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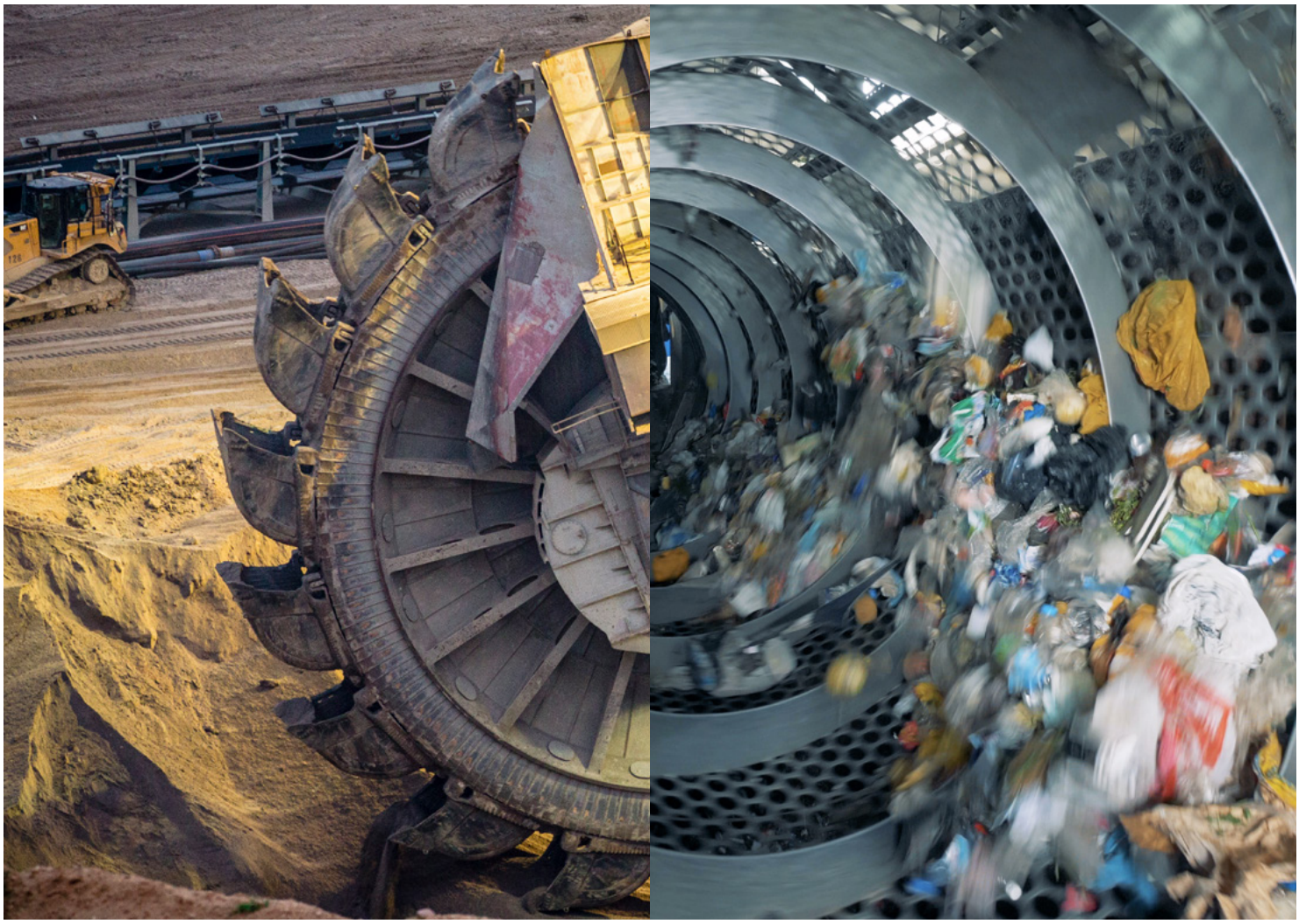

Waste Management as a catalyst to a Circular Economy

Olusosun landfill , Lagos, Nigeria. ©Freek van Eijk

Content

“The Netherlands is proving to be a living lab for environmental solutions and a true Circular Hotspot. Together we can adapt the Dutch solutions presented in this brochure to local conditions and solve environmental issues in the process”

Ms Vivianne Heijnen

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Minister for the Environment, Netherlands

Waste Management as a catalyst to a Circular Economy

The world faces unprecedented challenges in waste management. Currently, only 67% of global solid waste is collected, whereas that 33% is openly dumped. The global growth in population and consumption is yet to be matched by a similar increase in waste management infrastructure. From a resource perspective, more than 91% of what we take from the earth is wasted.

For the sake of our planet and future generations we can't go on like this. It is one of the biggest and potentially most rewarding challenges of our time and the missing link to achieve the Paris climate goals. In order to combat the growing mountain of waste, resource scarcity and the associated CO2 emissions, the Netherlands has committed itself to a circular economy.

The Netherlands wants to be fully circular by 2050 and reduce the amount of - non-renewable - resources by 50% in 2030.
However, no single country can face these challenges alone. That is why I am happy to see that the authors of this brochure share their lessons learned on waste management. Internationally, the focus on circular economy has increased, and that's important.
A circular economy isn't 'nice to have' – it's 'need to have'. Especially if we want to tackle the three main planetary crises – climate change, biodiversity loss and pollution – and secure the supply of key resources for the energy transition.
The Netherlands is proving to be a living lab for environmental solutions and a true Circular Hotspot. Together we can adapt the Dutch solutions presented in this brochure to local conditions and solve environmental issues in the process. By doing so, we create meaningful local jobs, achieve the climate goals and Sustainable Development Goals, all of this not as a cost but as a business model.

More action is needed and therefore I hope that this brochure will be a source of inspiration and can be the start of a longer strategic collaboration between the Netherlands and yourself.

Introduction and context

This brochure shares best practices from entrepreneurs and lessons learned from public authorities and institutions active in waste management in the Netherlands that can be applied anywhere in the world. As a small, densely populated country in a vulnerable delta, the Netherlands started early on with the organization of waste management and learned what is working and what is not. The Netherlands is now considered a front-runner in both waste management and circular economy. By sharing these lessons internationally, other parties can accelerate their development.

A Circular Economy is not conceivable without a sound waste management system. Waste management is the last step in a circular economy but at the same time, it is often a precursor to a circular economy in a sense that it is the first point of action driven by acute health, hygiene and city development challenges. A well-implemented waste management system can serve as a catalyst for further circular development.
Furthermore, sound waste management contributes significantly to the Climate Goals and Sustainable Development Goals and can give a boost to local employment.
Waste management needs a.o. regulation, financing, enforcement and innovation in order to be successful.

This brochure shares facts and figures on waste management (chapter 1). It also contains a toolkit for setting up an adequate waste management system, covering, for example, regulatory aspects, organizational aspects and economic steering instruments (chapter 2).
In chapter 3, the brochure provides inspiration with clear examples of best practices from the beginning to the end of the value chain for various flows like Municipal Solid Waste, Organic Waste, Construction and Demolition Waste and Plastics. It presents accomplishments from the private sector in prevention, collection, sorting and recycling, composting and digestion, energy from waste, landfilling and data management and provides links to propagate further circular action.

By publishing this brochure, the authors hope to share views, as well as stimulate debate and action, as reflected in chapter 4. By sharing lessons internationally, others can accelerate development and avoid pitfalls.

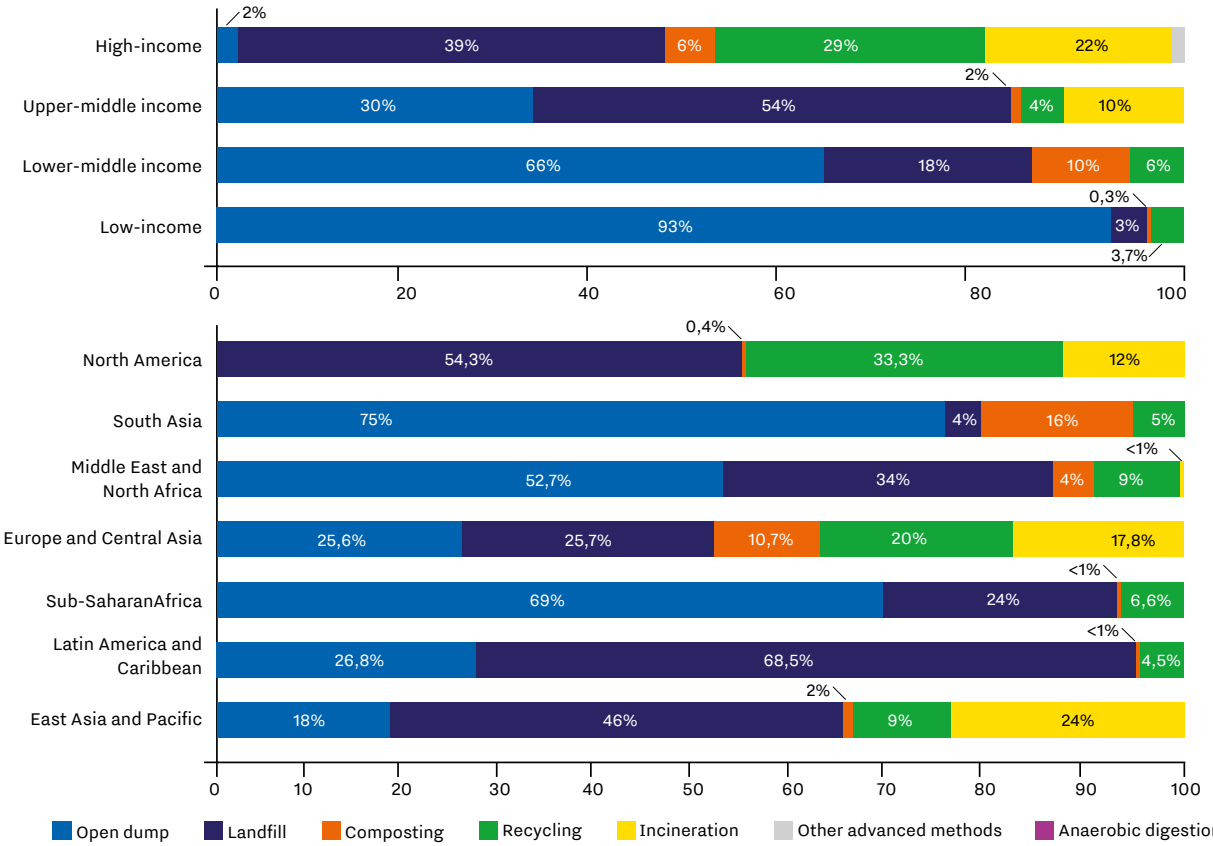
Polluted water in Jakarta. ©Carel de Groot

Chapter 1

Waste Management Challenges

The world faces unprecedented challenges in waste management. Currently, only 67% of global solid waste is collected and 33% of it is openly dumped.[1] This chapter will elaborate on the projection of waste generation and the current waste management trend. It also sheds light on the risks of unmanaged waste that need to be tackled to achieve circularity and help countries move towards meeting the Sustainable Development Goals.

Figure 1: Disposal methods by Income



Source: What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank, 2018.

Waste generation

In recent years, waste production grew substantially. In 2016, an estimated 2.01 billion tonnes of municipal solid waste were generated, a number that is expected to grow to 3.40 billion tonnes by 2050 under a business-as-usual scenario.[2] It is expected that in 2050 waste production will be 70% higher than in 2020.[3] The situation in low-income countries is particularly alarming,[4] with the total quantity of waste expected to increase by a factor of more than three by 2050.[5] This is partly caused by the increase of production and consumption in those countries. Authorities at all levels will face challenges in this perspective. In circular economy terms, more than 90% of what is taken from the planet is wasted. Only half a trillion tons per year of virgin materials make it back into our economy. All in all, our world is currently only 8,6 % circular.[6]

Municipalities in low-income countries are spending about 20 percent of their budgets on waste management on average, yet over 90 percent of waste in low-income countries is still dumped or burned.[7] Waste challenges also persist in European countries, with many still relying heavily on disposal and energy recovery instead of recycling and other more circular practices.

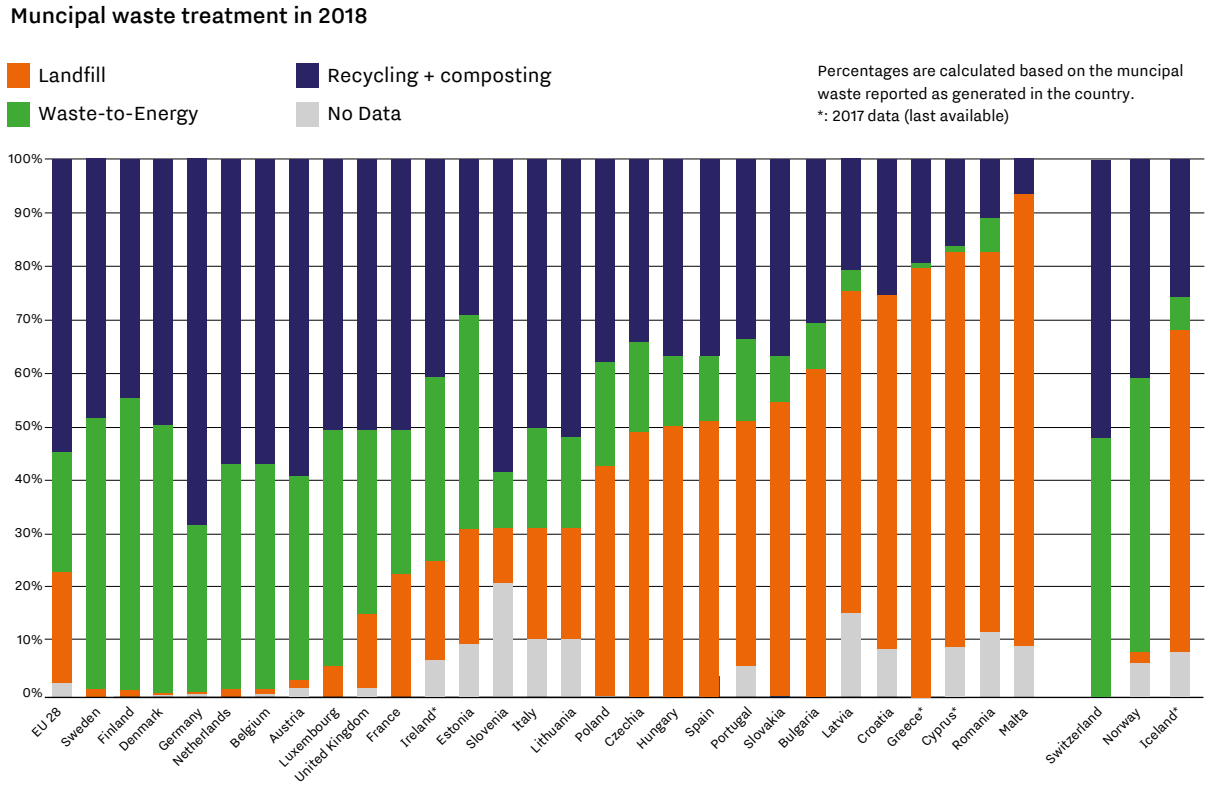
Globally, solid waste management costs will increase from today's annual US$205.4 billion to about US$375.5 billion in 2025.[8] In high-income countries, operating costs for integrated waste management, including collection, transport, treatment, and disposal, generally exceed US$100 per tonne. Lower-income countries spend less on waste operations in absolute terms, with typical costs of about US$35 per tonne and sometimes higher, but these countries experience much more difficulty in recovering costs.[9]

The recycling industry is now a global business with international markets and extensive supply and transportation networks.[10] However, it is important to recognise that the waste management sector relies on the hard work of more than two million informal waste pickers, in particular in low and mid-income countries. This informal sector faces specific challenges and should be supported by public policies as it contributes to essential waste management services for the communities. There are policy options that can leverage and formalize the informal waste sector, but it has to be done in a very careful and inclusive manner, in order to secure sustainable livelihoods for people.[11]

Waste composition

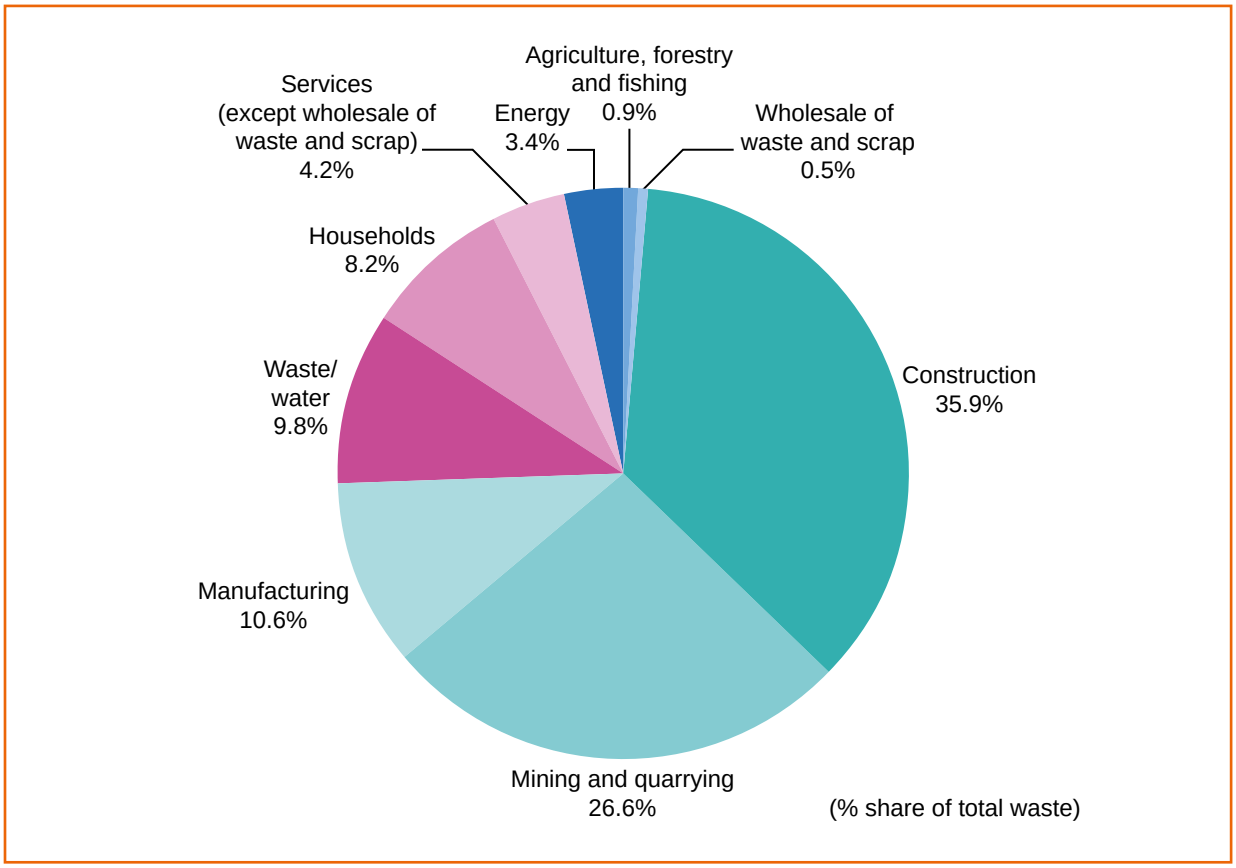
While talking about waste, people mostly focus on Municipal Solid Waste, also known as household waste. It is however important to realize that household waste is only a modest fraction of overall waste volumes in a country.

Figure 2: Municipal solid waste treatment in 2018 in Europe



Source: CEWEP graph MSW treatment in 2018 (EU28 + Switserland, Norway and Iceland

Figure 3: Waste generation by economic activities and households, EU, 2018



Source: eurostat. 2021. Waste statistics. [online] Ec.europa.eu. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Waste_statistics#Total_waste_generation [Accessed 23-sep-2022].

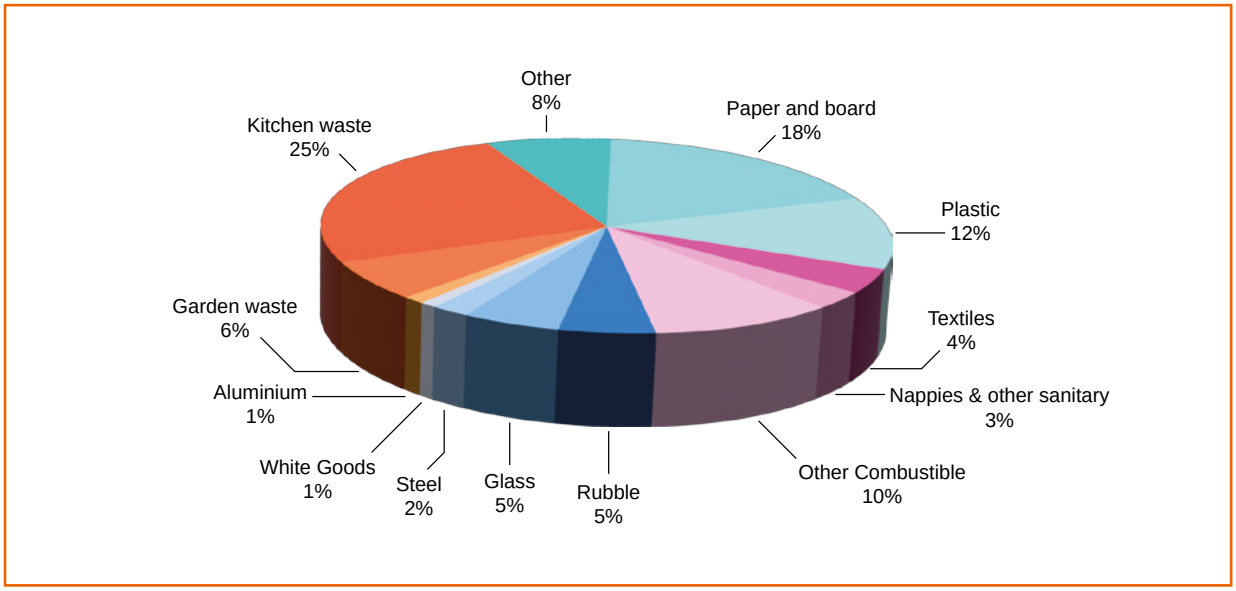
Several waste flows can be distinguished, sometimes with different names:

- Municipal Solid Waste (made up of source-separated waste and residual waste) or Household waste
- Commercial and Industrial waste
- Construction and Demolition waste
- Hazardous waste (for example from the chemical industry)
- Waste from Mining, quarries etc

Specific waste flows include:

- Organic waste
- Waste from Electrical and Electronic Equipment (WEEE)
- End of Life (EoL)vehicles
- Medical Waste

Figure 4: Municipal solid waste composition EU 27

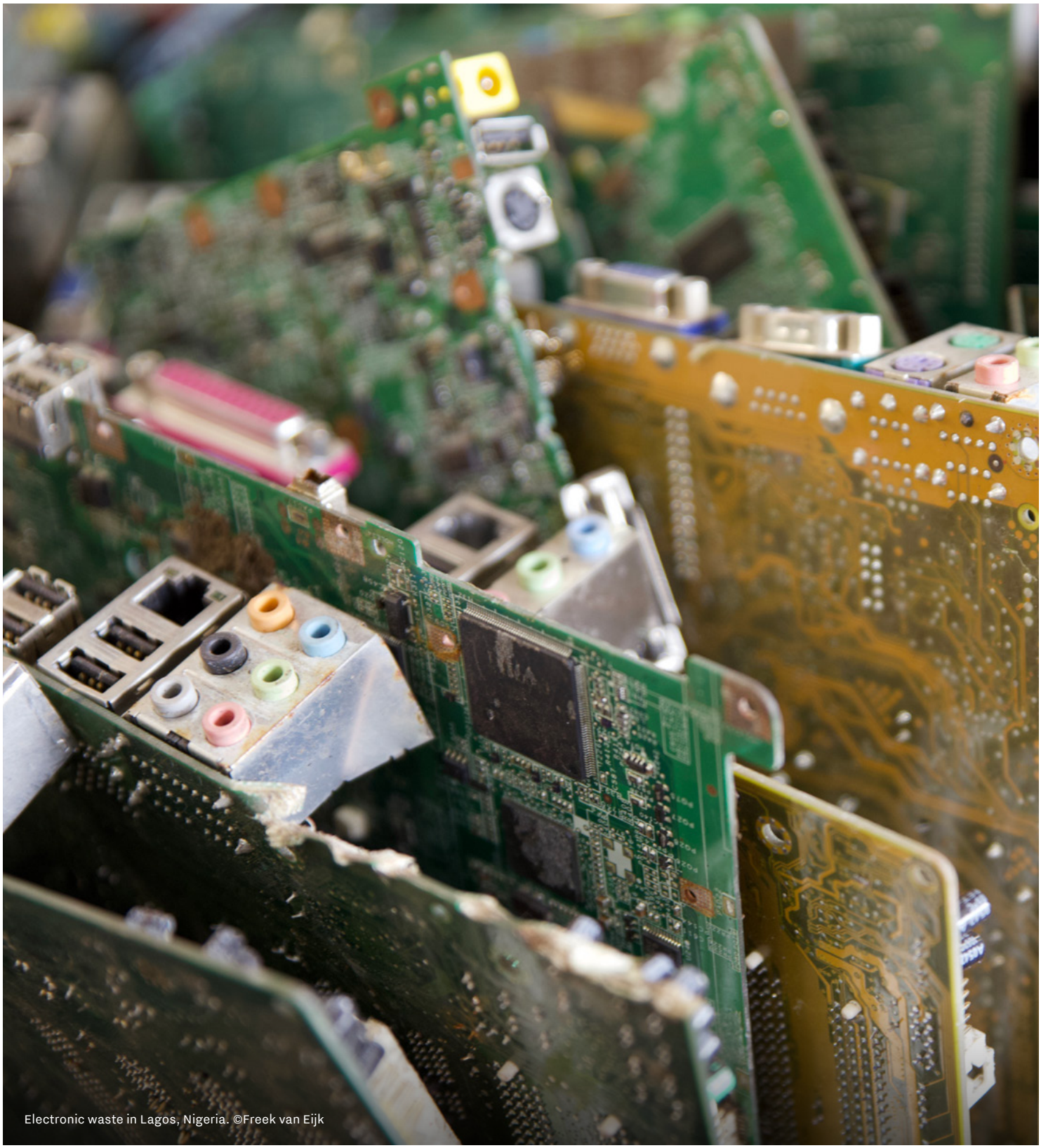


Source: Municipal Solid Waste Waste EU 27 by type (Eurostat)

Municipal solid waste is made up of many components, as illustrated by the data from the EU-27. In countries without a system of waste segregation, the composition of municipal waste tends to differ. Here, organic matter (garden and kitchen waste) often makes up more than 60% (weight based) of the waste.

Several types of waste need special attention:

- Electronic waste: This is the fastest growing waste stream and is expected to grow by 38% between 2019 and 2030. Today, only 17.4% is collected and recycled.[12]
- Plastic waste: Currently, 32% of plastics leaks into the environment. Only 40% of the plastic waste is landfilled, 14% is incinerated, and 14% is collected for recycling.[13]
- Plastic in the ocean: It is estimated that approximately 3% of global plastic waste ends up in the oceans.[14]
- Food waste: In a world where 811 million people go to bed hungry, one third of the food is lost or wasted, amounting to a financial loss of about US$ 1 trillion annually.[15]



Electronic waste in Lagos, Nigeria. ©Freek van Eijk

Risk of unmanaged waste

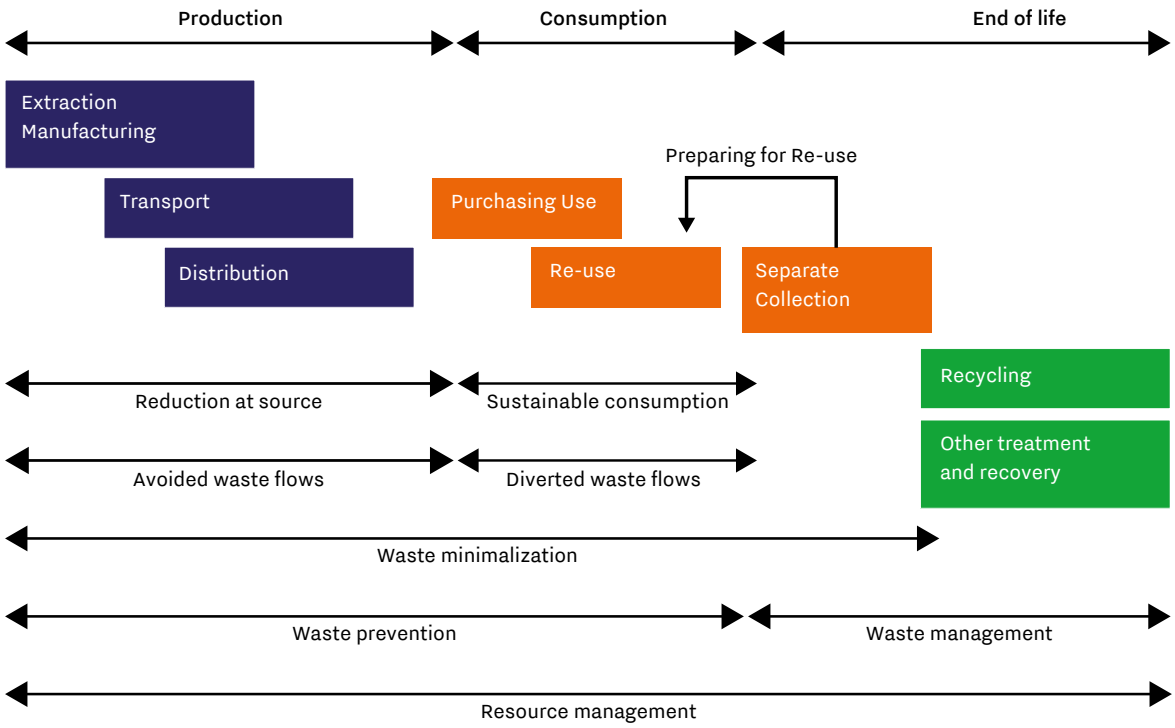
Waste can be considered to be a resource that has lost its way, due to the lack of enforcement of public policies to control it. Without measures, waste flows like water to the lowest point. The cheapest way to discard it is often illegal dumping. Inadequately managed (municipal solid) waste is a major source of marine litter and contributes 5% to greenhouse gases[16].

Poorly managed waste poses threats to both the environment and human health. It hinders human development, city development and economic activity, thus serving as a barrier to prosperity. Without proper waste management, the achievement of the United Nations Sustainable Development Goals (SDGs) will be practically unthinkable, particularly SDG12 (sustainable consumption and production patterns). Therefore waste issues need to be resolved. The good news is: they can be resolved if everyone puts their mind to it.

Waste issues are often the starting point for thinking about a circular economy, but creating a circular system and developing the role of the waste management sector is a slow process of change. Solid waste management is arguably among the most important municipal services and serves as a prerequisite for other municipal action. It is a critical - yet often overlooked - element for planning sustainable, healthy, and inclusive cities and communities for all. Waste management should be seen as part of a larger concept of resource strategy as illustrated in the figure below.

An adequate waste management infrastructure is a precursor and can act as a catalyst to a circular economy. Without proper waste management, a circular economy is not conceivable.

Figure 5: Transition from linear waste to circular resource management



Source: Transition from linear waste to circular resource management according to Antonis Mavropoulos, Theo Lemmen and Maarten Goorhuis, ISWA (Mexico, 2011)

Bantar Gebang landfill Jakarta, Indonesia. ©Freek van Eijk

Waste to Wealth composting plant Ikorudu, Lagos. ©Freek van Eijk

Chapter 2

Waste Management as a catalyst to a Circular Economy

This chapter describes the transition and steps taken by frontrunning European countries to develop a waste management strategy. “Circular economy is not about copyright, it is about the right to copy”. By sharing the waste management evolution of first moving countries others can learn, adapt and accelerate their own transition. The correlation between sound waste management and the achievement of a circular economy will be explored at the end of the chapter.

Evolution of waste management

Waste has always been around. In rural societies, this was considered a fact of life. Waste used to be deposited just outside the dwelling and it would decompose fast. But when urbanization started, this led to public health and social problems. In Europe, Roman and Ottoman cities were the first to pay attention to the improvement of hygiene and sanitary conditions. However, their effort could not catch up with the growth of cities in the middle ages. The waste problem strongly accelerated the spread of diseases, showing that the waste management effort still had a long way to go.

Typical view of Amsterdam in the time of cholera. Source: www.amsterdam.nl/nieuws/achtergrond/amsterdam-tijden-cholera/

The cholera epidemics in the middle of the 19th century sparked the awareness of city authorities to improve drinking water, the sewage system and waste collection. Around 1900, most cities in Europe started organizing city cleaning as an integral part of their responsibilities. During that period, the waste ended up in open dumps just outside the cities. Informal workers were trying to make a living collecting paper, metals and textiles.
In most western countries, in the first half of the 20th century, the professionalization of waste management started with the introduction of motorized collection, uniform household bins and the formalization of dumpsites. However, urban growth continued and new housing projects brought citizens to the periphery of these dumps and prompted concerns about smoke, smells and insects. Fencing and daily coverage of the waste body were introduced, yet environmental and health problems arising from this improvisatory waste handling method persisted. A similar problem is still faced by people in many parts of the world. The waste still often ends up in open dumps, causing environmental and health issues within a society.

Figure 6: Collaboration options for municipalities

Source Herman Huisman after NVRD

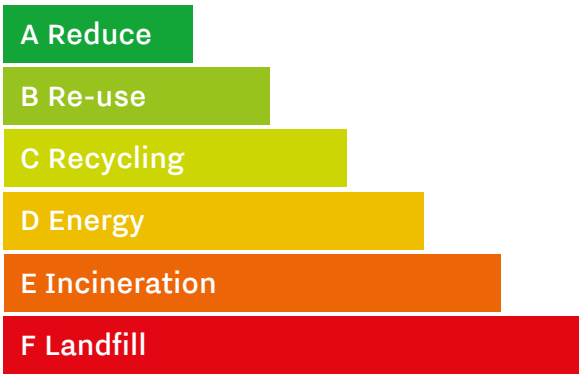
The increasing scarcity of space prompted urban authorities to introduce waste incineration. The other solution developed was the transportation of the waste by train and boat to dumpsites at longer distances, sometimes to other municipalities.

The management of waste disposal gradually improved following incidents of leaking landfills and toxic emissions from incinerators. Efforts were undertaken to abate the emissions and nuisances caused by disposal sites. Bottom floor liners were introduced to mitigate risks for groundwater and leachate, and biogas was extracted from landfills. Emissions from waste incinerators were investigated and dioxins were detected. These risks underlined that to protect the environment, a strong increase in investments and professionalism in waste disposal was necessary.

Handling this at the municipal or the provincial level was no longer sufficient. Sanitary landfills and waste incineration plants could only be operated profitably if capacities would be increased. Thus, neighboring municipalities started to cooperate in order to achieve economies of scale. In some cases, public authorities teamed up with private companies in order to secure financing and operations.
Developments in Western Europe led to a decreased number of landfills but, at the same time, to more large-scale incinerators, longer transportation distances and stronger local impacts at these facilities. Thus, in order to reduce impacts caused by those methods, policies were adopted to improve environmental safeguards and reduce the volumes of waste through recycling.

The toolbox for sustainable waste management opened up further with separate waste collection, organic waste composting, landfill bans and landfill taxes. Plus the **'waste hierarchy'** (Ladder van Lansink), initiated by (member of Dutch Parliament) Ad Lansink in 1979: a prioritized list of waste treatment options, starting with waste prevention and ending with disposal.

Figure 7: Waste hierarchy



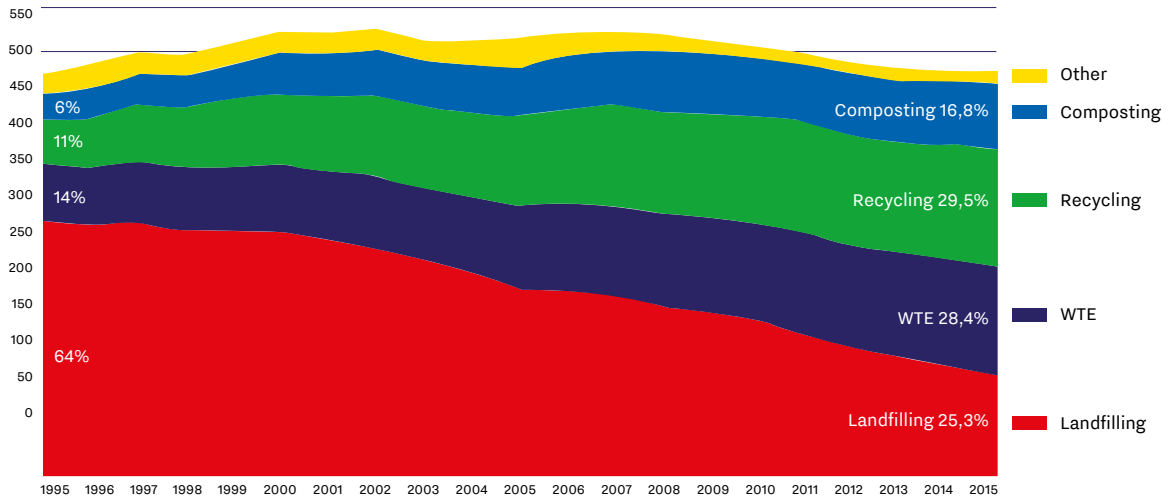
Source: Waste hierarchy as introduced by Ad Lansink as proposal in Dutch Parliament in 1979. www.recycling.nl

Composting facility in Surrey, Canada. ©Freek van Eijk

It sparked strong increases in costs and fees, which in turn led to more prevention and recycling. The private sector and individual municipalities started recycling activities and waste volumes for landfills went down drastically as can be seen in the graph below.

typically introduced at a base level and raised gradually over the years in order for society to adjust to the increased costs

Figure 8: Changes in E.U. generation & disposal of MSW, 1995-2015



Source: Eurostat data, graph by Earth engineering Center, Columbia

In the Netherlands, by 2010, most household, construction, demolition and industrial waste had vanished from the landfills. Composting, waste-to-energy and recycling facilities have become the pillars under the Dutch waste management system.

Developments in the European Union

In the EU, legislation has been introduced to encourage countries to better organize their waste system. Waste legislation at the EU level was set down in the Waste Framework Directive which gradually imposed higher and higher recycling targets and separate collection rules for different streams of waste. It also introduced new measures discouraging landfilling and incineration of waste. The Directive introduced an important legally binding decision making scheme in Art 4, notably the waste management hierarchy, in which prevention and reuse should be promoted.

The other regulation is the Waste Shipment Regulation. It set out the rules for cross border transport of waste. EU regulation laid out a minimum ambition level in the EU and outlined a path to a Level Playing Field. This created a (controlled) market and increased cross border waste trade for treatment of household waste, hazardous waste and of specific types of waste for which the national scale was too small.

In Europe, governments introduced economic steering instruments, with landfill taxes being a key element. The cost of the least desirable treatment option was artificially raised and made it less attractive compared to preferential treatment options. Landfill taxes are

In a subsequent step, the “polluter pays” principle was implemented through the concept of Extended Producer Responsibility (EPR).
This principle holds producers and importers financially and operationally responsible for the collection and recycling of their products as well as for safe disposal. The incurred costs should incentivize producers to put more sustainable products on the market. EPR moved the cost burden from municipalities (citizens) to consumers of the products covered by the system, notably packaging waste, batteries, car tires, electronic and electrical equipment. The funding generated by EPR allowed to put in place a much needed infrastructure for effective waste collection and processing that would otherwise have been very difficult to finance from public budgets.

In some countries, both public and private entities have invested at a large scale in waste incineration capacity (if combined with energy recovery, they are also referred to as energy from waste or waste-to-energy plants). These facilities with high investment costs have a long pay-back time and have to be in continuous operation. Modern facilities recover the energy content of the waste in the form of electricity and heat. Metals and non-ferrous metals are recovered from the bottom-ashes and part of the ashes are turned into aggregates for the construction industry. Prudent planning of waste incineration capacity (not more than the estimated future - non recyclable - waste fraction) has proven to be important, as they should not turn into obstacles for further increasing recycling rates.[17] Countries such as the Netherlands, with limited landfilling and a relatively high percentage of waste incineration, have introduced an incineration tax to make recycling options more attractive.

Recycled plastic waste, Source: Wecycle

Separation at the source

Waste is traditionally collected at the door. Initially, municipalities only collected unsorted municipal waste, with private companies or the informal sector focusing more on collecting valuables such as metals. The example below shows the Dutch current practice.

Figure 9: Waste collection in the Netherlands

	Curb side	Bring facility
Bio waste	Every other week	Recycling Centre
Paper / Cardboard	Monthly	Street container
Glass		Street container
Textile	Quarterly	Street container
Plastics	Monthly	Street container
WEEE		Recycling Centre / shop
Hazardous Waste		Recycling Centre
Bulky waste	On demand	Recycling Centre (> 20 streams)
Residual waste	Every other week	Recycling Centre

Effective recycling starts with easily accessible and user-friendly waste collection systems.
In many countries, separation at the source is nowadays obligatory to prevent cherry picking of the valuable components in easily accessible areas only when the market price is favorable.
By separating waste at the source, it is easier and often less expensive to retrieve value from the waste flow.
In Europe, a three bin system at households is quite standard. One bin for dry recyclable waste, another one for the organic fraction and one for residual waste. The dry recyclables are further sorted into monoflows in material recovery facilities.

Nowadays, it is not unusual for a household in Europe to separate its waste into paper and cardboard, glass bottles (in green, white and other colors), spent batteries, small electronics, light bulbs, organic waste, packaging materials, small chemical waste and residual waste.

Next to door-to-door collection, there are also environmental stations or Household Waste Recycling Centres (HWRCs), where people bring their (bulky) waste and separate it into even more fractions. HWRCs typically can accept 20 different flows of waste.

Citizens are increasingly stuck with a variety of garbage depositories and they can lose track of which type of waste goes where. In order to further incentivise waste separation, so-called “Pay As You Throw” (PAYT) systems have been introduced. With such systems, you pay more if you deposit more residual waste. Both volume and weight-based systems exist.

Sorting and recycling

For flows like glass and paper, a well-established collection and recycling infrastructure exists and these flows can come back for multiple life cycles.
Wet, organic waste is often the largest fraction of MSW and prevents recycling of the mixed fraction. If separated at the source, it can be turned into a quality compost or biogas by digestion. The biogas can be used for heat or electricity or even refined further into fuel or molecules. Plastics packaging can be sorted out into PET, PP, PE, beverage cardboards or foils.

Construction and demolition waste is a heavy fraction that takes up the majority of the overall mass of a country's waste. By mechanical recycling, elements such as metals, plastics and wood can be recovered and aggregates can be processed up to standards for application in road foundations or in concrete. Hazardous waste can be destroyed or neutralized and the energy content can be recovered for example in cement kilns or it can be stored safely and permanently in dedicated landfills.

Dutch waste streams to be sorted:

1. WEEE;
2. Asbestos;
3. A-wood & B-wood;
4. C-wood;
5. Soil, separated following legal classifications;
6. Gas tanks, fire extinguishers, pressure equipment;
7. Car tires;
8. Roof waste;
9. Expanded polystyrene foam;
10. Mixed stone material, not being asphalt or gypsum;
11. Gypsum;
12. Gross garden waste;
13. Hard plastics;
14. Mattresses;
15. Metals;
16. Paper and cardboard;
17. Textiles, not being carpet;
18. Flat glass

A Household Waste Recycling Centre in the Netherlands. Source: Modulo

Waste at the Khlong Toey Market, Bangkok's biggets wet market. ©Freek van Eijk

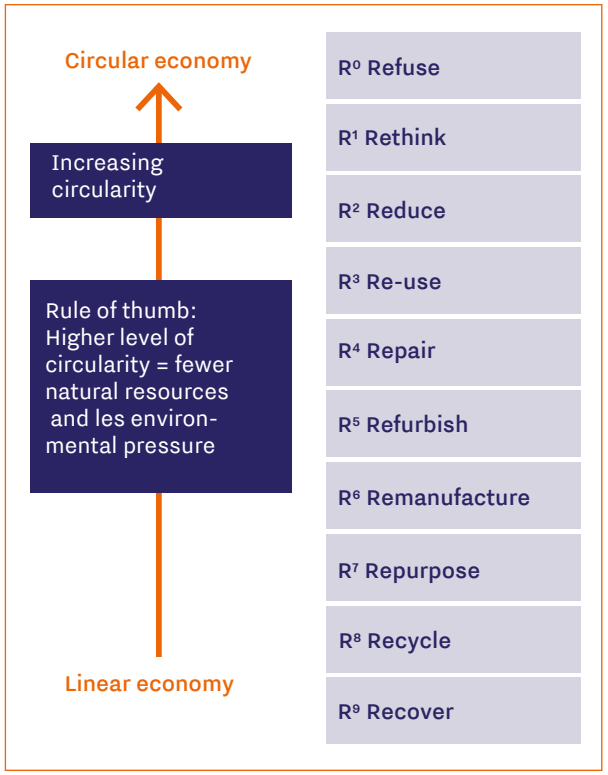
Waste management as a catalyst to a circular economy

The tremendous amount of waste produced is one of the most visible effects of the linear economy. Many products are still single-use. More people have started becoming aware of the damaging side effects of a linear economy. Depleting resources and international tensions make many people realize how dependent they are on goods from far away markets. This awareness has helped the circular economy rapidly gain ground.

Sound waste management, which includes the 3-R strategy "REDUCE, REUSE, RECYCLE", can be a precursor and catalyst to a circular economy. By tackling waste management, countries can improve health, hygiene, the environment and bring resources back into the economy.

Circular economy is building on earlier notions on the finiteness of resources and stresses the need for a paradigm shift in which societies need to move away from linear "take-make-discard" patterns in the production and consumption. Circular economy does not only deal with the last part of the chain, meaning recycling and recovery of waste, but with the entire cycle, including design, production, usage and the waste phase. The focus on eco-design includes the development of new business models and smarter and more efficient products, which last longer, consume less energy and are easy to repair and/or refurbish. It is also about reducing unnecessary consumption.

Figure 10: Levels of Circularity



Source: Rood and Kishna (2019), outline of the circular economy. PBL Netherlands Environmental assessment Agency, The Hague. Available at http://pbl.nl/en/publications/outline-of-the-circular-economy

In the quest for a circular economy, the 3-R strategy has expanded into a so-called 10-R approach. It involves making and using products smarter by Refuse, Rethink and Reduce. It is about product and parts life-extension by Re-use, Repair, Refurbish, Remanufacture and Repurpose. At the end of the value-chain it is about the valorisation of materials by Recycle or, if that proves impossible, the embedded energy by Recover.

Waste management has an important role to play in any circular economy scenario, it is the foundation that circularity can be built on. As stated before, without a sound waste management system a circular economy is not conceivable. That does not mean that one should aim at circularity only when a perfect waste management system is already in place. Waste is dealing with the past. Circular Economy practices keep materials in the loop today and good design can anticipate and prevent waste in the future. Circularity principles can help to avoid creating waste which could allow for some leapfrogging.

Moreover, the Climate Goals cannot be reached without a circular transition. A more circular economy can cut emissions from heavy industry by 56% in 2050 along three ways:[18]

- Materials Recirculation
- Product Materials Efficiency
- Circular Business Models

Waste management is part of the circular solutions. Adequate waste management can be 20% of the future solution,[19] instead of now being 5% of the Climate problem.[20]

As recently detected from space, methane emissions from organic waste in landfills are a main source of GHG emissions. By recycling and recovering organic and other waste into materials and energy, these emissions can be more than compensated and result in avoided emissions.

Proper waste management prevents health, hygiene and environmental problems and many valuable resources can be fed into the economy again, thus lowering the overall costs caused by poor waste management.

Circular economy and waste management actions contribute strongly to the SDGs as illustrated in the graph below.

Figure 11: Circular economy and SDGs

Topics	Statements	SDG
Chain management	Strengthening chain source management	
Prevention	Enlarging qualitive and quantitive prevention	
Re-use	Emphasis on re-use of products and materials	
Innovation	Constructive innovation by sustainable technologies	
Ecodesign	Circular product design (for recycling) and processing	
Recycling	Funtional up-, re- and downcycling	
Criteria	Establishing archievable recycling and energy criteria	
Responsibility	Shared responsibility of chain partners and government	
Instruments	Rapid implementation of financial policy instruments	
Climate policy	Firm relation to energy and climate policy	
Procurement	Stimulation of green public procurement	
Public support	Activating and ensuring public support	

Source: Ad Lansink. 2018. Challenging Changes: Connecting Waste Hierarchy and Circular Economy www.challengingchanges.eu

Mobile phones ready for recycling. Source: Closing the Loop

Source: Sweepsmart

Windmills at Kinderdijk. ©Luca Locatelli

The Netherlands: Small country, Big in waste management

“Waste does not exist”. This is the slogan of a Dutch waste company, meaning: if a product is designed, used and disposed of properly, every residual flow becomes a valuable resource again.

The Dutch Government adopted in 2014 a similar approach in its policy "From Waste to Resources": the recycling percentage of municipal solid waste should increase to 75% in 2020. Another 2020 goal was to lower the annual residual waste output to 100 kgs per citizen. In 2020 an average citizen produced 521 kgs of waste.

In September 2016, the Dutch government presented an inter-governmental national circular economy program "The Netherlands Circular in 2050". It envisions fully decoupling economic growth from resource utilization. The drivers behind this vision are fighting climate change, preserving biodiversity, creating less pollution and having better security of material supply. All in an economically viable and feasible manner.

To achieve these goals, the Netherlands has to take action at every societal level and set clear objectives. The first objective is ambitious but achievable: a 50% reduction in the use of non-renewable raw materials like minerals, fossil-based fuels and metals by 2030. The second aim is to have a 100% circular economy in 2050. This is even more ambitious and only achievable through international collaboration. In order to turn the set objectives for 2030 and 2050 into reality, the government signed circular economy agreements with a variety of stakeholders. On January 24th, 2017, the Raw Material Agreement was signed and in January 2018, five Transition Agendas for Biomass & Food, Plastics, Consumer goods, Construction sector and Manufacturing Industry were developed. In June 2018, the Dutch government endorsed these Transition Agendas. Soon after, the Implementation Plan 2019-2023 was published, including short and mid-term actions.

In the Netherlands, the process definitely did not start from scratch. In the 1970s, waste management was put structurally on the Dutch administrative agenda. In the 1990s, a transition took place in the waste sector, from a small-scale, inefficient and regionally organized activity to the current practice: a professional, internationally oriented and increasingly innovative sector. The results are impressive: nowadays around 81% of the waste is recycled, 16% is incinerated and only 2%-3% is landfilled.

A successful move towards a circular economy requires a solid foundation in sustainable waste management. In a 2013 EU-wide study, the European Union ranked the Netherlands, together with Austria, as the best performers in municipal solid waste management. The lack of space and a growing environmental awareness forced the Dutch Government early on to take measures to virtually eliminate landfilling of waste. This gave the private sector the confidence to invest more in sustainable solutions.

Dutch waste policy has five important elements:

1. The order of preference (the waste hierarchy)

The Dutch approach has been the 3Rs concept for long, but it has been extended to the 10Rs in the CE program: refuse, rethink, reduce, re-use, repair, refurbish, remanufacture, repurpose, recycle and recover (energy) and only then re-mine (meaning: landfill) the residues. An important note is that recently Dutch policies were adopted to start discouraging incineration of Waste-to-Energy, because, in the end, the deliberate and permanent loss of materials and resources has no place in circularity. Other new elements in the CE program include eco-design, design for disassembly, sustainable procurement and substitution of products with services.

2. Strict waste treatment standards

The policy is carried out, for instance, by setting standards for soil protection from landfilling, standards for the quality of secondary materials derived from waste (building materials), air quality standards for incineration, quality standards for organic fertilizers (from bio-waste), and a ban on landfills for 45 waste streams (waste streams that are suitable for recycling or incineration are not allowed on landfills). Since 2003, the Netherlands has worked on the National Waste Management Plan, which, after three versions, is currently redeveloped into the Circular Materials Plan. In this completely new plan, circular value chains have a central place. Materials, design and (long) use and reuse of products and materials define the input for the separation and recycling industry.

3. Cooperative approach

In the Netherlands, cooperation is considered key to effective waste management. Therefore, in 1990, the Waste Management Council was established. A voluntary agreement was signed between the three tiers of government to achieve a joint and coherent national approach in waste management. This Council's work ended in 2006 because all targets were met. The cooperation between the different tiers of government continues, however, to define policies, implementation and enforcement.

4. Extended Producer Responsibility (EPR)

EPR means that producers and importers are (co-) responsible for the end-of-life stage of the products that they put on the market. In the Netherlands, this responsibility is agreed upon voluntarily or through legislation (for WEEE, batteries/accumulators, End of Life Vehicles, car tires, packaging waste and plain glass). EPR is generally applied in combination with other instruments, e.g. landfill bans and landfill taxes. In a circular economy, EPR plays a big part in defining the roles of the different stakeholders, implementing the polluter pays principle and financing the waste management and recycling chain. Over time, EPR can be expanded to more product categories such as textiles and mattresses. Modulated fees can be introduced: for example, producers will have to pay a higher fee for materials or packaging that are difficult to be recycled. It helps to pave the way for design for recycling. Even mandatory minimum percentages for recycled materials in new products are foreseen as part of EPR agreements if the market does not take up these recycled materials for price reasons.

5. Various instruments to promote prevention and recycling

In the Netherlands, several financial instruments are applied, such as landfill taxes, incineration tax and volume-based waste fees. The tax in 2022 is at a level of €33,58 per ton for both landfilling and incineration.

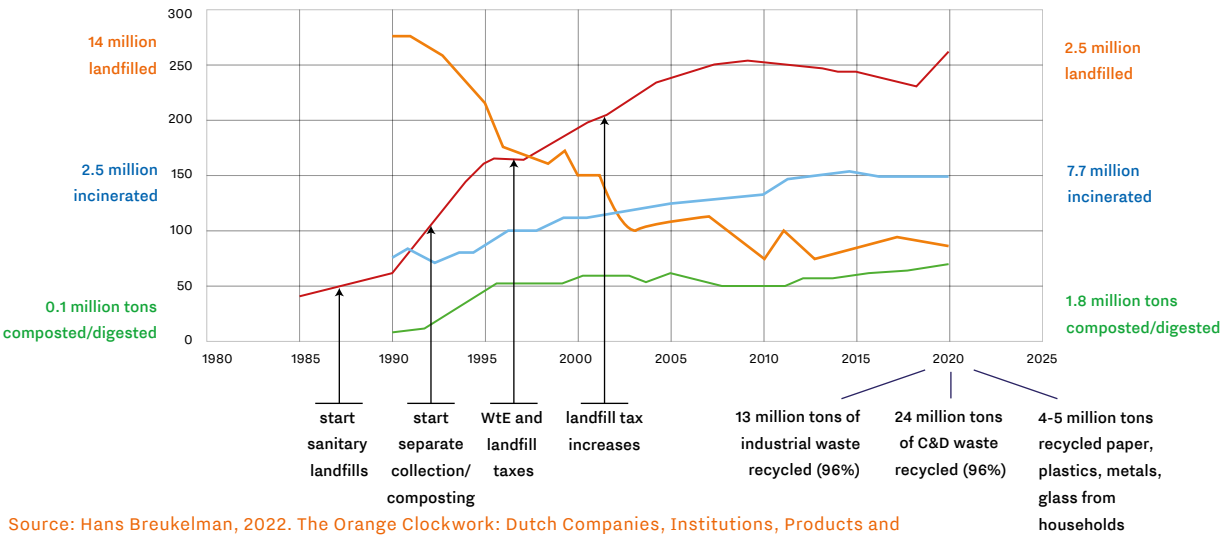
Economic steering instruments are considered effective in helping steer the waste toward the desired type of treatment. On average, households in the Netherlands pay less than €240 municipal waste tax per year per family. Close to 50% of the municipalities have introduced volume-based waste fee systems for household waste, also known as variable waste charging (or “pay as you throw”). As a result, Municipal Solid Waste (MSW) recycling rates in these municipalities tend to be above average, whereas total waste fees are lower.

Effective recycling starts with easily accessible and user-friendly waste collection systems, including systems for separate collection of recyclables such as organic waste, paper and cardboard, plastics, drinking cartons (tetra packs) and glass. Every municipality needs to have at least one household waste recovery center (HWRC) for (bulky) waste (or one for every 100,000 citizens in the case of large cities). The latest trend is “reverse collection”. It includes a service incentive by optimizing collection systems and collection frequency for recyclables but downscaling the service for non-recyclables.

A key element is raising community awareness through communication and education. It is essential to engage the public and to provide the necessary feedback on how successful (or not) these separate collection and diversion programs are and what they mean in terms of environmental quality or monetary savings.
Last, but not least: enforcement of legislation. An elaborate waste tracking and monitoring system must be in place to support enforcement.

The Netherlands has several waste management associations. The most important ones are the Dutch Waste Management Association (Vereniging Afvalbedrijven), info@dwma.eu, the public Royal Dutch Association for Waste Management and Cleaning (NVRD), post@nvrd.nl and the recycling branche BRBS, info@brbs.nl.
Rotterdam, The Netherlands is the home of the International Solid Waste Association, iswa@iswa.org.

Figure 12: Development of the average annual fee that households pay for household waste



Source: Hans Breukelman, 2022. The Orange Clockwork: Dutch Companies, Institutions, Products and Experiences on waste management and circular economy connecting to Asia. Netherlands Enterprise Agency.

Source: Renewi

Source: Theo Pouw Groep

Chapter 3

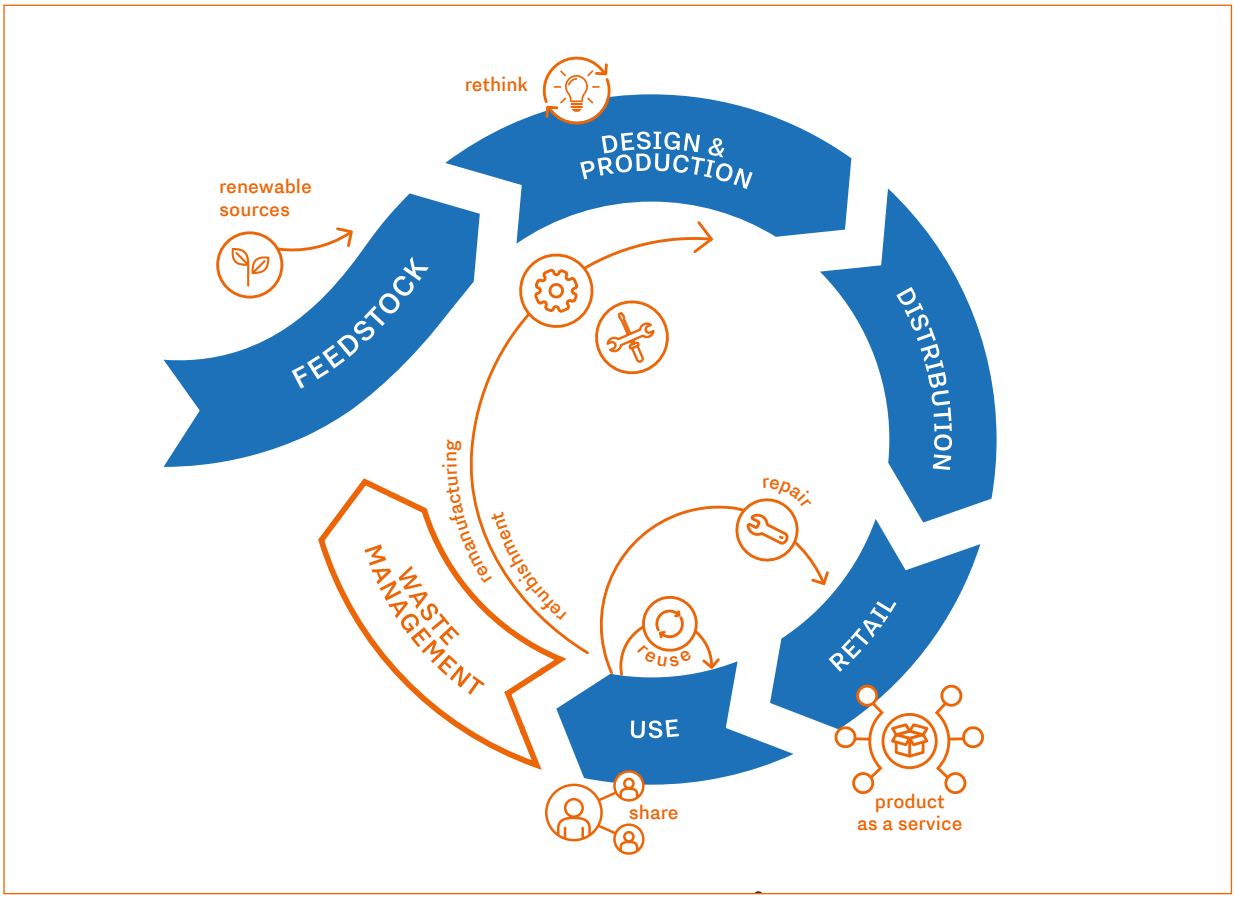
The Dutch approach and best practices

Best practices in waste management can be found following the waste management value chain from the beginning to the end and following various waste flows. This chapter describes Dutch best practices that have found their ways already to other countries and could inspire many more.

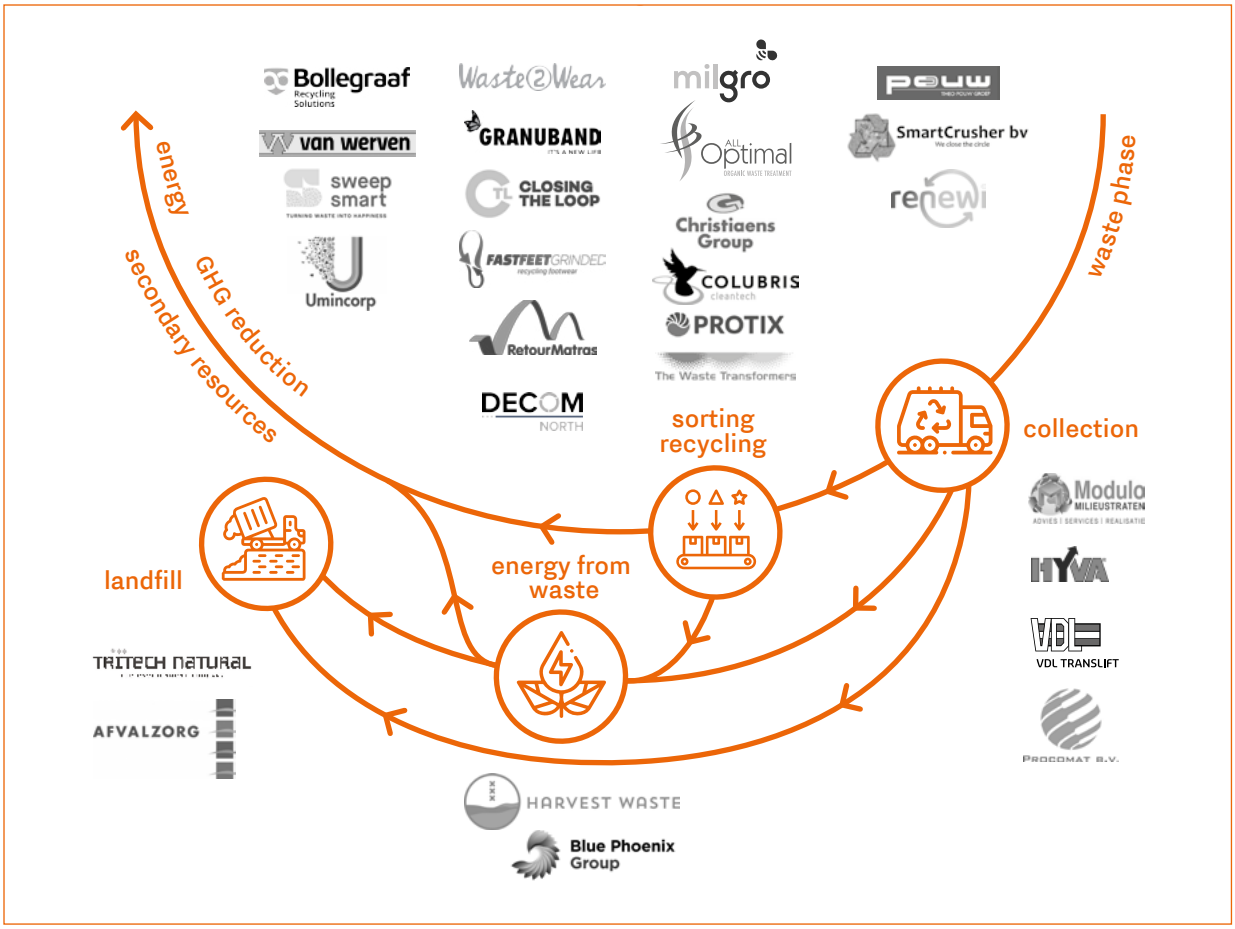
The chapter follows these segments:

- **Collection and waste management infrastructure**
- **Sorting and recycling**
  - **Paper**
  - **Glass**
  - **Organic waste**
  - **Construction & Demolition Waste**
  - **Plastics**
  - **Waste Electrical and Electronic Equipment (WEEE)**
- **Recovery**
  - **Hazardous Waste Treatment**
  - **Energy from waste**
- **Landfilling**

Circular Economy options



Zooming in on Waste Management



Source: Holland Circular Hotspot

Collection and waste management infrastructure

When people discard their waste, smart collection and (source) separation technologies can bring the waste back in circulation to enable valorisation.
Separate collection of waste has led to the development of advanced collection and logistics systems and vehicles. Nowadays, in the Netherlands, especially in the center of (historic) large cities, above ground containers have been replaced by underground containers for recyclables, such as paper, glass and plastics as well as residual waste. This system is aesthetically pleasing, more hygienic and more efficient. Several companies have developed systems for volume-based waste fees. Household Waste Recycling Centers can become easily adaptable modular environmental stations, even turning into a circular economy craft center.

HYVA

Hyva is one of the world's leading providers of innovative and highly efficient transport solutions for the commercial vehicle and environmental service industries through a large global support network. Logistics is the key to starting with the circular economy. Without proper environmental logistic solutions, waste will not be collected, transported, and transferred before further closing the loop. In Asia, Hyva has provided Refuse Collection Vehicles (RCV's), transfer stations (underground, mobile and static), or combinations of small collection vehicles (RCM) that can transfer into larger collection vehicles (Hyva Satellite Concept) for quick efficient improvements in the logistic chain.

www.hyva.com

VDL TRANSLIFT

VDL Translift produces waste collection vehicles for the collection of above and underground containers, offering logistic solutions based upon efficiency, safety, hygiene and trust.
Over the last few years, new collection vehicles have been developed and built in order to improve waste collection and transportation. One of its most promising vehicles is the sideloader, which enables waste collection (emptying of bins) with no additional personnel (one man operation). It works because the emptying process is operated from the side of the vehicle with a (semi) automatic lifter. The driver uses a joystick to operate the lifter, which can pick up different sizes of bins. This enables the driver to empty bins that are lined up along a street automatically. There is no need to leave the cabin, which results in a clean, healthy and safe process.

www.vdltranslift.nl

source: Hyva

PROCOMAT

Procomat designs and manufactures solar compacting bins and sells its solution currently in 17 countries and counting. Procomat shares the Netherlands government's goals of becoming 100% circular by 2050.
After extensive market research, the company designs with a focus on using the least amount of materials and energy. Only raw materials are used with a high recyclable worth. Modular design for a long lifespan is intended to only replace parts that need to. The supply chain is all located within a short distance from its facility, limiting transport. By working closely with supply chains, the company benefits from their expertise and both work in the most efficient way.

www.procomat.com

PROCOMAT B.V.

MODULO

Modulo-Milieustraten offers smart collection solutions with an affordable and easy-to-install drop-off facility for waste separation, which functions as a base for the next recycling steps, aiming to reduce illegal dumping and littering. The concept is simple: a drive-through offers multiple discard containers for different waste types. The installation allows flexibility (extension of installation) and application in different locations as it constructs quickly. Modulo offers the customers a Refund Guarantee and a Re-use-pool for the modular elements to support the Circular Economy. The Dutch drop-off innovation has already been implemented in Benelux, Germany and the Nordics States.

www.modulo-milieustraten.nl

Modulo MILIEUSTRATEN
ADVIES | SERVICES | REALISATIE

Sorting and recycling

Biowaste is often the most dominant component of Municipal Solid Waste.In the early nineties, source separation and separate processing of organic waste from households and markets became mandatory. As a result, Dutch companies have a long track record in composting and anaerobic digestion. Modern high-performing in-vessel composting facilities have been built. Organic waste material can also be digested in a closed system and used to generate electricity or converted into biogas. There are several companies with proven experience in the field of wet and dry anaerobic digestion of MSW, source separated organics, food waste or manure. New technologies on the market even convert biogas into biofuel. Think bio-economy: organic waste can even become a source for proteinstextile, building materials or essential chemicals. An important aspect of circularity is also whether parts and components (or structures as a whole) can be disassembled with ease and without damage. The better the de-mountability, or detachability, the higher the chances are for high-value re-use. A method to establish de-mountability has been developed for buildings: 'Circular Buildings - a measurement methodology for detachability v2.0' (Dutch).

Source: All Optimal

ALL OPTIMAL

AllOptimal is a young Dutch enterprise, combining waste treatment installation and realization experiences of more than 35 years, specializing in digestion and composting technology for biodegradable organic waste. The company's mission is the worldwide reduction of Greenhouse Gas emissions and the resolving of organic waste concentration with special PF-reactors while producing biogas (energy) and fertilizers.
Small scale installations are provided by the use of the BioBlox concept; a plug and play solution for companies who want to treat their own biodegradable organic waste in house or for organizations who aim to treat Municipal Organic Waste at neighborhood level.
Engineering services and turnkey solutions in this field are provided for both small and large treatment facilities.

www.alloptimal.nl

CHRISTIAENS GROUP

Christiaens Group is a global partner in the design and delivery of sophisticated In-Vessel Composting (IVC) technology for organic waste treatment. At present, approximately 1.000.000 m2 of composting area is in operation with Christiaens-technology worldwide (mushroom compost and waste treatment).

Products & Services

- Computer controlled, high quality composting tunnels.
- Automatic filling AND emptying machines for waste and compost handling.
- Air treatment systems to eliminate ammonia and odor.

Core themes

- Organic waste treatment
- Compost production

www.christiaens.com

Source: Protix

PROTIX

Protix breeds larvae from the black soldier fly and is the market leader in insect-based nutrition for healthy and sustainable feed and food. Organic waste from the food industry serves as feed for the insects. In turn, the insects are processed into sustainable ingredients such as proteins and lipids. These nutrients are used by Protix's customers as nutritious high-added value ingredients in pet food and animal feed. Insect ingredients are more sustainable ingredients than soy or fishmeal and help prevent overfishing and deforestation for soy cultivation. Protix contributes to a food system that is in balance with nature through the building of industrial insect facilities, providing the basis for a broad range of certified applications in feed and food.

https://protix.eu/

THE WASTE TRANSFORMERS

Food waste from businesses and communities has - when treated properly - tremendous value, financially and environmentally. The Amsterdam based The Waste Transformers develop and build modular, containerized anaerobic (meaning without oxygen, without smell) digesters ideal for urban environments, such as the hospitality industry. They are called Waste Transformers and turn daily between 350kg – 3000kg of food waste into biogas or electricity and heat, and natural liquid fertilizer, all at the site of the customer.

A Waste Transformer is placed next to a business that has food waste as a waste stream. With a short implementation time and positive business case, ease to operate and online monitoring of the daily processes, The Waste Transformers have become active on a global scale in a short time span.

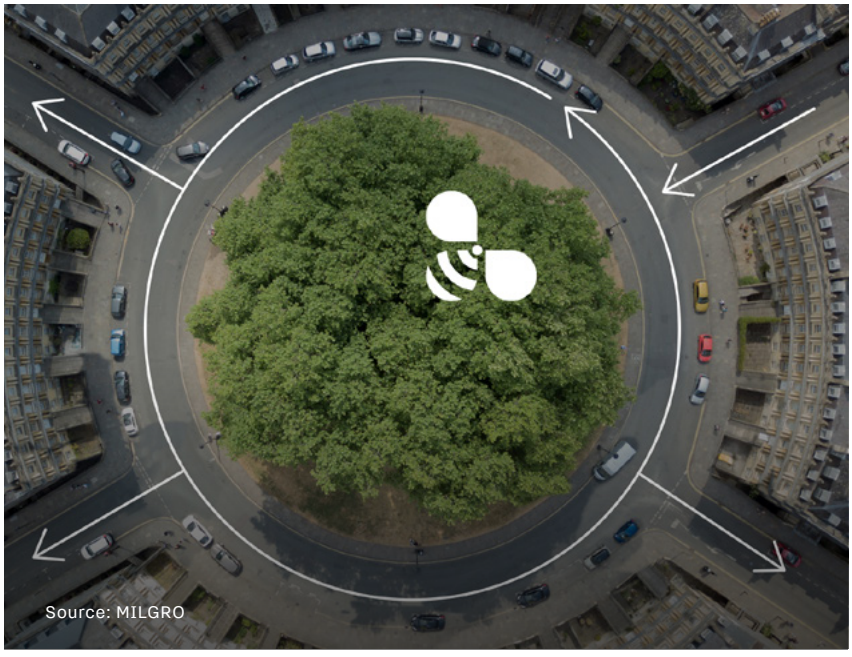
www.thewastetransformers.com

MILGRO

Milgro is the technology organization for managing natural capital. The company enables organizations to profitably integrate a sustainable use of natural resources into their business operations. In this way, they accelerate 'the new normal' of a circular economy. The demands and objectives to move towards a circular economy are challenging, especially in the food sector. Milgro supports its customers with a 3 step approach; 1) waste control, 2) waste avoidance and 3) raw material recovery.

Milgro closing nutrient cycle essential for a circular and sustainable food chain
A successful project, in which Milgro converted a phosphate-rich residual stream into a phosphate source for water treatment. This means that phosphoric acid, as a virgin stream, does not have to be purchased anymore by the client. As a follow-up development, Milgro has been investigating the possibility of implementing this program in other wastewater treatment plants with this sort of 'end-of-waste' approach. This resulted in the replacement of nearly 17.000 kilos of phosphate per year, which is equal to the size of 295 soccer fields.

www.milgro.eu


Source: MILGRO

Sorting and recycling solutions exist for a variety of flows and give the waste a second life as a material. Separation techniques to purify, sort and separate waste streams (from e-waste to residual and C&D waste) have a long tradition. Waste can be sorted and separated in many ways, by crushing and sieving, air separation, magnetic force, eddy current, heavy media separation, magnetic plates with magnetic liquids, near infrared techniques etc. An extensive infrastructure of separation plants is in place. These plants process C&D waste, commercial and industrial waste, bulky household waste, commingled recyclables and plastic packaging waste.

BOLLEGRAAF-LUBO

Together with the Nicollin Group, Bollegraaf designed, produced and installed a single stream waste sorting plant near Lyon, France. After a successful installation was accomplished within 16 weeks, the plant was inaugurated in September 2021. A wide variety of Bollegraaf and Lubo technologies has been implemented to ensure proper sorting of eleven different waste streams, among others cardboard, mixed plastics, PE+PP, clear PET, aluminum and ferrous materials. The plant outperforms local regulatory requirements for waste disposal with sorting capacities of up to 45.000 tons per year and exceptional performance and purity rates.

www.bollegraaf.com

Source: Sweepsmart

SWEEPSMART

SweepSmart builds safe, efficient and inclusive waste management systems for emerging economies. Having deep and long-standing experience in waste management around the world, the company tailors global best practices to the local situation. SweepSmart can provide support throughout the zero-waste journey: from consulting and design, to implementation and operational improvement. It always works hands-on together with local partners to achieve quick but long-term impact.
The company has set up 14 Smart Waste Centers that collect and sort waste for recycling (often run by informal waste pickers) and has worked in seven countries across South-East Asia and Sub-Saharan Africa. SweepSmart connects and creates, advises and engineers, develops and delivers.

www.sweepsmart.org

sweep smart
TURNING WASTE INTO HAPPINESS

COLUBRIS CLEANTECH

Colubris Waste Solutions designs and builds recycling facilities that allow various waste flows to be separated so they can be reused and upgraded. Separation technologies like screening, wind sifting and optical/advanced sorting are in the heart of the sorting lines. Composting or digestion steps are added in order to create complete waste-to-energy solutions. Although critical components are produced in the Colubris factory, cooperation with local partners ensures optimized results all over the world.

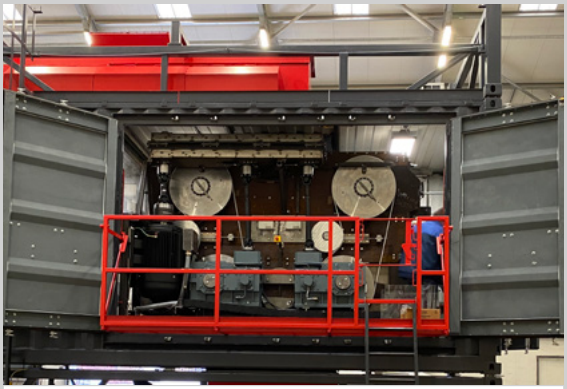
Colubris Cleantech consists of three divisions:

- Waste solutions: solid waste sorting lines
- Water solutions: wastewater treatment plants (e.g. leachate water)
- Bio resource solutions: extracting food grade proteins from vegetable waste

www.colubriscleantech.com

COLUBRIS
cleantech

Construction and demolition waste can be collected, sorted, upgraded and reused locally in roads or as secondary construction materials in close cooperation with the responsible government bodies.



SMART CRUSHER

SmartCrusher has developed a widely proven technique to make concrete rubble completely circular. The sand and gravel in virtually the original Particle Size Distribution (PSD) is recovered from concrete rubble and can immediately be reused in new concrete, yielding even better results.
After sieving and classifying, the cement fraction is also released cleanly without sand and is immediately suitable as a CO2-free raw material for the cement industry or as a concrete improver. In addition to the fact that the SmartCrusher cement fraction is CO2 free, it can also be used to make full-fledged cement using much less energy.

www.slimbreker.nl

SmartCrusher bv
We close the circle

THEO POUW GROUP

Since its foundation in 1981, Theo Pouw Group has been convinced that raw materials are infinitely recyclable. This leading supplier in civil engineering takes rubble, construction and demolition waste, asphalt and (contaminated) soil and processes them into high-quality secondary building materials using various techniques. The Theo Pouw Group produces high-quality concrete granulate, cleaned ballast gravel and thermally cleaned sand, cement substitute, granulate and gravel and also uses this for high quality applications. The concrete plants mainly produce so-called “green concrete” that consists of at least 30% to 50% recycled material as a replacement for primary sand and gravel. Research into how cement can be replaced is currently underway and it is expected that by 2030 concrete will be provided consisting of 100% recycled material. For the Floriade Expo 2022 in the Dutch City of Almere, cementless geopolymer concrete was used constructively for the first time in two circular bridges, a revolutionary milestone.

www.theopouw.nl/en

pouw
THEO POUW GROEP

Source: Theo Pouw

RWS

Rijkswaterstaat is part of the Dutch Ministry of Infrastructure and Water Management and responsible for the design, construction, management and maintenance of the main infrastructure facilities in the Netherlands. Together with Closing the Loop and Liggers2.0, Rijkswaterstaat has developed a method to deconstruct existing superstructures of bridges and overpasses made out of precast, prestressed concrete girders. After dismantling, the girders are transported to a hub where they are adapted for future use in a new bridge or overpass. Although the girders are designed to last for 100 years, they currently average only 40 years before being demolished. This innovation thus helps to make full use of their remaining service life. Through these pilots, the project partners have demonstrated that reuse of existing elements is technically feasible. This current consolidation of efforts and expertise can save up to 1400 girders for future reuse instead of being demolished to crushed aggregate.

https://www.nebest.nl/hoogwaardig-hergebruikte-viaducten-met-closing-the-loop

Glass and paper recycling have proven their value for many years.

MALTHA-RENEWI

Recycling glass is one of the many ways people can help reduce air pollution, cut waste and save energy. Historically, landfills contained a lot of glass objects, threatening safety and the environment. Today, this endlessly recyclable material is used to make new products, such as bottles.
Glass recycler Maltha, part of Renewi's Specialties Division, has invested in innovative (optical) sorting techniques such as the new spectrum-flash machine, which uses ultraviolet light to screen for heat-resistant glass.
Recycled glass has a life span beyond the norm, from high quality drainage layers in road construction to insulating glass wool and abrasive blasting. Today, the brick industry uses recycled glass dust as an additive which makes newly designed bricks circular – baking them at a much lower oven temperature than traditional bricks. A sustainable win–win!

www.maltha-glassrecycling.com/nl-nl

Textiles can be sorted out in many fractions and become the base materials for circular textile.

Regulation, economic steering instruments and Extended Producer Responsibility make it possible to recycle many other flows.

Plastics can be collected at the door or even retrieved from rivers and oceans, mechanically, chemically or even biologically sorted and recycled, and find a second life in new products or packaging.

VAN WERVEN

Since 2006 Van Werven has recycled post-consumer rigid plastics from household, commercial and building and demolition waste. After sorting, washing and grinding, the company sells its secondary raw materials to the plastics industry as a replacement of virgin plastics. Apart from saving raw materials, plastics recycling also contributes to lower CO2 emissions. In the EU, Van Werven has several recycling locations with a total capacity of 150.000 tons of end products a year.

www.vanwerven.nl | www.recyclingplastics.eu/

UMINCORP

Umincorp is working together with plastic product manufacturer Hordijk to make the plastic chain truly circular. Umincorp's innovative plastic recycling approach, based on Magnetic Density Separation, enables Hordijk to use recycled PET from household waste to produce food-safe and transparent plastic trays. This tray-to-tray recycling is one of the first in the industry. The quality of recycled plastic is comparable to that of virgin plastic, but the production requires 80% less CO2 than virgin plastic. Thanks to this innovation, household waste can now be used as a valuable resource and discarded plastic packaging can be turned into new packaging again.

https://umincorp.com

Umincorp

WASTE2WEAR

The best practice of Waste2Wear is their sustainable, transparent and traceable supply chain verified by blockchain technology. For this innovation, they won the World Sustainability Award in 2021. Their core business is to turn rPET (both pre-landfill and pre-ocean) into recycled fabrics and finished products. They also produce award-winning recycled polypropylene bags and packaging made out of discarded large domestic appliances such as fridges and washing machines, plus single use food containers. QR codes on all products show the provenance of the raw material and trace the supply chain with a variety of photos and unique string numbers and codes.

www.waste2wear.com/our-offer/blockchain

Waste2Wear

Extended Producer Responsibility organizations have been set up in the nineties to deal with different waste components. The government intervened in a way that collective schemes had to be implemented for consumer waste. The Netherlands has one (non-profit) recovery organization for each waste stream: car recycling,


Source: Umincorp

recycling of e-waste, collection/recycling of packaging waste (including plastics), collection/recycling of batteries. These organizations can be considered chain managers. They organize and monitor the system by contracting all operations (collection, recycling, etc).

Waste Electrical and Electronic Equipment, rich in (rare) metals can be collected and recycled using innovative business models and technologies.

CLOSING THE LOOP

Across the globe, companies, consumers and governments increasingly see value in aligning their crucial devices - such as phones - to their values. Doing so creates employee or customer engagement and delivers brand value. However, buying hardware in a ‘circular’ way is difficult for an individual buyer.
Closing the Loop`s service, waste-compensation, offers a safe and attractive starting point towards ‘circular tech’. When a customer buys/leases a new device, a small fee is added per device. That fee is used, by Closing the Loop, to recycle an equivalent amount of electronic waste in a country that lacks formal waste collection systems. The waste reduction is used to make the new device waste-neutral.

https://closingtheloop.eu/greener-procurement-safe-solid-and-engaging

CLOSING THE LOOP

Innovative solutions exist for end-of-life vehicles and tires , as well as end-of-life wind turbines.

GRANUBAND

In the Netherlands alone, over nine million car tires are replaced every year. To reduce the burden on the environment, Granuband collects these used tires and recycles them. Every year, Granuband processes about four million used vehicle tires. Used tires that meet the company's quality standards are given a new lease of life. Those that don't are shredded for recycling so the company can make new, circular products from the rubber granulate, which Granuband markets under the brand name Granuflex. Fitness centers are a key sector for Granuband. One of its first clients in this area is Rogue Fitness, to which the company supplies its Granuflex fitness floors. Rogue supplies these floors to fitness centers throughout Europe.

https://www.granuband.com/en/projecten/rogue-fitness/

GRANUBAND
IT'S A NEW LIFE

DECOM NORTH

The wind turbine industry is committed to promoting a more circular economy and determining how it can support this. A sustainable process for handling end-of-life wind turbines is needed to maximize the environmental benefits from a life cycle approach. Decom North offers a dismantling method in which the materials are processed in a circular manner.
The consortium processes the composites mechanically and chemically so that new basic raw materials such as recyclate and glass- and carbon fiber remain in a flake form. These flakes can be transformed into any desired shape via a heating and injection molding process.
The consortium has completed successful tests and manufactured products such as sheet piles. In 2023, a test factory will be set up that will process composites into new products on a larger scale.

www.decom-north.com

DECOM
NORTH

There are even innovative recycling solutions for mattresses, diapers, often the most voluminous waste fraction of young families, or sporting shoes.

FAST FEET GRINDED

Fastfeetgrinded has developed a unique process to recycle all kinds of shoes. In this process the company sorts and recycles the shoes to create new raw materials out of the recycling process, such as: rubber, eva, fibers made from shoe uppers, leather, ferro- and non-ferro materials. The main goal of FastFeetGrinded is to use the raw materials in the production of new shoes. To prove the purity of the raw materials, the company has created a casual sneaker that contains 70% of its raw materials produced by the FFG technique. The development of new products is also among Fastfeetgrinded`s goals. Opportunities for reuse can be found in playgrounds, flip flops, clothing hangers, etc.

www.fastfeetgrinded.eu

RETOURMATRAS

RetourMatras is a Dutch mattress recycling company that stands for 100% mattress recycling. Thanks to the unique RetourMatras method, the company contributes to less waste, reduces CO2 emissions and, above all, optimizes the reuse of raw materials. New raw materials are created from discarded mattresses and these are used for new products such as bicycles, insulation materials and (coming soon!) the circular mattress. RetourMatras accomplishes this by entering into circular partnerships and closing the chain. The company is currently entering the European market with the mattress recycling concept. In this way, RetourMatras wants to ensure that no more mattresses disappear into the incinerator and that all materials are fully reused through sustainable mattress recycling.

ww.retourmatras.nl

Source: Fast Feed Grinded

Hazardous waste like contaminated sludge, paints and liquid waste (tanker cleaning) can be treated in a fully integrated plant through pyrolysis, rotary kiln and a water treatment plant. Other companies produce new aggregates and filler out of C&D waste and contaminated tar asphalt and contaminated soil. Some are specialized in the recovery of precious metals from waste, and others in the recovery of solvents.

Recovery

Waste that cannot be recycled can be energetically recovered in highly efficient state-of-the-art waste-to-energy plants. These companies can turn residual waste into value by using excess heat locally, recovering and processing bottom-ashes and minerals.

HARVEST WASTE

Harvest Waste improves waste management systems in countries where populations and waste volumes are increasing but the resources and technology for sustainable waste management are lacking. Its High-Efficiency technology developed by the municipality of Amsterdam is carbon negative and it is widely known as “beyond Best Available Technology”. It operates well below the most stringent emissions levels worldwide and produces more electricity per ton of waste than any other waste to energy plant in the world. This is recognized by, amongst others, DNV GL and the Dutch Ministry of Infrastructure and Water.

www.harvestwaste.com

HARVEST WASTE

BLUE PHOENIX

The increase in municipal solid waste (MSW) in the past decades is a major environmental and societal concern. Waste management technologies have continuously improved to recycle and manage waste to minimize the impacts on the environment. Nevertheless, a great proportion of our waste cannot effectively be recycled. The incineration of MSW for energy recovery is an effective way to utilize the so-called “non-recyclable” portion, reduce waste volume and replace fossil fuels to generate energy for our society. The energy recovery process liberates valuable resources that can now be extracted from the ash residues and recirculated in our economy. Blue Phoenix Group operates incinerator bottom ash (IBA) processing installations globally and helps the Energy-from-Waste (EfW) sector with an alternative sustainable solution for IBA. The company processes the IBA and extracts valuable resources such as mineral aggregates and metals, preventing valuable resources from ending up at landfills.

www.bluephoenix-group.com

Blue Phoenix Group

Landfills

AFVALZORG

AFVALZORG is a specialized landfill company in The Netherlands. Afvalzorg supports governments and commercial companies worldwide on improving landfill management. A special focus is on landfill gas project development and CO2 emission reduction. Together with their partners, Afvalzorg brings all expertise, technology and financing to the table for landfill gas projects. This also includes closing and capping of (part of) the landfill.

www.afvalzorg.com

TRITECH

Tritech develops and provides its clients with state of the art technologies for safe sanitary landfilling: Trisoplast Mineral Liners (www.trisoplast.com) and Multriwell Intensive Landfill Gas Extraction (www.multriwell.com). Eye-catching projects carried out by Trisoplast include the total covering of the 56 hectare landfill “Derde Merwedehaven” in The Netherlands plus the fact that Trisoplast is the prescribed method of landfill isolation in The Netherlands. In fact, virtually all bottom liners and top covers in the Netherlands are constructed with Trisoplast.
The Multriwell landfill gas extraction technology has successfully been installed in numerous landfills worldwide, solving environmental, climate and health issues and providing high amounts of landfill gas for further utilization.
Both Trisoplast and Multriwell can make the difference in landfill management worldwide.

www.tritechnatural.com

Concerning Energy from Waste, only non-recyclable residual waste is incinerated and will generate electricity, heat and steam (including for district heating). All 12 Dutch Waste-to-Energy (WtE) plants are very innovative and state of the art. There is no risk for dioxin emissions and all plants meet high energy efficiency criteria (100% of the Dutch capacity meets the European R1 criteria). Many of these plants also incinerate waste from abroad (e.g., UK and Italy) and some help power Ecoparks, circular waste management hubs which aim to replace landfills by extracting as many valuable resources from waste as possible. There are companies focusing on the recycling of bottom ashes and others even capturing and utilizing the CO2 emissions of their incinerator.

The Netherlands is a flat country, the delta of large European rivers, with high groundwater tables. Due to these complicated geo-hydrological conditions, landfilling continues to be an area of outstanding expertise. The remediation of old dumpsites also has a long tradition because of the scarcity of space.

The Netherlands has extensive expertise in the extraction and treatment of gas from landfills. Appropriate capping combined with a high-tech and highly efficient gas extraction system allows for optimized extraction of the harmful gasses. Innovative techniques developed by Dutch companies allow for faster gas extraction and efficient treatment.

If you can measure it, you can manage it. Good data management practices highly contribute to effective waste management.

Many Dutch consultancy companies can provide support you by designing the best solution for a particular waste situation or help to set up a regulatory system, or even evaluate the stage of development of the waste management and circular economy sector in a particular country or region.
The Netherlands is home to internationally renowned consultancy companies with extensive expertise in (feasibility) studies and the design of waste management systems. ICT support systems are also available.

Note that the best practices from companies mentioned in this chapter should be considered examples. There are more Dutch product and service suppliers to the waste sector.

Source: WeCycle


PLASTIC
TAKES
500
YEARS
TO
DECOMPOSE
@LilacCompany
Mogul X
ONMOGUL.COM/MOGULX
SKULL N TONES
Unsplash

Chapter 4

A Pathway and Action Agenda

This last chapter aims to translate intentions into actions by exploring the roles to be played according to the triple helix combination of actors.

Which actions can governments and academia take today to move towards a sound waste management industry infrastructure that can act as a cornerstone in a transition? It contains a.o. a system toolkit, an economical instruments toolbox and a pathway to set up a waste management system from scratch. This chapter does not intend to cover all aspects in detail but rather will present our choice of options. To make it less theoretical and more tangible, a waste management action agenda proposal for the Latin American (LATAM) region will be used as an example.

Agbogbloshie e-waste dump, Accra, Ghana. ©Freek van Eijk

Unsplash

Toolbox

What should be in the toolkit for setting up an adequate waste management system? Based on the experience in the Netherlands, the following critical content factors are considered crucial:

- Introduce a “waste hierarchy”, the order of preference for waste (in the Netherlands since 1979)
- Set minimum standards for treatment of specific waste types
- Introduce separate collection of valuable waste streams like plastics
- Waste Management needs financing: introduce economical steering instruments
    - Introduce landfill (and later incineration) taxes combined with landfill bans for specific waste flows
    - Set up Extended Producer Responsibility (EPR) systems in close collaboration with federal and local authorities plus producers and importers while aligning closely with consumers and waste managers

Essential system aspects:

- Set up an adequate waste infrastructure planning system as waste management professionalizes. In due time, the municipal and sometimes even the national level will no longer be sufficient to handle all types of waste
- Introduce a (municipal) waste tax that covers all costs including for example landfill after-care
- Make sure that there is cooperation between authorities at municipal, provincial and national level for example on regulations, infrastructure planning, enforcement and communication
- Waste management needs action of us all! This requires a quadruple innovation by involvement of authorities, knowledge institutes, industry (including waste management companies that bring in waste management technology and efficient practices) and consumers
- If you want to manage something you have to be able to measure it. It is highly suggested to organize consensus on data
- Waste management has a value-chain deficit. Waste is like water: if uncontrolled, it flows to the lowest point. Monitoring and enforcement of the system are an essential part to steer waste in the desired direction of the waste hierarchy

The importance of regulation of cross border waste flows

As waste has a negative value, it often flows to the waste management treatment option with the lowest cost or to countries with the lowest cost under the pretext of recycling. Waste shipment limitations can boost national waste management and CE plans which is illustrated with the example of plastics.

Until 2016, China imported two-thirds of the world's plastic waste, mostly mixed or of low quality, everything unwanted and too hard to deal with for other countries. However, due to new national goals of boosting China's own circular economy and recycling capacity, and getting in the critical spotlight of a more and more sustainability-aware global community, China announced to the World Trade Organization to put in place contamination standards for imported plastic waste in July 2017. In 2018, this Act, known as the Chinese National Sword, was enforced, which suddenly banned imports of eight types of plastic. Malaysia, Vietnam, the Philippines and Thailand, also known for waste export opportunities, have started to follow China's example by setting higher quality standards on imported plastic waste to keep up with their own sustainability goals. The reduction of low-quality plastic waste trade forces exporting countries to deal with their own waste, stimulating better waste management and recycling systems.

Since 2019, solid plastic waste has also been recognized by the Basel Convention, which aims to limit global trade in hazardous waste, and therefore prohibiting contaminated plastic waste export. Unfortunately, guidance and enforcement tools are not provided which weakens implementation.

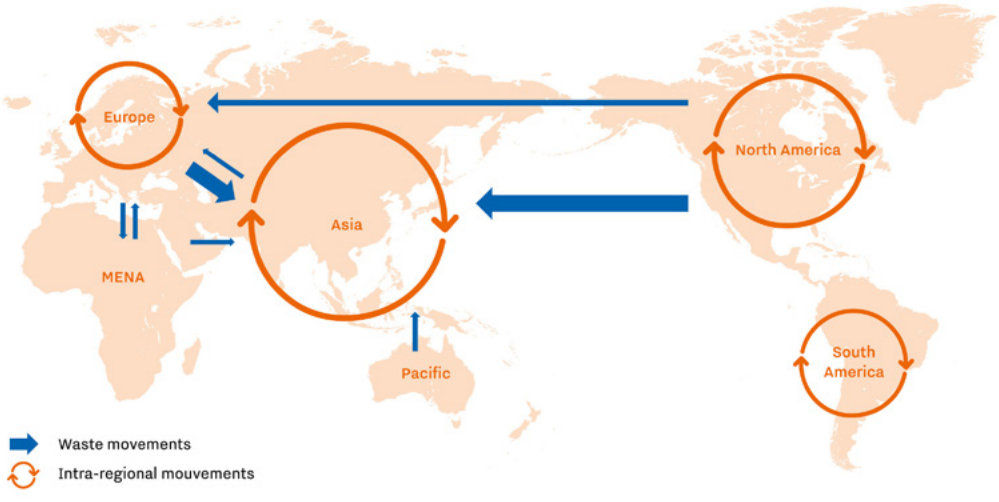
Plastic exporters are now required to notify and obtain consent from importers for mixed plastic bales through the Prior Informed Consent procedure. Waste exporting countries confronted with the impact of China's Operation National Sword are, however, slowly taking responsibility. As an example, in November 2020, the Australian House of Representatives passed the country's first Recycling and Waste Reduction Bill that bans the export of waste plastics, glass, tires and paper. The law also modernizes product stewardship regulation.

Transnational trade in plastic waste

Source: Interpol (2018)

Emerging from interpol data collection bases on 39 countries contributions

Source: Strategic Analysis Report Interpol 2018.



Setting up a waste management system from scratch

Countries have diverse economies, geographies and therefore waste characteristics. There is no single approach that offers guaranteed success in setting up a waste management system. Below are some observations of goals that have been proven successful in the transition to a sound waste management system.

Short Term Goals

- Extend waste collection service to 100% of the population
- Create awareness and change citizens' attitude toward waste
- Close dumpsites and construct sanitary landfills, taking into account apex, opex and post closure costs

Mid Term Goals

- Separate organics and treat them
  - Biodegradable waste: source of methane, leachate and pest animals on landfills
  - Largest fraction in household waste (60%-65% in developing countries)
  - High value compost and biogas when processed
  - Low cost options available: windrow composting
- Collect the dry recyclables (commingled and glass separate)
- Introduce a fee system to cover the cost (and explain the costs)
- Introduce a monitoring system
- Divert from landfilling

Long Term Goals

- Plan and license incineration capacity only for non-recyclable waste
- Stringent environmental standards for all operations and products
- Introduce Extended Producers Responsibility for recyclable products
- Move to a circular economy
  - in parallel to developing waste management
    - Waste is dealing with the past
    - You can deal with today's flows by sharing models and products as a service
    - You can work today on the products of tomorrow by design

A vivid discussion on Energy from Waste: is it part of a circular economy trajectory?

As long as products are not designed for reuse and recycling, incineration has a place in the waste hierarchy. In countries that still dispose of 60%-70% of their MSW in non-sanitary landfills and lack waste management infrastructure, it can buy time in strongly urbanized environments to set up a desired waste management infrastructure as a first step towards a Circular Economy. It is a temporary step and capacity should only be erected for the volume of non-recyclable waste in a country. Incineration should ideally be combined with source separation and recycling of recyclable flows or post-collection sorting to make sure that only non-recyclable waste enters the incineration facility.

By source separation of organics (that can be composted or digested), the residual waste for incineration becomes less wet and, depending on the amount of paper or plastics removed, sometimes the caloric value increases.
Regulation can set minimum treatment standards for specific flows. For example recyclable flows can be forbidden to be incinerated.

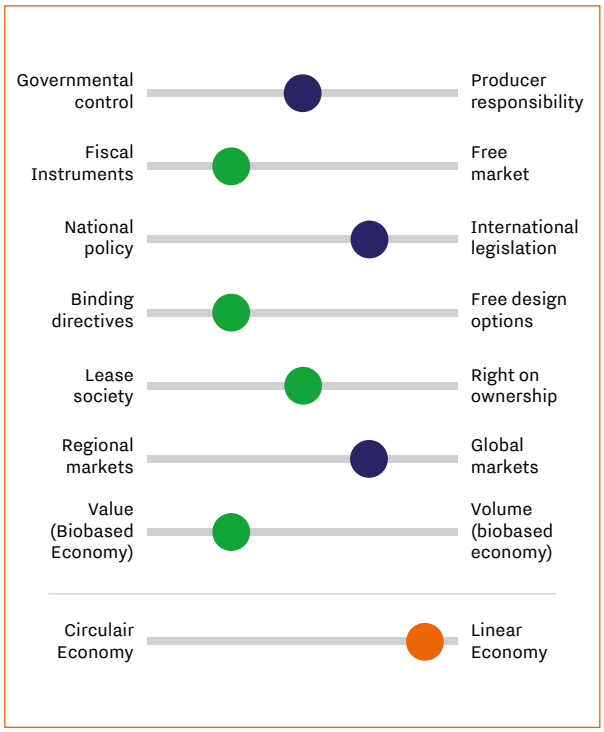
Strong EU-style environmental criteria should be applied to the permitting of facilities.
The focus should be on maximum extraction and reuse of energy and residual heat and extraction and reuse of resources from residual flows like bottom-ashes or even CO2. In this manner, waste incineration facilities can become regional energy and resource hubs.
Central capacity planning is key in order to prevent over-capacity and a lock-in situation that according to many, but not all, experts might be an obstacle for further increase of recycling. Economic steering instruments can enforce the hierarchy. In countries that have successfully reduced landfilling, taxing incineration can help to steer flows towards recycling.

Policy choices

Waste is everywhere, it is highly visible, people have to pay for it and everybody has an opinion on it or is linked to it. That makes changing waste management a political risk factor at the local level.

As visualized below: in most cases, the transition of a linear economy to a circular economy generates dilemmas in different political, social and economical arenas. At times it requires a delicate balancing act between contradicting or opposing options.

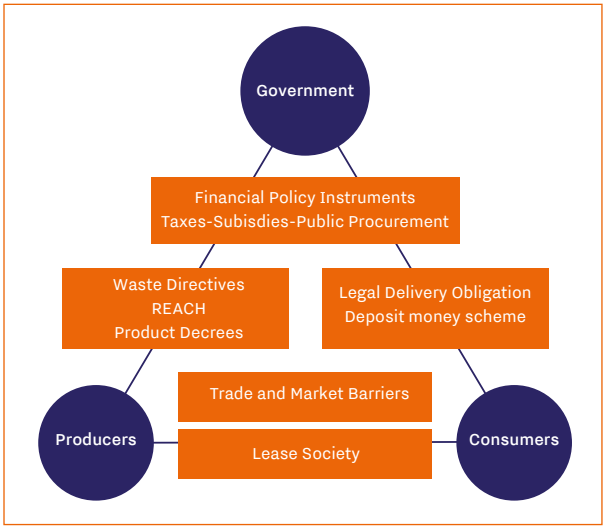
The choices in the graph may be subjective but they illustrate the struggle. The green dots intend to represent promising choices. The blue dots concern difficult choices. The orange dot shows that closing the loop needs a lot of work.



Source: Several presentations of Ad Lansink about Challenging Changes during 2018-2020

In the triangle of government, producers and consumers, different policy instruments are used on each side of the relationship. Financial policy instruments regard both producers and consumers. The same is true for trade and market barriers.

Figure 14: Policy instruments



Source: Several presentations of Ad Lansink about Challenging Changes during 2018-2020

As waste management becomes more intertwined with geopolitical resource strategies or circular economy policies, governments have the option to set the direction and create boundary conditions.

In 2016, the Dutch government created a moonshot ambition to become fully circular in 2050 and to reduce non-renewable resource use by 50% in 2030. In collaboration with society stakeholders, the Government designed specific plans for five priority markets (or transition agenda's) and organized a set of interventions (regulation and policies, market incentives, access to finance, adjusted R&D agenda, programmes aimed at behavior changes and international collaboration).

In the table from Material Economics below, the elements of a policy agenda can be found related to material recirculation, produce material efficiency and circular business models.

It is clear that the approach goes beyond waste management and involves actions in the whole value-chain and stimulates the creation of new markets by breaking down less desirable aspects and stimulating initiatives that are highly needed.

	SET THE DIRECTION	CREATE ENABLERS	LEVEL THE PLAYING FIELD	TAKE GOVERNMENT ACTION
MATERIALS RECIRCULATION	Targets for high value recycling Improved transparency and statistics for waste and recycling	Support for innovation and technology development Standards for secondary materials Waste regulations and landfill bans Regulation of long-term destructive practices (e.g. copper, additives)	Carbon pricing Extended producer responsibility Quotas or other support for demand Improved end-of-life handling (e.g. shredding, demolition) Product design (e.g. Ecodesign directive)	Public procurement Waste regulation systems
PRODUCT MATERIALS EFFICIENCY	Targets for efficient materials use and re-use in key sectors Materials passports and documentation	Information systems and platforms (e.g. BIM) Labelling schemes for materials efficiency in construction etc. Fund innovation and technology development	Waste charges Support for design for disassembly	Stimulate re-use and recycling markets Require high materials efficiency (re-use, design for disassembly etc.) in public procurement
CIRCULAR BUSINESS MODELS	Improved evidence base and conviction about benefits of shared mobility and buildings Endorse shared mobility systems as target vision	Create supportive city regulations (e.g. parking for shared cars) Revise barriers in existing regulations (e.g., insurance) Adapt data regulations to support in new business models	Pricing or regulation of congestion, air pollution and other externalities Include efficient materials use or labelling in building standards	City plans for longevity and adaptability of buildings Integrate car sharing with public transport systems

Source: Material Economics - The Circular Economy A powerful force for climate mitigation Transformative innovation for prosperous and low-carbon industry (May, 2018). Published by SITRA, European Climate Foundation a.o.9.1% circular,leaving a massive Circularity Gap.

Evolution of waste management the example of the LATAM region

Source Market opportunities in the waste/circular economy sector in eight countries of Latin America

A helicopter view of the evolution of the waste management sector starts with (1) collection (waste out of the way for health reasons), (2) control and technical fix (focus on environmental protection through e.g. controlled landfills), (3) integrated policies (diversion from landfills through e.g. recycling and EPR) and (4) circular economy (integrated chain approach and waste as a resource).

In many countries, for example in the LATAM region, waste management hovers around phase 2. This means that waste collection tends to be pretty well-organized with good coverage, but waste disposal leaves much to be desired and recycling rates are as yet low.

The waste management and circular economy sector is highly dependent on good governance, planning and enforcement. All the investigated countries (Mexico, Costa Rica, Panama, Colombia, Ecuador, Peru, Chile and Argentina) have a national waste management framework. Half of them have adopted Extended Producer Responsibility (EPR) legislation and some countries even have a circular economy strategy or roadmap. No doubt these are important and promising developments, but target setting and particularly enforcement is still poor. The lack of regulation and enforcement means private companies never know if their market and/or concession is stable and protected. There is always a risk that lower treatment options (in terms of the waste hierarchy) will be allowed or not be enforced.

Informal waste pickers still play an important role in the collection of recyclables. As a result, recycling rates are low; only materials with a positive market value are collected. The informal sector has made important first steps in recycling, but it is time to professionalize collection, increase the scale of recycling activities and improve working conditions. Authorities will have an important role to play: “pricing” waste by means of landfill taxes, landfill bans and EPR. When these policies are introduced, waste pickers can become employees or even entrepreneurs in the expanding markets because there is a benefit to be gained by collecting and processing recyclable materials.

Waste disposal sites are a prime concern. Apart from the problem of illegal waste dumping and burning, too much waste still ends up in small uncontrolled dump sites where it threatens (human) health, groundwater quality and the environment. Small landfills are not the solution. It is important to centralize landfills and increase the scale of operation. Therefore, many countries are developing plans to close illegal dumps and move towards regional controlled landfills. In this process, they are facing problems of land scarcity, increasing public resistance and sometimes political differences between municipalities. Problems are getting worse and the pressure to solve them is mounting.

The largest component of Municipal Solid Waste (MSW) - the organics – are still sparsely recovered and treated, causing many of the problems on the waste dumps (methane emissions, leachate polluting the subsoils and pest animals spreading diseases). Climate change mitigation programs can be a vehicle to get things in motion. Using the compost to enhance the organic content in soils prevents deterioration of the soil quality and increases crop production. Organic waste treatment can solve a waste problem, a soil problem, an air problem and even an energy problem in one go.

Construction and Demolition (C&D) waste is getting higher on the agenda of authorities in the countries studied, since it is a big part of the overall waste stream, especially in terms of weight. Representatives of the waste sector in the countries studied are asking for options to properly treat and reuse C&D waste. Traditionally, C&D waste has been used a lot in the foundation for roads (and indeed, many roads in Latin America could use a solid basis) and as granulates in new construction materials. However, business models that are valid in the Netherlands would need a serious makeover before application in Latin America.

Same as in many places in the world, packaging materials and especially plastics are making it to the priority list of the authorities in the countries studied. As an example, two years ago, the Colombian Industry Association (ANDI) developed a strategy to implement a nationwide system of Extended Producer Responsibility (EPR) for Packaging. More recently the NGO Recíclame did the same in Perú.

Authorities are becoming increasingly aware of the specific challenges surrounding special waste streams such as e-waste, mattresses and pharmaceutical/hospital waste. The relatively small quantities (especially in countries such as Costa Rica and Panama) mean that in some cases (same as in Europe), proper treatment will have to be organized on a trans-national scale.

In the LATAM region, the waste management sector is underfinanced. Many countries do not have a waste tariff framework in which citizens pay a waste tariff or a waste tax based on real costs. As a result, citizens are not aware of the costs of waste management services and have no incentive to minimize these. Additionally, financial and economic tools such as landfill taxes or EPR legislation are often not in place. Therefore, public authorities are reluctant to grant concessions for treatment (a guarantee for minimum delivery of waste per year at a minimum price for a certain time). Concessions reduce the risks for the investors and give them an opportunity to earn back their investments. There is a lot of ground to cover in this area.

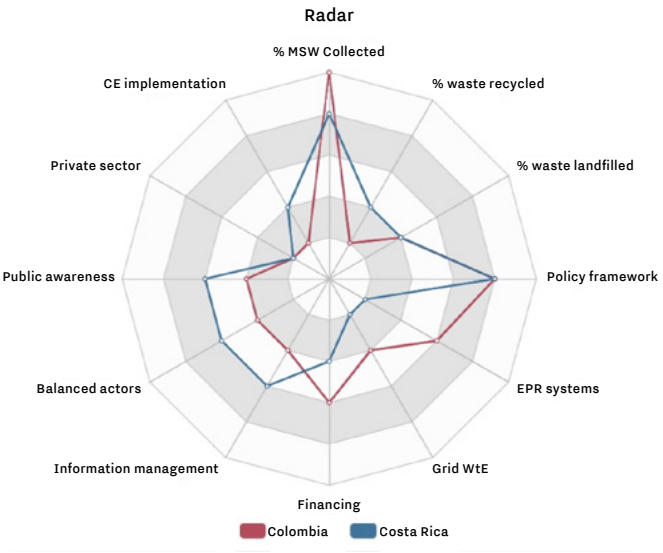
As the saying goes in the Netherlands: “to measure is to know”. Proper data management is the very foundation of sustainable waste management. The project team found that in none of the target countries waste management data is collected and managed adequately and consistently.

In all target countries, there is a lack of public awareness and education concerning source separation and reducing the generation of waste. From a business point of view, public awareness may sometimes be a nuisance in the short term, but in the long term it almost always turns out to be a positive driver for change.

In most target countries the project team encountered a keen interest in the concept of the circular economy. In some cases (e.g., Colombia and Chile) a CE strategy has been developed, in others this is still in a preparatory stage.

MATURITY MATRIX

The so-called “Maturity Matrix on Waste and Circular Economy” is a user-friendly tool to evaluate the stage of development of the waste management and circular economy sector in a particular country or region. It was developed as part of a Holland Circular Hotspot market study on waste/CE in eight countries of Latin America. The matrix contains general country indicators, plus quantitative and qualitative indicators on the waste/CE sector. The MMWCE was applied to Argentina, Chile, Peru, Ecuador, Colombia, Panama, Costa Rica and Mexico. It can be readily applied to other developing and emerging countries and regions anywhere in the world.



http://tiny.cc/MaturityMatrix

The money issues: toolbox Economic and other Steering Instruments

Waste management costs money however efficiently it is organized.

The root issue is that in linear economics, the negative consequences of resource depletion, decline of biodiversity and pollution are mostly not accounted for. If climate impact, loss of biodiversity and pollution would be truly priced, waste would become highly undesirable. Acting in accordance with the waste hierarchy can be incentivized through financial mechanisms. The use of effective market-based instruments is mentioned to incentivize changes in the value chain that support sustainability. Taxes, for example, can be applied to penalize specific products (or chemical additives) and less preferable waste treatment practices (i.e. landfilling or incineration).

The tax instrument has proved to be very effective for waste diversion from landfill sites and is, in the Netherlands, now also used to reduce the attractiveness of waste incineration and exports. These financial instruments can be complemented by implementing landfill-bans for specific waste streams in order to prevent waste from being landfilled, even when good (but still expensive) recycling options are available.

Full cost coverage at the appropriate environmental standards
The first and most direct mechanisms are the legal obligation that disposal sites are operating at Best Available Technology (BAT) and that all costs are covered in waste management tariffs of municipalities and in the gate-fees of disposal sites.

- For sanitary landfills this includes all expenses on double bottom and top layers, extraction and treatment systems for leachate and landfill gas, control systems for groundwater and the installment of a secured fund for final investments and for eternal after-care after closing down the site.
- An extra option is to include the costs of remediation of old dumps in the costs of new landfill sites.
- BAT for incinerators should include compliance with the most stringent emission standards, all expenses of reusing bottom ash, safe disposal of fly-ash and other hazardous residues, and the compulsory use of all generated energy to replace fossil fuels.
- All expenses for needed transfer and transportation to more remote disposal sites must be included in the gate-fees.

Including all these costs will raise the tariffs and fees and will diminish the appetite for choosing options lower on the preferential waste treatment ladder.

Extended Producer Responsibility (EPR)
Extended producer responsibility is a key element of waste management. EPR shifts the responsibility of waste management partially to manufacturers as it describes the producer's legal obligation to pay for rising pollution from its produced products, like environmental externalities. This mechanism encourages manufacturers to invest in sustainable design of products to improve collection and recycling opportunities. EPRs are most prominent in plastic packaging but also enforced on electronic and electrical equipment. There is a variety in how EPRs are approached. Most common are take-back arrangements, deposit/refund, and advance disposal fees (ADF). Because realization of EPRs requires efforts from government, local authorities and a variety of producers and importers, most companies to which EPRs apply, work with or are part of Producer Responsibility Organisations (PROs). There are 14 EPR policies that are applied in the EU, the US and Canada and in many other countries work is in progress on such policies. By combining EPR with Eco-modulation a price differentiation can be made for good (reusable or recyclable) versus bad products or packages. Setting up the contours of an EPR is important, implementing it and enforcement is often proving to be as challenging.

Critics say that the cost of EPR should increase significantly to act as a steering mechanism towards more sustainable products. If the price is too low, the cost for collection and recycling are just passed on to the consumer. The scope and targets for EPR should be revised regularly to make sure that the desired impact is reached.

Bans and levies
More and more countries implement policies regarding the usage of single-use plastic items to limit their waste production. Over 60 countries have adopted bans or regulations, such as pricing of plastic bags or the prohibition of single- use plastic items.

Deposit return schemes (DRS)
Deposit return schemes are a popular tool that allow for separate collection of bottles, beverage card boxes and cans. DRS can be part of EPR and is applied in many countries. By adding a surcharge on products, consumers are incentivised to return waste to collection points. This passes financial responsibility down to end-consumers which has shown to be effective with an almost 90% rate in Europe and is thereby one of the most efficient instruments to tackle plastic leakage into the oceans and the environment. DRS can reduce drink containers in the ocean by up to 40%.

Advantage of scale
The advantage of scale helps to reduce costs and prices and is an indirect mechanism that can help in stimulating recycling. Every technology has a certain optimal scale. This relates to the aspect of national planning of waste management infrastructure.

Cross border Transportation
Open markets and international competition can create a market mechanism that incentivizes recycling. Nevertheless, it should be subject to a regulatory Level Playing Field with stringent quality standards and be balanced against a proximity principle, especially for landfilling.

Minimal recycled content
This mechanism is being considered at this moment. It is about the obligation for producers to use a minimum percentage of recycled materials to replace virgin ones. For plastics, this could mean that recycled granulates gain a competitive advantage over virgin granulates. This will then lead to a steep increase in the value of re-granulates and this will provide additional cash flows for the recycling sector and stimulate the demand for waste plastics.

Circular Procurement as pull factor
Public procurement is a significant percentage of a government's budget (EU: 14% of GDP). If directed at circular initiatives, it can be a tremendous pull factor for new initiatives. Buildings, catering, uniforms all can be tendered in a circular manner.

Behavioral aspects

Education
There is a lack of public awareness and education concerning source separation and reducing the generation of waste. From a business point of view, public awareness may sometimes be a nuisance in the short term, but in the long term it almost always turns out to be a positive driver for change.

NIMBY's dual role
A particular and highly underrated type of environmental consciousness is the so called "Not In My Back Yard" (or NIMBY) effect, sometimes also referred to as "BANANA" (Build Absolutely Nothing Anywhere Near Anything). People have always been aware of the disadvantages of living near waste. No wonder this leads to a "NIMBY effect". It is the responsibility of the authorities to make sure the negative impact of e.g. Household Waste Recycling Centers (HWRCs), waste transfer stations, landfills and waste incinerators is kept to a minimum, and that is what they tend to promise.

And yet, it can be difficult for public authorities to find a proper location for waste infrastructure. Waste operations and nuisances reduction must be improved in order to make waste management facilities become a normal part of economies. At the same time, it is worthwhile to value the effect of NIMBY around waste infrastructure: it has the potential to act as a strong catalyst for a more circular economy.

A growing and changing public awareness
Public awareness on the quantity and the possible dangers of waste can be a strong driver for a circular economy. These days, when people are asked whether they are environmentally conscious, many will answer: "Well, I do separate my waste", which is the result of many years of public awareness campaigns. However, it is not enough: our awareness grew and made us aware of the limitations of waste management. It is time to move on towards a circular economy.

Dedicated awareness raising campaigns can help to point out the importance of waste separation. For instance, images of stray plastic on far away beaches and the notion that in 2050 there will be more plastic than fish in the oceans help to make people aware of the waste situation. "Earth overshoot day", which fell on 28 July in 2022, can provide additional perspective: the date when humanity has used all the biological resources that earth regenerates during the entire year.

A growing environmental awareness fires up waste management policies and has the potential to act as a catalyst for the circular economy. This awareness has taken us far in improving our waste management system. However, in order to move up on the circular R-ladder and shift from reuse and recycling towards reduction and even prevention of waste, a new public awareness is now needed that is exercised in the supermarket rather than next to the garbage bin. This new awareness will be about purchasing less, with no or less or simpler or more sustainable packaging.

Closing words

The Dutch have been working on their waste management infrastructure since 1875. Today we have a sound waste management system that is the foundation for our circular economy aspirations. We hope that with the insights and best practices in this brochure others will find inspiration that can accelerate their transition.

The journey is rewarding. Together we can adapt the Dutch solutions and practices to the local context, solve environmental issues and by doing so create meaningful local jobs, contribute to the climate goals and the Sustainable Development Goals.

If you want to read more on circular economy opportunities by market segment, do read our other reports here: https://hollandcircularhotspot.nl/publications/.

If you want to work together with us, then send your ideas, thoughts and proposals to info@hollandcircularhotspot.nl.

In fond memory: Herman Huisman 1952-2021

This publication is dedicated to the memory of Mr. Herman Huisman, the uncrowned Waste Management Ambassador of The Netherlands.

Herman Huisman stood at the basis of many economic instruments and policies that shaped Dutch waste management in recent decades. Think of landfill bans, waste taxes, deposit systems, organic waste collection, benchmark systems and national waste management plans. Starting in 1990, he became one of the key figures in the Dutch Waste Consultation Body (AOO), which successfully rebooted waste management in the Netherlands.

Later in his career, as a Senior Advisor for the Ministry of Infrastructure and Water Management, Herman Huisman traveled the world to spread the word on sustainable waste management. He spoke at many International Conferences and worked on projects all over Europe, in the Americas, Africa and Asia. He managed to inspire many with his profound knowledge and his passion. "The choice is (y)ours", Herman would say: good waste management is our common responsibility. With this brochure we present to you and honor his legacy.

Construction waste, Dhaka, Bangladesh. Source: Unsplash.

Olusosun landfill , Lagos, Nigeria. ©Freek van Eijk

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