastructure from extreme weather events since floods and fires at waste sites can lead to disastrous consequences for public health and the environment. A number of measures can be implemented to mitigate the worst impacts of extreme weather on waste management operations, such as: collecting waste more frequently and on shorter routes, providing shelter for waste workers, ensuring daily cover on disposal sites to reduce fire risk, siting waste

management facilities in elevated areas safe from floods and coastal erosion, and developing Disaster Waste Management Plans to deal with debris and keep recycling chains active in times of emergency.

How to use waste management for climate action

1. Raise awareness and capacity among finance actors regarding the contribution of waste management to deliver on the climate agenda, and integrate this into strategies and financing and investment decisions.

2. Take priority actions to prevent greenhouse gas emissions from waste, including universal collections to prevent open burning of waste, food waste prevention and composting or conversion to biogas. Use online tools such as the Solid Waste Emissions Estimation Tool (SWEET) to compare emissions from different waste management scenarios, and WasteMAP to develop methane reduction plans.

3. Incorporate waste action into Nationally Determined Contributions (NDCs).

Integrating zero-waste and the informal sector into NDCs in Tanzania and Chile: Tanzania's NDC explains how the private sector and communities are encouraged to improve waste management by enhancing recycling, reuse, and mapping and identifying informal dumpsites. Its NDC involved the participation of different social groups and emphasises the promotion of gender equity and people with disabilities in future development plans and adaptation strategies. The NDC includes landfill gas recovery and electricity generation programmes.

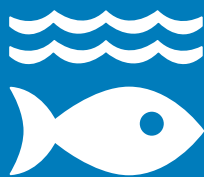
Chile's NDC provides insights for climate-oriented waste policies based on waste reduction, reusability, job creation and Extended Producer Responsibility (EPR), as well as through its National Organic Waste Strategy. The NDC includes consideration of waste pickers, gender equity and indigenous people, as well as the participation of civil society in decision-making. The Chilean Government aims to send 100 per cent of all residual municipal waste to sanitary landfills with landfill gas capture by 2035. (GAIA 2022).

4. Strengthen the resilience of waste management infrastructure. Map and include waste management infrastructure in Disaster Risk Reduction plans; step-up measures to prevent waste from blocking drainage channels; and prepare plans for the maintenance of waste management services and infrastructure in extreme weather events (Kaza et al. 2018; IPCC 2022).

Using GIS and drones to map flood risk at waste sites in South Africa: Following a fatal flash flood in April 2022, GIS and drone flight operations were deployed in eThekweni (Durban) to assess the flood damage to dumpsites, landfills, and low-lying informal settlements, and to understand what risks this might pose to the public, the environment, and service delivery. The drone photos were much more detailed than the usual satellite imagery. 3D results included detailed renders of a broken riverbank at an informal settlement hard hit near an industrial area, and damage to infrastructure, such as a wrecked access road to a landfill. This quality of data is cost-effective to collect and can be especially powerful in helping policymakers design effective solutions (Palfreman 2022).



14 LIFE BELOW WATER



- Prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities and plastic debris (14.1)

With 75-199 million tonnes of plastic estimated to be in the oceans, plastic pollution is considered one of the greatest threats to coastal and marine ecosystems worldwide (UNEP 2016a; UNEP 2021c). The rate at which plastic pollution is increasing represents a serious global environmental issue that negatively impacts the environmental, social, economic and health dimensions of sustainable development (ibid.).

The 2022 United Nations Environment Assembly adopted a resolution to develop a global treaty to end plastic pollution (see [SDG10](#)), and negotiations are expected to be complete by the end of 2024.

In the meantime, under a business-as-usual scenario and in the absence of necessary interventions, the amount of plastic waste entering aquatic ecosystems could nearly triple from some 9–14 million tonnes per year in 2016 to a projected 23–37 million tonnes per year by 2040 (UNEP 2021c). Understanding why and how waste from the land reaches the sea, and introducing mitigation measures is essential. Urgent action is particularly required for Small Island Developing States, which face a complex set of waste management challenges (UNEP 2019a).

Solid waste in the marine environment includes waste littered on land and in rivers, waste that has escaped from disposal sites by the wind, flooding or erosion, and marine-based sources such as ghost fishing gear and waste discarded from vessels. Plastics are the largest, most harmful and most persistent fraction of marine litter, accounting for at least 85 per cent of total marine waste (Law 2017; Agamuthu 2019). A growing body of evidence points to the fact that marine litter, including plastics and microplastics, is now found in all oceans, and at all depths (UNEP 2021c). Plastics are a persistent form of pollution, taking many years to break down into smaller particles and possibly never fully degrading in the marine environment (Diez, Patil, Morton, Rodriguez, Vanzella, Robin, Maes and Corbin 2019).

The impacts of marine plastic pollution are varied

and significant. Additives used in the production of plastics and oily pollutants attracted to plastic particles accumulate in the food chain and may cause harm to human health in ways that are age and gender-differentiated (UNEP 2016b; European Chemicals Agency 2019; UNEP 2020b; Wenham, Smith and Morgan 2020).

Through the process of 'rafting', pathogens, microorganisms, seaweeds and invertebrates are dispersed long distances on floating litter, spreading disease and invasive alien species in coastal and marine habitats (UNEP 2021c), posing risks to entire marine ecosystems, coral reefs and mangrove forests, shellfish and fish stocks, and aquaculture (Lamb, Willis, Fiorenza, Couch 2018; Bijsterveldt, van Wesenbeeck, Ramadhani, Raven, van Gool, Probadhi and Bouma 2021; Richardson, Asmutis-Silvia, Drinkwin, Gilardi, Giskes and Jones 2019).

The annual economic cost of marine plastic pollution, including its impacts on fisheries, aquaculture and tourism as well as the cost of clean-ups, is estimated to be at least US\$ 6-19 billion globally (Deloitte 2019). This figure does not, however, account for impacts on human health or marine ecosystems.

Preventing marine plastic pollution requires a combination of approaches, including education, awareness raising and behaviour change, innovative business models, legislation and regulation, monitoring and enforcement. Regulatory approaches need to be approached with care to avoid unintended consequences (such as small vendors being unable to afford alternatives) and unfavourable trade-offs (for example, banning thin plastic bags could result in a greater use of thicker plastic bags). In 2022 the UN Environment Programme Finance Initiative published a report for financial institutions "Diving Deep: Finance, Ocean Pollution and Coastal Resilience", which has a chapter on solid waste prevention and management, including a detailed breakdown of which activities to seek out as best practice, which activities to challenge, and which activities to avoid completely due to their damaging

nature (UNEP Finance Initiative 2022).

Small Island Developing States (SIDS) face unique waste management challenges due to their remoteness, scarcity of land, lack of economies of scale for waste management and recycling infrastructure, and large quantities of waste generated by the tourism sector. Further problems arise from a lack of technical skills in waste management, hindering maintenance and operation of waste treatment technologies, and preventing the proper regulation and enforcement of environmental standards.

While SIDS rely on tourism for prosperity, a business-as-usual approach is expected to lead to economic losses of around US\$ 28 million per year due to damages from the accumulation of toxic substances and waste in the environment (UNEP 2019a).

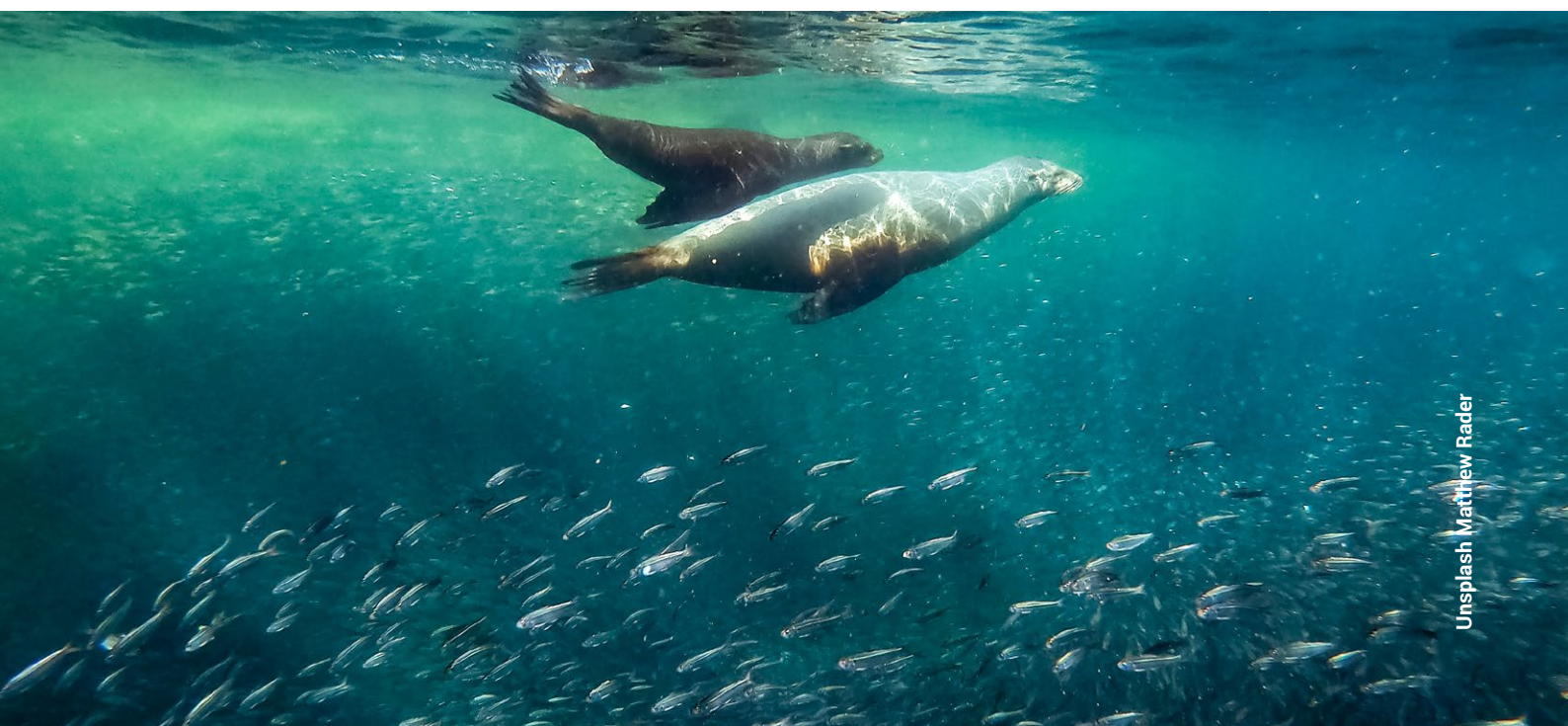
How to prevent marine pollution from waste, and especially plastics

1. Understand and report on the sources and costs of marine pollution using harmonised tools and methods (UNEP 2020c; GESAMP 2019). Use this data as a business case for action and consult widely on potential actions, making efforts to involve women, youth and marginalised groups as key stakeholders and agents of change (Convention on Biological Diversity 2022). Implement actions, monitor impacts (including through regular stakeholder engagement) and report on progress. Review the success of different measures on a regular basis and introduce changes where necessary.

Kenyan Government sets its sights on problematic plastics: In 2022, the Kenya Plastics Pact published a list of problematic and unnecessary plastic items that

the Government intends to address through legislation. This adds to the existing plastic bag ban that came into force in 2017, and the ban on selected single-use plastic items in protected areas since 2020. The priority list supports a collective plan to phase out problematic and unnecessary items by 2030, including certain plastic packaging items, non-packaging plastic items, and additives. The rationale for phase-out is provided for each category, such as the availability of alternatives, the lack of recyclability, or negative impacts to human health and the environment when disposed (Kenya Plastics Pact 2022).

2. Prevent waste leakage from Small Island Developing States. In addition to the processes above, SIDS are encouraged to join the ISLANDS initiative to address common waste management challenges, control the import and disposal of hazardous substances, and establish environmentally-sound waste management including regional agreements for the repatriation of wastes and measures to improve economies of scale (IISD 2019). Incorporate waste management infrastructure into Disaster Risk Reduction Strategies. *The ISLANDS Initiative to help SIDS manage hazardous chemicals and waste is supporting 33 island nations in the Atlantic, Caribbean, Indian and Pacific regions to improve chemicals and waste management. ISLANDS will safely dispose of over 200,000 tonnes of hazardous products and 17,000 tonnes of toxic chemicals, including POPs. It will also lead to the avoidance of nearly 90 tonnes of mercury. Through co-finance activities it will avoid over 300,000 tonnes of marine litter - mostly plastics. Small Island Developing States (SIDS) are dependent on imports for everyday items like batteries, computers, cars, and plastic-based items, which are polluting if not disposed of safely.*



15 LIFE ON LAND



- Protect land, soil, mountain ecosystems and inland freshwater ecosystems from pollution from waste (15.1, 15.3, 15.4)
- Reduce the degradation of natural habitats by poorly managed waste (15.5)

The long-term pollution of terrestrial and inland freshwater ecosystems from mismanaged waste is one of the main drivers of biodiversity loss and puts the integrity of ecosystems at risk (Tovar-Sánchez, Hernández-Plata, Santoyo Martínez, Valencia-Cuevas, and Mussali Galante 2018; UNEP 2021f). The terrestrial environment continues to be the primary sink for waste, though research on the harm caused by waste to terrestrial and freshwater ecosystems currently falls far behind that of the marine environment.

Agricultural livelihoods are dependent on soil and ecosystem health, yet rural communities are the least likely to have a waste management service (Vinti and Vaccari 2022). Similarly, communities in mountainous regions and national parks face complex waste management challenges and the added burden of waste generated by visitors, which if left unmanaged can significantly impact ecosystems, amenity value and dependent livelihoods (Alfthan et al. 2016).

Zero-waste and decentralised waste management models in these areas offer a cost-effective and sustainable way to prevent pollution and protect vulnerable ecosystems.

Many informal and unregulated recycling and waste disposal activities pollute the soil and fresh water sources, putting entire ecosystems at risk. Soil loss and declining fertility has been identified as the main threat to sustainable development (Leonardis 2022) (see also [SDG2](#)). Soil provides 95 per cent of our food, plays a vital role in the water cycle, is home to about a quarter of all the planet's biodiversity, and is the largest carbon store on the planet (Food and Agriculture Organization 2020; Leonardis 2022). With growing populations and increased waste arisings and complexity, the need to protect soils from waste-related contamination is growing in urgency.

Rural communities are often the last to benefit from waste management services and infrastructure. Consequently, open dumping and burning of waste is commonplace, polluting the soils on which many rural livelihoods depend. Waste collection and transport in rural areas can be prohibitively expensive, and so policies and practices that reduce waste generation, promote segregation at source (into at least three streams: biodegradable, recyclable, and hazardous wastes), and encourage the in-situ treatment of biodegradable waste through composting or anaerobic digestion, provide the most cost-effective and least polluting approach to waste management. Rural communities can be enabled to manage their waste safely through participatory decision-making and the provision of storage space, transfer stations and inter-municipal cooperation.

Women in the agricultural labour force are essential players in environmental protection and have extensive knowledge of traditional sustainable practices. This contextual expertise can be leveraged to benefit the entire community by including women in decision-making at all levels of waste management (UNEP 2020a).

Mountainous regions are facing a growing waste management challenge. Mountains play an essential role in supplying water, energy, food and other services to millions of people living in the mountains and downstream. Weak road networks, steep terrain, landslides and tourism combine to make waste management particularly difficult. Mismanaged waste in mountainous regions pollutes the watershed on which vast populations depend. Since many mountainous regions and national parks are outside municipal boundaries, they require special measures to bring waste management under control. Such measures include a combination of behaviour change campaigns, source-separated waste collection systems, deposit return schemes and the provision of carry-bins for trekkers.

How to protect terrestrial ecosystems from mismanaged waste

1. Reduce risks of soil pollution to human health.

Assess heavy metal contamination (as a proxy for other pollutants) in soils close to waste treatment and disposal sites, educate residents on the risks of soil and water pollution, and encourage the separate collection and composting of food waste as an organic soil conditioner for agricultural soils.

2. Assess waste arisings in rural communities and engage with local residents, particularly women, to identify locally-appropriate and cost-effective solutions that reduce waste at source. Use traditional art forms to raise awareness among communities; introduce source-segregated collections with composting or biogas production; and collect recyclable materials for sale into the value chain.

Creating hygienic, plastic-free and environmentally-conscious rural communities in India: The Barefoot College is a community-based grassroots organisation near the village of Tilonia, Rajasthan, working to make marginalised communities sustainable and self-sufficient since 1972. The larger neighbouring village of Nalu of 660 families was selected for a pilot Zero-Waste programme. Open dumping and burning were the norm; plastic waste was commonly burned on cooking stoves and drainage ditches were blocked with plastic waste. A community awareness-raising campaign addressed more than 500 village residents using traditional art forms of puppetry and plays, and engagement through women's groups reached more than 200 women.

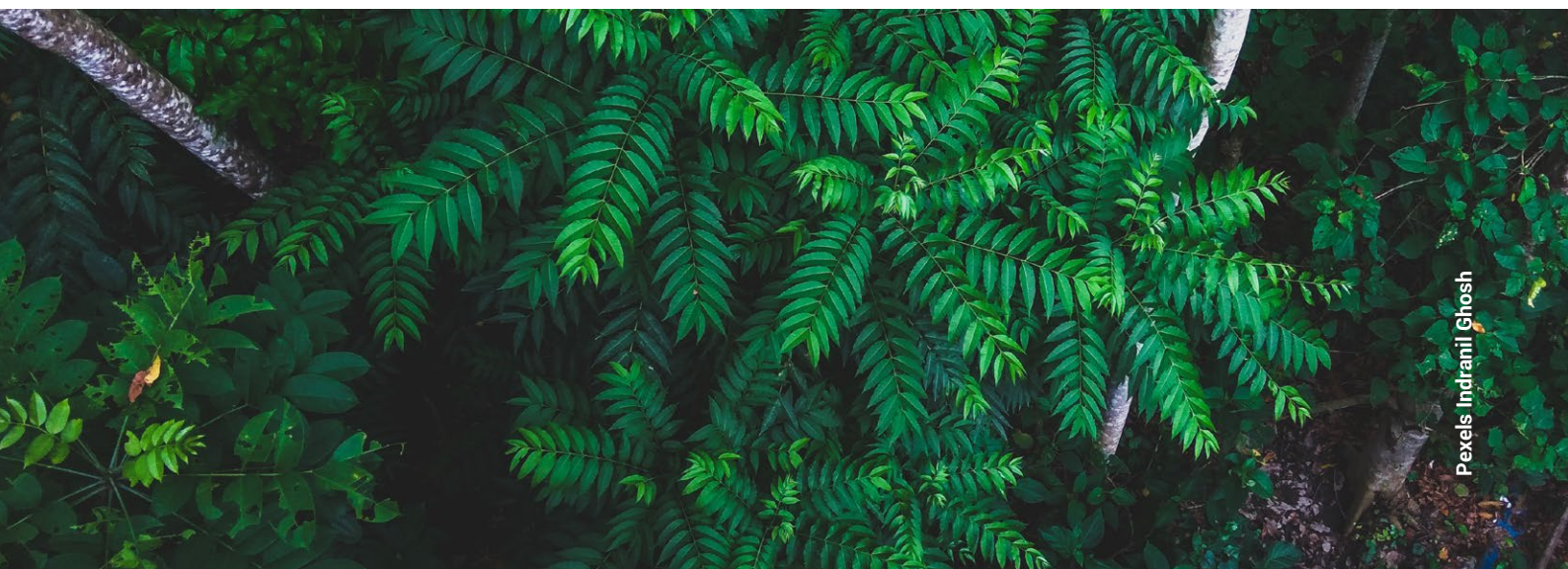
A thousand discarded oil cans were refurbished into dustbins to promote household level source segregation. Land was allocated on the village outskirts for a resource recovery centre, with compost pits and a storage area for segregated dry waste. For the monthly cost per person of US\$ 0.12 (in year 3), open dumping and burning have

been almost entirely eradicated, eliminating soil pollution from waste and its harmful effects on wildlife, livestock and human health (Barefoot College Tilonia 2019).

3. Assess waste arisings in mountainous regions and national parks, and work with stakeholders to introduce a range of measures, including behaviour change campaigns, source-separated waste collection systems, deposit return schemes and the provision of carry-bins for visitors. Build the capacities and knowledge of local women, youth and marginalised communities as key agents of change (Convention on Biological Diversity 2022).

Waste management on Mount Everest: With increasing numbers of visitors each year, Mount Everest has become severely polluted and the watershed has become contaminated, threatening the health of local people. Climbers generate around 8 kg of solid waste each, which is disposed in large pits or littered along mountain paths and in glaciers. During the monsoon season the waste washes into waterways and down the mountain to neighbouring communities. The watershed has become contaminated with waste and sewage, posing a serious health risk to the entire population.

Efforts by government and local communities to address the problem are ongoing. Since 2014, visitors must pay a US\$ 4,000 deposit which is refunded if the person returns with 8 kg of solid waste. In 2019, the Nepali government launched a campaign to clear 10 tonnes of waste from the mountain and made it more difficult to obtain a climbing permit, and in 2020, banned certain single-use plastics. To complement government restrictions, the Sagarmatha Pollution Control Committee (a local non-profit run by Sherpa people) is carrying out activities to manage waste and educate visitors on the importance of taking care of the environment (Borgen Project 2020; National Geographic Society 2022).



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



- Develop effective, accountable and transparent institutions with inclusive, participatory and representative decision-making (16.6, 16.7)
- Broaden and strengthen the participation of developing countries in the global governance of wastes (16.8)

Universal, safe and sustainable waste management can only be delivered through effective, accountable and transparent institutions at all levels. Everyone needs to be clear about their roles and responsibilities, as well as those of others. Policy-making and governance are strengthened when institutions cooperate with one another (EBRD 2018).

Well-informed waste management policies are built upon inclusive, participatory and representative decision-making, and this requires all stakeholders to be identified and involved, helping ensure potential consequences are considered and managed (UNDP 2021b). Making specific efforts to include local women, youth and marginalised communities who are often left behind is crucial (Convention on Biological Diversity 2022).

In addition, the increasingly global nature of waste management calls for heightened international cooperation to build national capacity for the safe management of hazardous wastes, and to prevent its illegal trafficking (Basel Convention 2017, 2019; IMPEL 2022).

Improving waste management requires strong institutional governance. Many governments are responding to the urgent need for waste collection and recycling services, with national waste management

strategies and circular economy roadmaps setting out high ambitions. For these to be effective, governments also need to set the overall institutional, policy and legislative framework to enable and govern waste management services at the municipal level (EBRD 2018).

Ministers, government officials, mayors, governors, municipalities, environmental regulators and financial bodies are all agents of change and need to be equipped and empowered to deliver on the original intention of waste management laws, policies and regulations. Governments can benefit from capacity building on the role of private finance and how it can be leveraged. Finally, monitoring frameworks, including monitoring of financial flows, need to be in place with clear responsibilities, mechanisms and timelines to enable policies to be improved over time.

Controlling hazardous wastes such as healthcare waste and e-waste is an important responsibility of governments and municipalities. To assist, Basel Convention regional and coordinating centres for training and technology transfer provide support on integrating the informal sector, strengthening waste management laws and the role of customs to prevent illegal trade, harmonising procedures and building capacity among stakeholders.

Essential components of an effective system of waste governance

A comprehensive policy and legislative framework	Institutional structures and organisational arrangements	Accurate, reliable data on the sources, nature, quantities and fate of solid wastes
Gender-balanced human resources, with the necessary capacity and expertise	A programme and system for ongoing consultation with, and inclusion of, all key stakeholders	Policies and programmes for financing, funding and recovering costs, enabling investment and ensuring the long-term viability of the national waste management sector

Preventing waste crime remains a serious challenge globally. Waste crime is expected to grow significantly as prices and standards for environmentally sound waste management increase. Common examples of waste crime adopted by organised criminals and unscrupulous businesses include avoiding costs by mixing different types of waste or declaring hazardous waste as non-hazardous (INTERPOL 2020).

National waste crime can be combatted by requiring all waste handlers and operators to be fully registered and by ensuring public procurement contracts are transparent. Collecting data on waste generation, treatment and disposal routes helps authorities identify where waste is going missing, while proactive monitoring and investigations act as a deterrent to waste crime.

How to build effective and accountable waste governance

1. Coordinate and cooperate between relevant national and local government departments and bodies, and ensure representation of all stakeholders, including public and private finance actors, paying special attention to traditionally under-represented groups including the informal sector, youth and women, in decision-making processes. Ensure routes for giving feedback are accessible and formalised with accurate record-keeping. Communicate with stakeholders readily to build trust and ownership over new policies (EBRD 2018; International Bank for Reconstruction and Development and World Bank 2021; UNDP 2021b).

Embedding stakeholder engagement: A well-planned waste management project will include representation from residents, local businesses, and young people, ensuring both male and female perspectives are considered. Stakeholder engagement provides an opportunity to hear and consider issues and experiences

that may not be obvious and can save time and costs in the long run.

Questions to help understand stakeholders' needs

include: What financial or emotional interest do they have in the outcome of the proposed plans? Is it positive or negative? What is their motivation? What information do they need to be able to be fully engaged, and what is the best way to communicate with them? How are their opinions influenced, and are there other stakeholders to engage with?

It is good practice to keep stakeholders informed throughout the decision-making process, giving opportunities for further input as plans are refined. Once a new strategy or policy has been implemented, it is beneficial to keep in touch with stakeholders at regular intervals to provide a forum for any further issues to be raised and dealt with, and to enable the monitoring of progress and impacts.

2. Prioritise governance of hazardous wastes, cooperating with other nations and international organisations to implement the Basel Convention requirements (and Bamako and Waigani Conventions in Africa and Pacific Islands as appropriate). Prevent hazardous wastes entering a country and arrange for the offshoring of hazardous waste management where local capacity is lacking.

3. Prevent waste crime and its negative effects on vulnerable communities and ecosystems. Require waste handlers and operators to be fully registered; ensure public procurement contracts are transparent. Collect data on waste generation, treatment and disposal routes to identify where waste is going missing, and implement monitoring and investigations to deter waste crime. Cooperate internationally and adopt tools such as those provided by Waste Force to disrupt international waste crime (IMPEL 2020).



17 PARTNERSHIPS FOR THE GOALS



- Mobilise finance and enhance cooperation to build capacity, knowledge and technology development for waste management (17.2, 17.3, 17.6, 17.7)
- Enhance policy coherence for waste management and sustainable development (17.14, 17.15)
- Pursue sustainable waste management objectives through multi-stakeholder partnerships (17.16)

Despite waste management being a powerful tool for sustainable development, it remains significantly underfunded. Private finance is constrained by risk and return requirements, while public finance is in scarce supply (UNEP Finance Initiative 2018). Across the Global South, waste generation is increasing by 27.5 million tonnes per year (Kaza et al. 2021). If the financing gap remains unresolved, far higher investments will be needed in the future to cope with increasing waste generation and the accumulation of legacy wastes.

As has been demonstrated throughout this report, investments in inclusive and sustainable waste management bring an impressive range of economic, social and environmental benefits and can contribute to all the Sustainable Development Goals.

Over the past decade, the World Bank and other Multinational Development Banks have seen their portfolio of investments in the solid waste sector grow due to rising demand, supported by efforts to improve baseline data such as the Waste Wise Cities Tool (UN-Habitat 2021). Innovative financing mechanisms that attract vibrant private sector competition can further help to close the funding gap (Schröder and Lahn 2023).

Within the waste management sector, women's knowledge and expertise also need to be recognised, while gender responsive budgeting will help women access technology, promote their leadership and influence, and secure their access to the benefits afforded by a growing waste management industry (UNEP-IETC and GRID-Arendal 2019; UNEP 2020a).

Governments and municipalities can catalyse investment in the value chain through policies that incentivise the use of recycled content (such as Extended Producer Responsibilities or minimum recycled

content standards) (UNEP 2023), incentivise investment (through tax credits or subsidies), and reduce and share risk (for example through blended finance or other de-risking mechanisms). Coordinating policy initiatives with stakeholders across the value chain can help to improve the economics and attract the interest of private sector investors.

Governments need to ensure that funds raised through Extended Producer Responsibility schemes are ring-fenced for investments into both upstream business models that reduce waste, and downstream activities to increase the collection, sorting and recycling of waste through support for the informal sector.

In particular, the potential of micro-, small and medium sized enterprises (MSMEs) to provide waste management services, generate employment and create investment opportunities deserves greater recognition. While equity capital for MSMEs is readily available in some established sectors, investments in the waste management and recycling sector are lagging. Additionally, women and youth who often do not own assets and thus lack collateral have limited opportunities to access financial services. Specific measures and mechanisms are required to meet the needs of this demographic (UNEP 2020a).

Multistakeholder partnerships help ensure the effectiveness of investments in infrastructure and services. For example, private sector participation in infrastructure (as discussed in [SDG9](#)) can be complemented by service delivery by informal sector cooperatives. For governments to provide an enabling environment for local and domestic waste management, it is essential that system design is context-specific and supports local businesses and supply chains.

One way of organising stakeholders is through the DIAMOND model developed by WASTE. Importantly, WASTE only facilitates the improvement of stakeholder interactions; it does not become part of the system itself (WASTE 2022).

- Residents are willing to pay for waste management.
- Financing institutions offer credit products to businesses.
- Businesses (small and large) see opportunities in waste management.
- (Local) governments are responsible for setting rules and regulations.

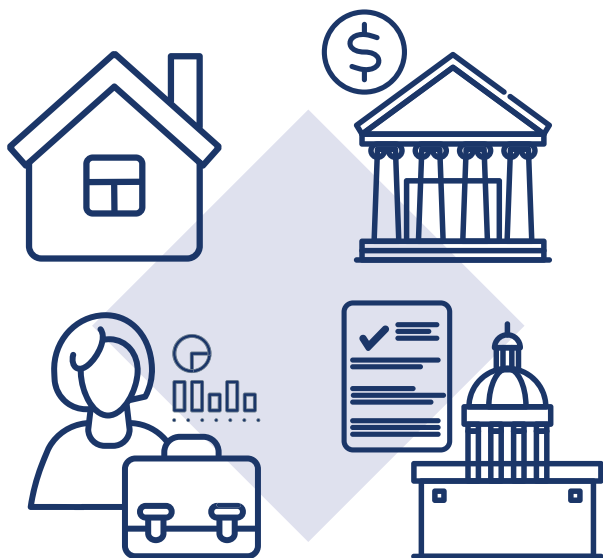


Figure 17.1: The DIAMOND model to sustaining value chains (Source: WASTE 2022)

Cooperation between countries in the Global South has many advantages for the design and implementation of waste management projects, as cooperation is built as a partnership between equals. This is generally more cost-effective than other modalities, as it offers a vehicle for countries to support each other without the need to use large amounts of resources (United Nations General Assembly 2018).

Since the contexts for waste management in Global South countries are very distinct from those in industrialised nations, solutions developed through South-South cooperation can have increased relevance. Shared challenges and opportunities include the dominant role of the informal sector and MSMEs, poor road networks and advantages of decentralisation, job creation benefits of low-tech and labour-intensive solutions, and the opportunity to leapfrog using modern digital technologies and non-polluting vehicles in service design and delivery.

How to maximise the benefits of partnerships for waste management

1. Coordinate policy initiatives across the value chain to catalyse investment, promoting upstream (waste reduction) and downstream (recycling and waste management) business activities, and encouraging enterprise among (particularly women-led) MSMEs and the informal sector. Establish partnerships with banks to give confidence in the direction of travel and unlock finance for waste management and recycling service providers.
2. Coordinate stakeholder activity and invite the formal and informal sectors to deliver complementary services. *Innovative partnerships lead to “Zero-Waste City” status for San Fernando in the Philippines: The city has achieved 80 per cent diversion from landfill and savings of almost US\$ 1 million per year, through partnerships between the City Government, a private sector partner, a Filipino non-profit and informal waste workers. Waste workers are formalised and integrated in collection, sorting, recycling and composting activities (GAIA 2018).*
3. Cooperate with countries and municipalities with shared challenges and contexts; take inspiration and adapt successful models to the local context. Participate in South-South Cooperation programmes and share knowledge and experiences.



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