ZERO WASTE CITIES OF THE FUTURE

How can Dutch cities lead the circular transition?

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CIRCLE ECONOMY FOUNDATION

Ministerie van Infrastructuur en Waterstaat

Contents

Introduction

Today's world is predominantly linear: materials are extracted, processed, used and discarded at a rate and scale never seen before. Worldwide, total material extraction has more than tripled since 1970 and almost doubled since the year 2000—reaching 100 billion tonnes today. This take-make-waste economy has led emissions to spiral and has pushed us past the limit of several planetary boundaries: we no longer operate within Earth's safe limits. **The circular economy—a system in which waste is designed out, products and materials are used longer, and ecosystems are regenerated—is being championed as a solution.**

The Netherlands boasts ambitious goals for both climate change mitigation and resource use: it has pledged to reduce greenhouse gas (GHG) emissions by at least 49% by 2030 and by 80–95% by 2050. It also aims to be fully circular by 2050, with the intermediary target of halving resource consumption by 2030. **In working towards a circular Dutch economy, waste prevention will be key.** Despite the Netherlands' reputation for resource efficiency and waste recovery, the country grapples paradoxically with substantial waste generation, averaging 557 kg per capita, surpassing the European average. This stark reality underscores the urgent need for waste prevention strategies in the country's pursuit of achieving a 100% circular economy. While commendable efforts have been made in recycling and waste management, it is clear that the sheer volume of waste generated remains a critical concern. To attain true circularity, the nation must prioritise measures that cut waste at its source, such as sustainable product design, extended product life cycles, and fostering a culture of conscious consumption.

Cities, regardless of their size, occupy a key role in waste prevention due to their dual role as consumption hubs and waste generators. Furthermore, local governments typically bear the responsibility of waste management in cities. With the global trend of urbanisation on the rise, a substantial share of resources will be incredibly consumed and disposed of within urban areas. This presents cities with the opportunity to serve as breeding grounds for innovative waste prevention approaches, cultivating a culture of responsible consumption and shaping the evolution of zero-waste products and services.

But what will a municipality focused on waste prevention look like in 2030? And which instruments are at the disposal of local governments to achieve this?

Rijkswaterstaat (RWS), the executive agency of the Ministry of Infrastructure and Water Management in the Netherlands, commissioned Circle Economy to answer these questions and help a frontrunner group of municipalities to investigate how cities can be designed in a way that helps citizens reduce waste. In this study, we present insights into the influence of a municipal government on waste prevention.

Current status of waste prevention in the Netherlands

DEFINITIONS AND SCOPE

Waste prevention, as a fundamental component of the waste hierarchy, encompasses a set of proactive measures to minimise waste generation at its source. It emphasises the three 'R' actions: Reduce, Reuse and Repair.[4]

Reduce is at the top of the waste management hierarchy. It involves conscientiously decreasing the overall consumption of goods and resources to limit waste production at the source.

Reuse is the subsequent step. It promotes the repeated use of products or materials, diverting them from the waste stream and contributing to a more sustainable and resource-efficient approach to consumption and waste management.

Repair, at last, encourages the refurbishment and restoration of items to extend their useful lifespan, reducing the need for disposal.

In essence, waste prevention focuses on strategies higher up on the waste hierarchy. It is not about reducing residual waste through better separation or about reducing littering but about decreasing the total amount of waste generated in cities.
This study will focus on **Municipal Solid Waste (MSW)**, mainly generated by households and small businesses. Municipalities directly manage and oversee the collection and management of this waste, making them the key actors in implementing targeted policies, education campaigns, and infrastructure improvements to reduce this waste at its source.

4. Reduce, Repair and Reuse are measures that contribute to reducing the total use of materials and resources, but also extending the lifetime of goods and products as much as possible. By doing so, such measures contribute to prevent the generation of waste at the End-of-Life. In that sense, these R-strategies are aligned with the two measures from the Dutch National Circular Economy Programme: 'Reducing raw material usage' (Narrow), and 'Extending product lifetime' (Slow).

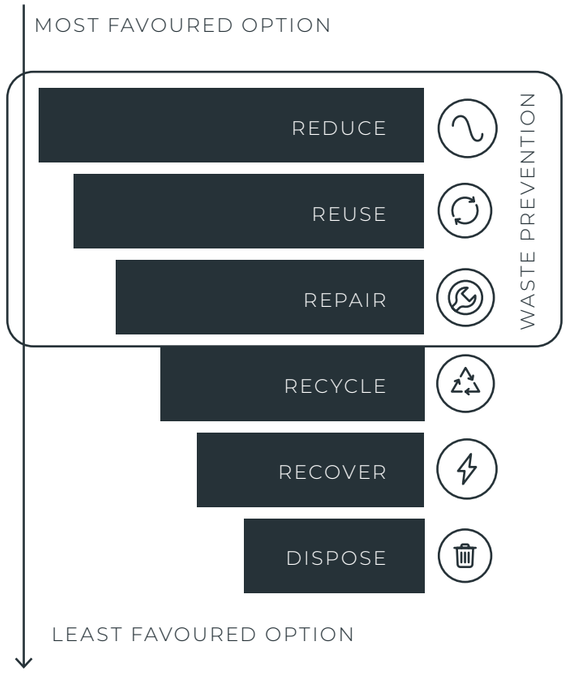
A SNAPSHOT OF THE CURRENT STATUS OF DUTCH WASTE GENERATION [5]

In 2020, the Netherlands produced **9.1 million tonnes** of household waste. Dutch average household waste generation was **524 kg per capita**, slightly higher than the EU average of 517 kg per capita.

Waste composition is dominated by **organic waste, consumer goods** (e.g. textiles, electronics and furniture, etc.) and **packaging** (e.g. paper/cardboard and plastics).[6]

- The Netherlands ranks fifth-worst in the EU for **food waste** per resident. Although most accuse along the supply chain, over a third is produced by households
- **Textiles** stand out as the waste stream with the greatest growth in percentage composition in the past decades
- **Plastic waste,** despite volumes slowing down in household residual waste in 2010 thanks to a dedicated separate collection scheme, remains one of the highest shares of household waste.

An analysis of residual waste reveals that nearly **two-thirds of residual waste could still be recovered** (essentially organics, plastics, paper, glass, metal, etc.) either for recycling or (partly) for reuse.



A GENERAL ATTITUDE OF HOUSEHOLDS TOWARDS PREVENTION

Changing behaviours will be key to preventing waste at the source. Residents can refuse a purchase in its entirety. In addition, they can refuse to buy something by repairing items they already own. They can also purchase products that replace disposable products (e.g. washable diapers). Another possibility to realise less household waste is to pass on items to other people instead of throwing them away, just as they can seek to purchase second-hand or refurbished goods themselves. Additionally, products can be shared and borrowed more, in particular, if they are only needed occasionally. However, assessing waste prevention from a behavioural perspective is challenging compared to other waste management aspects due to its personal and imperceptible nature.

- Attitudes can vary among individuals and households, but overall, Dutch households exhibit a strong commitment to environmental sustainability, especially regarding recycling, composting, and single-use plastics reduction.
    - Surveys indicate that Dutch consumers generally hold negative views about waste generation and express a desire to prevent it, but these attitudes don't always translate into actual waste-reducing behaviours.[7]
- Although waste-preventing behaviours are often associated with socially engaged, environmentally conscious, and educated consumers, these traits alone may not ensure waste prevention. Psychological and systemic barriers persist at the individual level, such as a lack of knowledge, a limited sense of urgency, entrenched wasteful habits, and perceived time and effort constraints.[8]
- In practice, waste prevention is often seen as a beneficial side effect rather than a primary goal, with actions like sharing, reusing, and reducing waste driven by factors beyond waste avoidance.[9] For example:
    - **Reduce:** Opting to read from a tablet instead of physical books is typically a matter of convenience rather than a primary strategy for waste reduction.
    - **Reuse:** Purchasing vintage items is often driven by specific needs and cost considerations rather than a sole commitment to waste avoidance.
    - **Sharing Economy:** Engaging in the sharing economy often stems from a desire to assist others rather than primarily focusing on waste reduction.
- Moreover, the current infrastructure does not support waste prevention in daily life. For example, it is cheaper to buy a new product than to repair it, and it is more convenient to use single-use than reusable packaging.[10] **There is a need first to reform the whole urban system and the surrounding conditions to make waste prevention economically feasible and attractive to both consumers and producers. and, secondly, to cultivate relevant values in individuals to encourage and embrace this transformative change.**

What does waste prevention entail for households' key waste streams?[11]

11. The following table presents examples of waste preventive measures. It is important to note that these are illustrative examples and do not encompass all existing waste preventive measures, which may vary by region, industry, and specific waste types. Additional strategies and initiatives may also contribute to waste prevention efforts

	WASTE	REDUCE	REUSE	REPAIR
ORGANICS	Organics waste stream primarily consists of **food, yard waste, and diapers.** Recognised as the most significant waste stream in all households, organic waste is a prime area for effective waste preventive action.	FOOD WASTE • **Buying less:** Reduce food waste by planning meals, buying only what you need, minimising impulse purchases, and using perishables before expiration. • **Smaller Portions:** Serve smaller portions and offer seconds to reduce leftovers that often go to waste. • **Buy ugly foods:** buy "ugly" or imperfect produce to avoid its disposal. YARD WASTE • **Natural Landscaping:** Replace resource-intensive lawns with native plants and reduce the need for frequent mowing and yard waste. • **Selective Pruning:** Trim trees and shrubs selectively to minimise yard waste generated during landscaping. • **Minimal Grass Clippings:** Reduce grass clippings by setting the mower at a higher height, allowing the grass to mulch naturally.	FOOD WASTE • **Creative Cooking:** Repurpose food surplus, leftover meals and scraps like vegetable peels and stale bread to make soups, broths, or croutons. • **Often good after date.** Look, smell and taste the food before discarding it. Similarly, the labelling on packaging can also be changed from "use by" to "best before" where appropriate. YARD WASTE • **Mulching:** Reuse fallen leaves and grass clippings as natural mulch for gardens and flower beds. • **DIY Garden Pathways:** Reuse larger branches or wood logs to create garden pathways or decorative elements.	FOOD WASTE Repair here is intended as a means of extending the lifetime of food products, so: • **Food Preservation Techniques:** Use canning, pickling, or fermentation to preserve food for later consumption. • **Salvaging Spoiled Ingredients:** Repurpose overripe fruits by making smoothies or jam, and revitalise stale bread as croutons, for example.
CONSUMER GOODS	The consumer goods waste stream encompasses **electronics, textiles, and bulky furniture.** With consumer goods representing a rapidly rising waste stream driven by contemporary trends of hyperconsumption and planned obsolescence, empowering households to make more sustainable choices, ultimately preventing the unnecessary disposal of such items, is key in a circular economy.	ELECTRONICS • **Mindful Technology Consumption (buying less)** avoiding the purchase of latest gadgets, evaluate your actual needs instead. • **Energy-Efficient Devices:** Reduce electronic waste by purchasing energy-efficient devices that have a longer lifespan. • **Minimal Upgrades (buying less):** Avoid frequent upgrades of smartphones and laptops; instead, use them until they are no longer functional. • **Modular products:** modular design in electronics allows for easy replacement of components when damaged without the need to throw away entire products and purchase new ones. TEXTILES • **Conscious Shopping:** Reduce textile waste by purchasing clothing and textiles mindfully, choosing quality over quantity. • **Minimal Wardrobe:** Maintain a smaller, versatile wardrobe to reduce the need for frequent new clothing purchases. • **Seasonal Storage:** Store seasonal clothing properly to prevent damage, reducing the need for replacements. BULKY ITEMS • **Multi-Functional Furniture:** Reduce furniture waste by choosing multi-functional pieces that can serve multiple purposes. • **Minimalistic Design:** Adopt a minimalist approach to interior design, reducing the need for excess furniture. • **Quality Over Quantity:** Invest in durable, high-quality furniture that has a longer lifespan. DIAPER WASTE • **Cloth Diapers:** Reduce diaper waste by using modern cloth diapers, which can be reused many times. • **Diaper-Free Time:** Implement diaper-free time for infants, reducing the overall number of diapers used. • **Potty Training:** Encourage and actively engage in potty training, gradually reducing or eliminating the need for diapers.	ELECTRONICS • **Donation Programs:** Reuse electronics by donating still-functional devices to charities, schools, or local community programs. • **Secondary Markets:** Sell or trade used electronics on platforms and stores. TEXTILES • **Thrifting and Secondhand Shopping:** Reuse textiles by shopping at thrift stores and secondhand markets. • **Clothing Swaps:** Organise clothing swap events with friends or local communities to exchange and reuse clothing. • **Upcycling Projects**: Transform old or damaged textiles into new items like quilts, tote bags, or rags. BULKY ITEMS • **Furniture Banks:** Donate gently used furniture to furniture banks that provide it to those in need. • **Resale Markets:** Sell or buy used furniture through online resale platforms or physical secondhand stores. • **Hand-Me-Downs:** Reuse and refurbish furniture passed down from family members or friends. DIAPER WASTE • **Cloth Diaper Services:** Use diaper services that collect, launder, and reuse cloth diapers. • **Hand-Me-Down Diapers:** Pass down gently used cloth diapers to younger siblings or friends. • **Reusable Diaper Covers:** Reuse diaper covers with inserts, which can be replaced without discarding the entire diaper.	ELECTRONICS • **Refurbishing Services:** Consider refurbishing older electronics like smartphones, tablets, and laptops to extend their usability. • **Component Replacement:** Repair or replace individual components within electronic devices, such as batteries or circuit boards. • **Software Optimization:** Address software issues to improve the performance of electronic devices and extend their lifespan. TEXTILES • **Parth and Repair:** Repair small tears, seams, and hems in clothing to extend their wearability. • **Washing less, at Lower Temperatures, and Air Drying** clothing not only extend the lifespan of garments but also minimise wear signs and tear. BULKY ITEMS • **Furniture Refinishing and Repair:** Repair and refinish furniture to give it a fresh look and extended life. DIAPER WASTE • **Repair reusable diapers:** Replace worn-out or stretched diaper elastics or fix minor leaks to extend their lifespan.

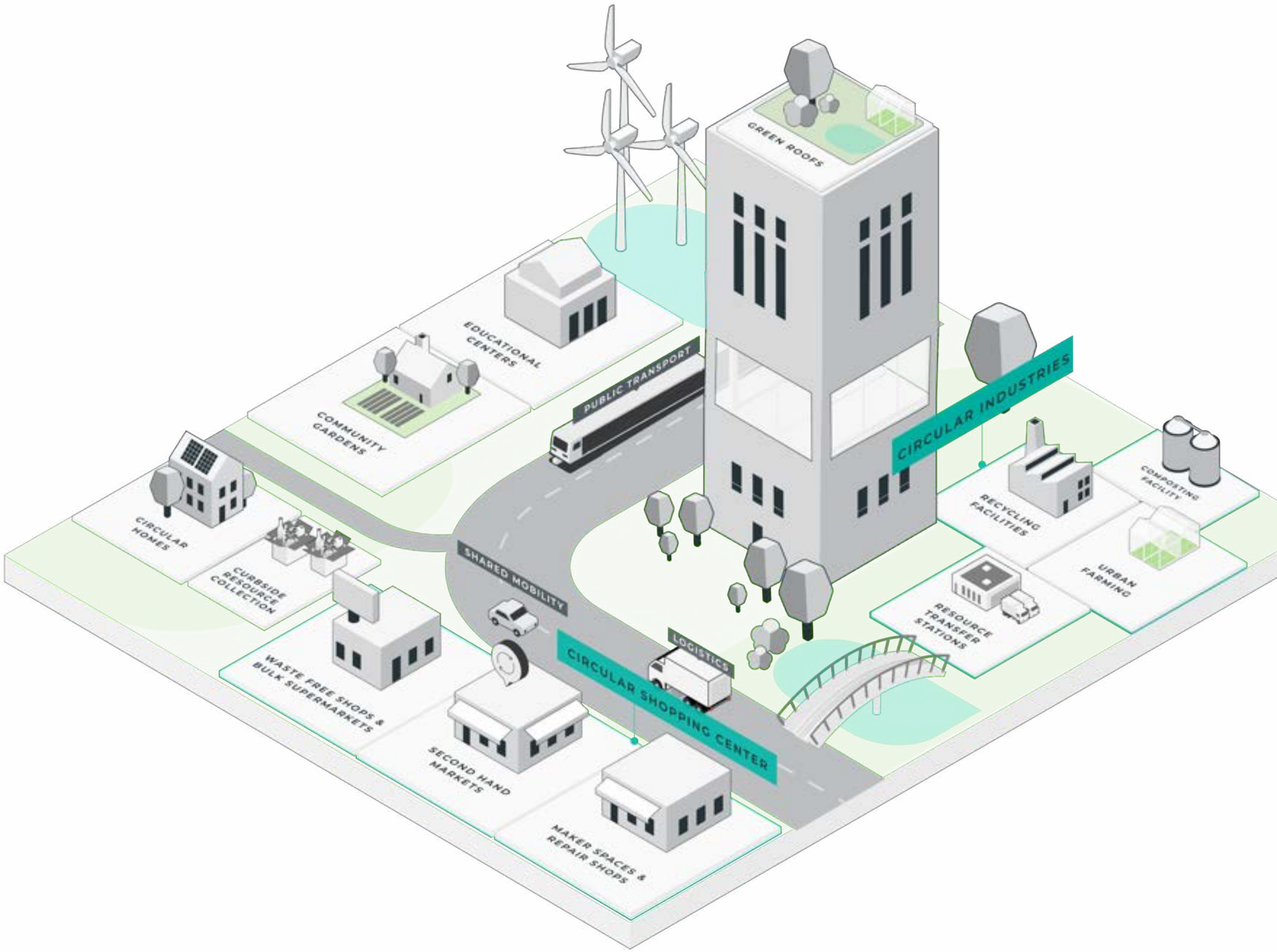
	WASTE	REDUCE	REUSE	REPAIR
PACKAGING	Packaging waste includes items such as **cardboard, plastic, glass** and various mixed materials used for packaging consumer goods. Packaging is typically discarded after use, contributing significantly to waste generation. **Plastics,** especially, are the second-largest contributor to household waste, posing significant environmental threats through greenhouse gas emissions and pollution. Most of this waste can be entirely prevented through thoughtful design and by minimising unnecessary packaging.	• **Minimalist Design:** Choose products with minimalist and eco-friendly packaging, using less material. • **Refill Stations:** Offer refill stations for products like detergents, shampoos, and cleaning supplies, reducing the need for new packaging. • **Bulk Shopping:** Encourage bulk shopping, where consumers can bring their containers to purchase items in larger quantities, minimising packaging waste. • **Store shopping**: Buy directly in-store and avoid unnecessary delivery to minimise packaging.	• **Reusable Packaging:** Choose packaging that is intended for multiple uses, such as durable glass or plastic containers. • **Deposit-return systems:** Prefer products where customers can return packaging for reuse.	• **Damaged Packaging Repair:** Repair minor damages in packaging, such as torn boxes or broken closures, before discarding. • **Packaging Modifications:** Adapt packaging to extend its use, such as converting a cardboard box into a storage container. • **Re-labeling:** Reuse packaging with new labelling for different products, preventing unnecessary disposal.

From waste to resource: What does a waste-free city look like?

So what will Dutch municipalities focused on waste prevention look like in 2030? What will they need regarding basic facilities and logistics, and where should these facilities be located?

The design of a municipality focused on waste prevention will be significantly different from that of a municipality entrenched in the linear economy. While most change will occur at the household level, in shops, and businesses, and from a consumer behaviour perspective, a circular and waste-free city will leave behind certain urban features, facilities or logistics systems that belong to the linear past. These may include:

- **Overflowing garbage bins on the streets.** This common image symbolises the excess waste generated in a linear economy, which overwhelms even the most advanced collection systems due to the sheer volume of waste produced.
- **Commercial streets dominated by fast-fashion, fast-furniture retailers and shops with cheap throw-away products.** The increasing collection rate of textile waste across Europe has gone hand in hand with a decline in the quality of collected goods due to the increasing number of fast-fashion suppliers.
- **Food and drink takeaway shops.** Modern cities are seeing a growing number of food and drink franchises whose model relies principally on fast service for takeaway. While individually this does not seem very large, many of the individual items all packaged individually on the basis of "convenience" and to gain time are creating disproportionate volumes of packaging waste.
- **Large treatment plants** such as residual **waste sorting facilities, incinerators and landfills** located on the periphery of cities are currently essential features of urban agglomerations as they deal with the disproportionate amounts of waste accumulating in cities.



On the contrary, a forward-thinking municipality in 2030, committed to waste prevention and sustainability, would exhibit a unique blend of innovative facilities and logistics to redefine waste management practices, such as:

- **Repair Shops** and well-equipped, professionalised **Maker Spaces**[12], offering easy access to skilled repair technicians and state-of-the-art tools for individuals to mend and refurbish and repair a wide range of items. Additionally, businesses would offer **mobile repair units** and **collection services** to complement these facilities for on-the-spot repair services and convenient recyclables collection.
    - **Location:** These facilities should be strategically established throughout the city to offer easy access to skilled repair technicians and state-of-the-art tools. They could be distributed in various neighbourhoods and commercial areas.

- Vibrant **second-hand markets and large warehouses** where residents can buy, sell, or exchange pre-loved goods, serving as community hubs. Notably, the popularity of second-hand clothing and furniture has risen over the years, but they remain outnumbered by existing linear offerings, and their affordability compared to newly produced goods may vary[13]. *Kringloopwinkels*, which differ from second-hand shops as they obtain goods for free, are a great example: they sometimes serve as *Sociale Werkplaats,* or offer opportunities to consumers to repair goods. However, they are generally located in large warehouses on the city outskirts, making them less visible and accessible in the daily streetscape of Dutch cities for consumers not specifically seeking these goods or services.
    - **Location**: There should be one **central warehouse for bulkier items**, complemented by **smaller, decentralised markets for common consumer goods**, ensuring convenient access for all residents. These can be placed in both residential and commercial areas to serve as community hubs, reducing the need for dedicated linear shopping spaces and thus becoming the prevailing choice for consumers, meaning that reverse logistics will also play a key role here. This shift towards more sustainable practices could then encourage conventional, linear retailers to incorporate second-hand sections into their offerings, both online and in physical stores.

- In a circular city, the **landscape of retail and shopping streets** would undergo a transformative shift. Nowadays, the typical Dutch city is mainly centred around the consumption of new goods and services. Different cities have identical shopping streets, with the same shops where they sell the same products. In a circular city, shoppers would be encouraged to invest in items with a timeless appeal, and innovative technologies would enhance the shopping experience, providing consumers with detailed information about product origins, sustainability ratings, and repairability scores, empowering them to make informed, eco-conscious choices.[14] As e-commerce continues to grow, however, shopping streets will also need to integrate local delivery and collection points and storage spaces. This will also require strategic urban planning with broader sustainability and logistics considerations in mind, such as last-mile delivery and micro-mobility solutions (e.g. cargo bikes).
    - **Location**: These areas can replace traditional shopping complexes and be accessible via public transport. Instead of sprawling shopping complexes dominated by fast fashion and disposable goods, circular urban areas would feature vibrant, walkable streets adorned with locally owned businesses and circular enterprises.

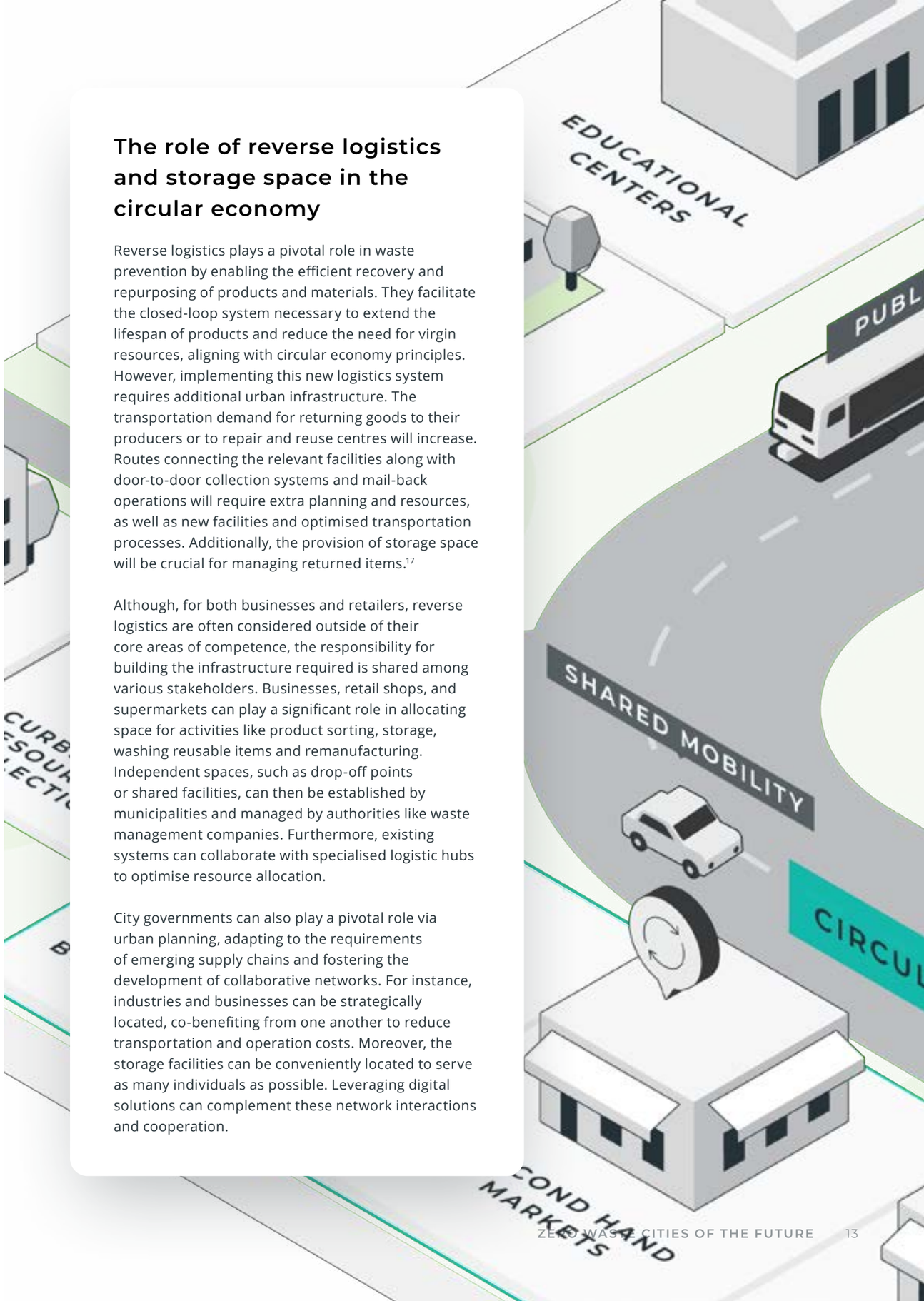
- **Local food markets and bulk, packaging-free supermarkets in every neighbourhood**. These markets prioritise zero packaging, breaking away from the conventional oversupply model of major supermarket chains. The rationale behind this shift is twofold: firstly, it offers citizens easy access to locally grown produce, fostering a sense of community and sustainability. Secondly, it enables consumers to purchase food without excessive packaging. As these smaller markets gain popularity, big supermarket chains might increasingly follow the demand for these new waste-free products, making zero-waste shopping a future norm for larger chains as well. Already, some supermarket chains have begun introducing packaging-free options for select products, albeit gradually.
    - **Location:** These markets and supermarkets should be available in every neighbourhood, promoting accessibility and sustainability. They can be located in both residential and commercial areas.

The role of reverse logistics and storage space in the circular economy

Reverse logistics plays a pivotal role in waste prevention by enabling the efficient recovery and repurposing of products and materials. They facilitate the closed-loop system necessary to extend the lifespan of products and reduce the need for virgin resources, aligning with circular economy principles. However, implementing this new logistics system requires additional urban infrastructure. The transportation demand for returning goods to their producers or to repair and reuse centres will increase. Routes connecting the relevant facilities along with door-to-door collection systems and mail-back operations will require extra planning and resources, as well as new facilities and optimised transportation processes. Additionally, the provision of storage space will be crucial for managing returned items.[17]

Although, for both businesses and retailers, reverse logistics are often considered outside of their core areas of competence, the responsibility for building the infrastructure required is shared among various stakeholders. Businesses, retail shops, and supermarkets can play a significant role in allocating space for activities like product sorting, storage, washing reusable items and remanufacturing. Independent spaces, such as drop-off points or shared facilities, can then be established by municipalities and managed by authorities like waste management companies. Furthermore, existing systems can collaborate with specialised logistic hubs to optimise resource allocation.

City governments can also play a pivotal role via urban planning, adapting to the requirements of emerging supply chains and fostering the development of collaborative networks. For instance, industries and businesses can be strategically located, co-benefiting from one another to reduce transportation and operation costs. Moreover, the storage facilities can be conveniently located to serve as many individuals as possible. Leveraging digital solutions can complement these network interactions and cooperation.



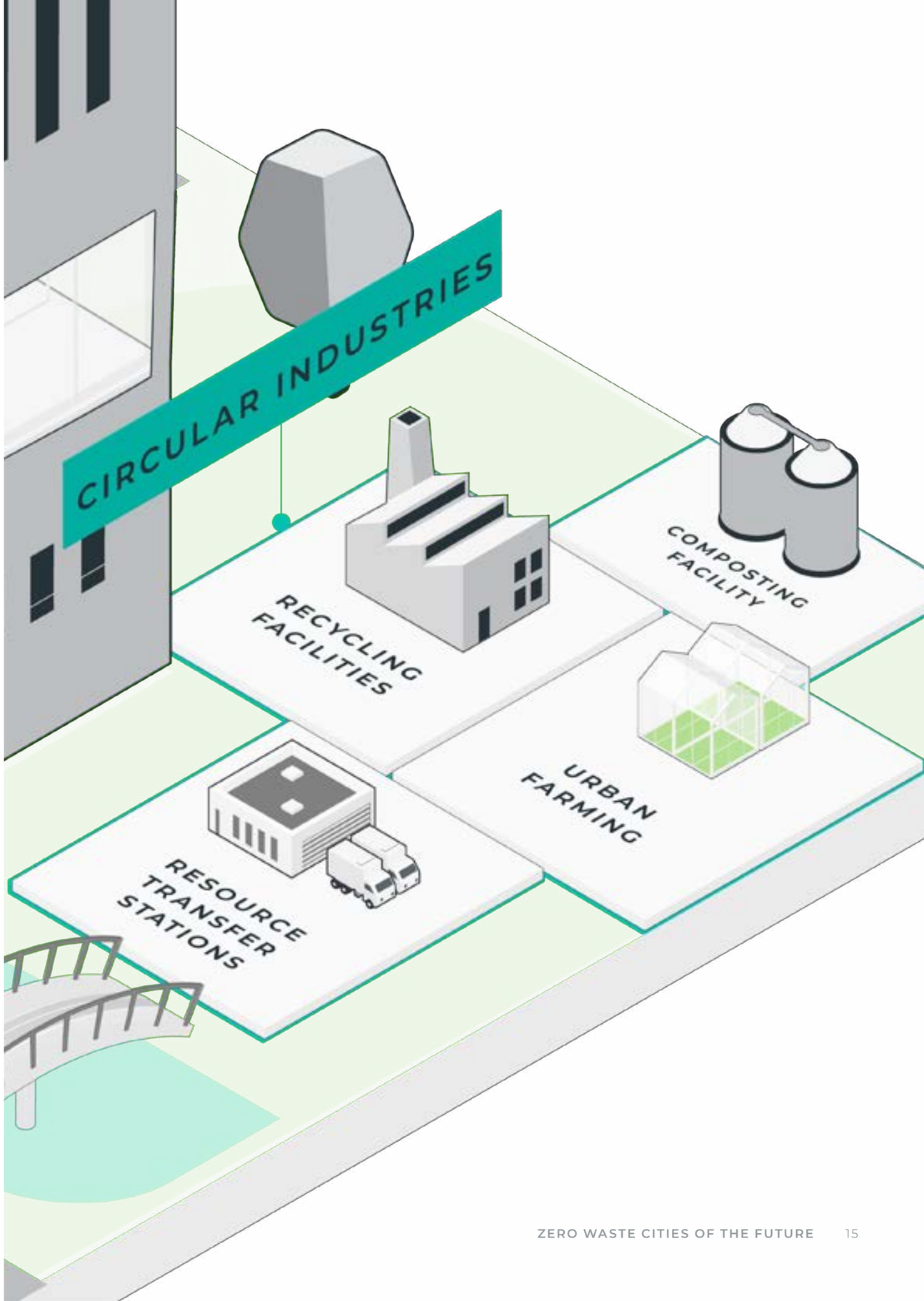
- **Thriving community gardens and innovative urban agriculture solutions.** Community gardens and urban agriculture serve dual purposes, enriching the urban environment with greenery while simultaneously contributing to local food production, reducing the need for extensive packaging and transportation of food products while fostering a stronger sense of community, as well as educating consumers to not discriminate against "ugly" but perfectly edible foods.
    - **Location**: These should be integrated into the urban landscape, potentially in parks, vacant lots, and rooftops, ensuring that they are easily accessible to residents.

- **Material Reuse**[15] **and Circular Craft Centers.**[16] Zero-waste cities would collect and process durable and non-durable goods, including electronics, plastics, and metals. Utilising cutting-edge technologies and practices, material reuse and circular craft centres are locations where parties work together to refurbish and resell items, effectively minimising waste sent to landfills while providing more affordable options to the community. Such centres can change the way people feel about second-hand or refurbished products.
    - **Location:** These centres should be strategically located within the city, ensuring efficient collection and processing. They can be placed near transportation hubs or industrial areas.

- **Local second-hand or sharing digital platforms**. Global second-hand platform models rely heavily on extensive logistics and packaging for shipping items across regions or even countries, significantly increasing their environmental footprint. Prioritising local platforms encourages residents to source goods from nearby sellers, not only reducing the carbon footprint associated with transportation but also strengthening the local economy and promoting more sustainable consumption practices over globally active ones. **Digital platforms** can also emerge to foster local resource sharing among residents. This platform would seamlessly connect individuals interested in sharing underutilised items, ranging from power tools to camping equipment, promoting a thriving sharing economy within the community.
    - **Location**: These platforms should be accessible online, but physical drop-off and pickup points for shared items could be located in central community areas.

- **Dedicated education centres or interactive museums** would empower citizens with the knowledge and skills needed to lead a zero-waste lifestyle. These learning hubs would offer comprehensive DIY programs and workshops that cover a wide array of sustainable practices, from upcycling and repair skills to waste reduction techniques. By equipping residents with the tools to mend, repurpose, and create, these centres would not only reduce waste generation but also play a crucial role in lowering living costs. As citizens embrace self-reliance and resourcefulness, they will discover the financial benefits of a more frugal, sustainable way of life, fostering a community dedicated to both environmental stewardship and economic well-being.
    - **Location:** These centres should be dispersed throughout the city, potentially near schools, libraries, and community centres, to offer educational programs and workshops for all age groups.

To achieve this, it is imperative to acknowledge the need for infrastructure development to provide ample space for these initiatives to scale up. While many communities and organisations have already embarked on smaller-scale, community-based initiatives to promote sustainability and reduce waste, the current goal is to scale up these efforts. It is no longer about isolated, local endeavours; it is about integrating these initiatives into the very fabric of urban planning and lifestyle. Consequently, it won't be solely about individuals and communities making sustainable choices; it will be about the city itself actively facilitating and promoting those choices at every juncture, transforming the environment in which citizens operate. Indeed, the path to a waste-free city begins with bold municipal action to guide consumers to embrace circular lifestyles.



From waste to resource: how can cities achieve it?

Cities have an array of instruments at their disposal to ensure waste prevention becomes a reality and to ensure that the essential facilities are not only available but also located strategically to maximise their impact. Within this context, this section delves into five primary policy instruments that cities can harness, collectively forming a comprehensive approach to effective waste prevention. Each of these instruments can be adapted and customised to suit the unique needs and challenges of a city and be deployed in parallel.

1. **Urban and spatial planning**
   To drive circular choices, everything should also be conveniently located. Urban planning that promotes mixed land use and creates “15-minute cities” can reduce the need for long commutes and make it easier for residents to access circular services and products.

2. **Regulations and legislation**
   Implementing strict waste-related regulations and legislation can accelerate waste prevention efforts, ensuring that businesses and individuals adhere to circular practices.

3. **Business support via economic and financial incentives**
   To choose a circular lifestyle, households need to have options available and convenience. By offering financial and economic incentives, cities can stimulate the availability of eco-friendly products and services in the urban space.

4. **Circular Public Procurement**
   Local governments can lead by example. By adopting circular procurement practices, cities can demonstrate their commitment to circularity, encourage the market for circular products and services, and set standards for responsible consumption and production.

5. **Awareness and education**
   Citizens should be educated as to what a waste-free life looks like and how they can implement it in their day-to-day lives. Effective awareness campaigns and educational initiatives can empower residents with the knowledge and motivation to reduce waste generation.

Note: The potential of waste prevention measures in urban settings depends on several critical elements, including the waste stream’s mass in kilograms and the degree to which citizens can embrace waste reduction practices. When considering whether to prioritise a waste stream in policy, the total environmental impact of the waste stream should also be considered.[18]

1. Urban and spatial planning

DESCRIPTION

Urban and spatial planning, often referred to simply as urban planning, is a multidisciplinary field that focuses on the design, organisation, and development of urban areas, including cities, towns, and metropolitan regions. In realising zero-waste cities, urban planning will be the key to establishing a distributed and interconnected network of facilities and infrastructure elements to ensure equitable access for all residents while simultaneously reducing transportation-related emissions. Local governments should rethink the urban fabric as a whole to support waste prevention.

MEASURES CITIES CAN USE

There are several ways urban and spatial planning can be used to support waste prevention in cities:

- **Permitting** can be used to ensure that businesses offering circular products and services have access to permits to set their stores and facilities across the urban space. This can be done by establishing a prioritisation framework that aims to encourage more and more of these businesses, as opposed to wasteful ventures. Or by no longer giving out permits for certain linear-based businesses.
- Moreover, a permitting system can also encourage the incorporation of **sharing economy principles in housing design and construction.** For example, permits could set that for every X apartment built, one exchange room for goods and one repurpose room with tools is required. This approach promotes collaborative consumption, allowing residents to share and exchange items they no longer use, such as carpentry tools and sewing machines, reducing the need for purchasing new items and the associated waste. It also fosters a sense of community and sustainability within housing developments.
- A permitting system can also allow for the creation and operation of **Reuse Centers** within the city. These centres can process and refurbish discarded items like appliances and furniture. Permits can be used to regulate and monitor these centres, ensuring they comply with environmental and safety standards.
- **Mixed-Use and Compact Development.** Promote mixed-use developments and walkable, compact districts and neighbourhoods, which encourage people to shop locally, reducing the need for packaging and transportation-related waste.
- **Green Spaces and Urban Agriculture.** Allocate space for green areas and urban agriculture, which can help reduce food waste by promoting local, sustainable food production.
- **Through zoning,** city planners can create self-sufficient neighbourhoods, or industrial symbiosis[19] parks, where resource flows are maximised and shared across spaces.

KEY CONSIDERATIONS

Omgevingswet: a new way of working
From January 2024, spatial planning in The Netherlands will change significantly. A new competition of laws (***Omgevingswet***) will be introduced to regulate spatial planning, housing, infrastructure, environment, water and nature.[20] The implementation of tasks and powers under the new *Omgevingswet* will be left to the municipalities. State and province will only perform tasks if necessary when there is a clear provincial or national interest.[21] [22] [23] With the new *Omgevingswet*, municipalities will be able to better respond to local situations, formulate their own strong vision and translate circular economy ambitions into measures, rules and indicators.

For all municipalities, it will take some time to get used to the new way of working. This creates an opportunity to give the circular economy a more prominent place in this new approach. Whereas circular economy is now often treated as a separate topic, in the future, it will have to be interwoven with a broader scale of 'regular' interventions, regulations, practices and policies to have greater impact, and both systemic change and a holistic approach are necessary. The new way urban development in the Netherlands is being organised offers the opportunity to adopt this new approach.

Strategic Location Planning: existing and new built environment
Before embarking on any urban planning initiative, municipalities must conduct a thorough analysis of their local context. This analysis includes understanding the current state of waste generation, the availability of resources, the needs and preferences of the local population, the existing infrastructure, and the environmental and social challenges the city faces. This analysis helps identify the areas in the city where circular urban planning principles can be effectively applied.

For example, the dynamics of these locations vary between densely populated urban areas, where consumer waste constitutes a higher proportion, and rural areas, where agricultural and industrial waste holds greater significance. Research conducted in the Netherlands on the spatial distribution of material types within a circular economy revealed that minerals, plastic, wood and paper, fertilisers, food, machinery and electronics, metals, and mixed construction materials tend to cluster in specific areas.[24] Building upon these research findings regarding material hotspots, municipalities can strategically plan and design a circular infrastructure. This includes allocating suitable **spaces for material storage at strategic locations**, dedicated areas for circular activities such as repair, recycling, and refurbishment industries, and establishing an efficient **reverse logistics network.**

In contrast to existing urban areas, municipalities often have the authority to guide new urban development and influence the daily behaviours of citizens. Municipalities can work towards promoting mixed-use developments, compact and walkable districts, and ample green spaces for community gardens and urban agriculture. Furthermore, municipalities can encourage incorporating a sharing economy and Product-as-a-Service principles in housing design when soliciting projects. On the retail and consumer front, specific shopping areas can be designated for circular businesses by including such provisions in zoning plans and regulations.

Formulating the right approach
After analysing the local context and identifying the areas where certain circular urban planning principles can be applied, municipalities need to formulate ambitions, goals and guidelines to ensure the desired outcome. The choice of approach depends on various factors, with the landowner's role being particularly influential. The initiative *Circulaw,* set up by the city of Amsterdam and Dark Matter Laboratories, can help municipalities throughout the Netherlands find the right approach and instruments for circular urban planning. This initiative combines the expertise of governmental and knowledge institutions and sets up a context-specific approach.[25]

Collaboration and Stakeholder Engagement
For urban planners and designers, the concept of the circular economy may be relatively unfamiliar. Therefore, early engagement with relevant stakeholders and end users is essential in the planning process. Achieving a circular city requires a new, more active form of cross-sector collaboration. The city's design and planning must account for the entire waste and resource management chain, some aspects of which may fall outside the municipality's direct authority or influence.[26] By establishing a collaborative vision and ambition document at the outset, municipalities can garner support for developing a circular city. The success of planning and designing a circular city hinges not on the ability to do so but on the willingness to embrace this transformative approach.

Accessibility and Neighborhood-Level Integration
Circular businesses, driven not solely by profit but by a profound commitment to sustainability, often find themselves relegated to the peripheries of our cities. Repair cafes, community gardens, and municipal Material Recovery Centers, all pivotal for a waste-free tomorrow, struggle to compete with profit-driven enterprises in our urban landscapes. The strategic placement of these facilities should consider the local context, transportation networks, and community needs. Furthermore, local food markets, bulk packaging-free supermarkets, community gardens, and urban agriculture solutions should be integrated into the urban landscape at the neighbourhood level, making them easily accessible to residents.

PLANNING FOR REUSE CENTRES IN PRAGUE

In 2019, the city of Prague, together with Amsterdam-based organisation Circle Economy, analysed local material flows and carbon emissions in relation to the local economy, with the goal to provide the city with action plans for key industries to embed the circular economy into their practices. The resulting action plan translated into creating a network of Re-Use centres that process discarded elements such as appliances and furniture. These reuse points have been integrated into collection yards. Citizens can drop off their unwanted yet still-functional furniture, sports equipment or appliances, which are then uploaded to an online portal and can be collected for free by residents, NGOs and charities. Earlier this year, Prague opened its fifth reuse point. At these centres, items are being examined and repaired or redesigned if necessary.

CONSTRUCTION PERMITS IN FINLAND

The City of **Espoo**, Finland, is a pioneering city in terms of sustainable development. The Kera neighbourhood, previously an industrial area, will be transformed into a mixed-use and dense neighbourhood of 14,000 residents. The municipality's ambition is to transform the industrial park into a liveable neighbourhood by 2035.[27] The goal of the project is to make Kera an international showcase district for the circular economy. One of the measures to ensure this is the creation of the Kera Design Manual. The manual imposes that all constructions are required to be biobased or fully recyclable. The flexibility of the buildings is one of the document's guiding principles. This flexibility underpins the possibility of future 'circular regeneration' of the building stock. Thus a Life Cycle Assessment (LCA) will be mandatory. Regarding reuse and recycling, the project focuses on both existing materials, such as asphalt, to be recovered and the structural elements of existing halls, such as beams, slabs and columns.[28]

SPACE FOR CHARITY SHOPS IN THE UK

One of the first steps that municipalities should take is to actively confront consumers with circular options by adjusting the offer in the street scene. The *Charity Shops* in the United Kingdom can be used as an example. Medium-sized retail spaces in (local)shopping streets are being designated for Charities that sell second-hand goods. Additionally, these initiatives receive tax benefits, which makes it feasible for them to sell second-hand goods on main streets.[29]

2. Legislation and regulation

DESCRIPTION

In the field of waste prevention, regulatory and economic interventions are the most direct mechanisms that local authorities can leverage. Indeed, municipal governments have a certain degree of legislative and regulatory power that can be leveraged to issue concrete guidelines and frameworks or compulsory legal rules to impose regulations and policies aiming to avoid or prevent municipal waste generation. Regulatory instruments strongly associate with government authorities and typically manifest as tools that express the legitimacy of legal and official power. This is achieved by formulating laws, rules, or directives that delineate a set of obligations and boundaries for various societal actors.[30]

MEASURES CITIES CAN USE

The role of regulatory instruments is to ensure adherence to these obligations and boundaries. Such instruments encompass diverse strategies, ranging from standard-setting and command-and-control measures to economic interventions, like price regulations and restrictions on certain activities (e.g., the prohibition of single-use plastics). Examples include:

- **Economic instruments**, such as Pay as You Throw (PAYT) and Save Money and Reduce Trash (SMART) programmes, designed to influence consumer behaviour by discouraging households from adopting wasteful consumption habits. The underlying principle behind such programmes is that by making citizens pay a higher price (through taxation or waste collection charges) per quantity (unit, volume or weight) of waste generated, substantial reductions in the generation of municipal solid waste can be achieved.
    - **Pay-as-You-Throw (in Dutch 'Diftar', or "differentiated rate")** is a waste management system with high success rates. Residents are charged for collecting and disposing of their household waste based on the quantity generated. The key feature is variable pricing (directly linked to the quantity of waste produced), although in some cases, such programmes may also include equity considerations based on residents' socioeconomic status. The aim of such schemes is to foster source separation but, most importantly, ultimately reduce the amount of waste generated by pricing waste by quantity.[31] Additionally, PAYT is also a way for local governments to generate tax revenue which they can use to implement other policy instruments to support waste prevention and the circular economy.
    - **Deposit Return Schemes (DRS)** are designed to encourage the return of different products, typically containers like bottles, in exchange for financial retribution—the deposit refund, which often takes the form of credits for purchasing new products.[32] Since consumers have a monetary incentive to return containers, there is less likelihood of them being thrown away. DRS programmes can be enabled by legislation that establishes various parameters. These are laws specifying the eligibility of different containers (for instance, by material type), the deposit refund amount and the handling fees and costs paid to retailers), whether it is mandatory or voluntary. It may also determine the regulatory and enforcement framework that ensures compliance with DRS rules, including penalties for non-compliance.
- **Regulatory and legislative** instruments are designed to achieve compliance through enforcement. They give strategic direction to engender focused action or coordinate and implement policies. Such efforts can be both prohibitive (banning certain practices) or prescriptive (imposing or facilitating other practices).
    - **Bans and restrictions** have been commonly used to phase out certain products or components, in particular single-use plastics like bags, straws, disposable utensils (cutlery), styrofoam containers and many others. Cities can also restrict excessive packaging or non-recyclable packaging materials by limiting packaging size or weight and encouraging businesses to adopt alternative options (refillable or reusable containers). This has already been applied in particular in the form of single-use plastic bans in commerce and retail centres (e.g. pharmacies,

supermarkets) in different cities such as San Francisco,[33] Buenos Aires,[34] or Montréal.[35] These should serve as examples to other cities, particularly in the EU, which could expand the range of products or practices that could be banned beyond single-use plastics. In fact, the Netherlands, and in particular Dutch city councils, are already pioneers in such practices as bans on certain types of products or practices have already been approved and passed in cities like Haarlem, Amsterdam, Leiden and The Hague.[36] In the Netherlands, municipalities can establish rules and regulations under the Algemene Plaatselijke Verordening (APV), or "General local regulation" policy. More direct measures can be defined through specific zoning plans or operating agreements, but these belong to the set of instruments available under the urban planning competencies.

KEY CONSIDERATIONS

Building on national and supra-national legislation
While the legislative authority and influence of municipalities are limited in comparison to that of national and supra-national governments, Cities can work towards developing a legislative and regulatory framework that is structurally supported by the national one in order to reinforce its implementation on the ground. In addition, they can also support and take an active role in advocating for national-level governance to put in place different measures. By doing so, they can indirectly shape the instruments that will influence waste prevention in households and local businesses.

For instance, Extended Producer Responsibility (EPR) schemes indirectly affect municipalities, as cities and their residents directly benefit from this scheme. Cities should, therefore, strengthen the conversations with higher level of governance in regards to setting EPRs—or producer responsibility for single-use plastics (SUP)—to organise, facilitate and execute their implementation. Furthermore, cities can actively endorse and support legislative efforts at the national level. Los Angeles City Council recently passed a resolution endorsing the Right to Repair Act, joining other California municipalities in advocating for reduced e-waste and promoting repair. This action not only demonstrates the city's commitment to sustainability but also contributes to the broader movement seeking legislative changes.[37]

Only what is measured can be clearly and effectively managed.
Finally, while monitoring and evaluation are not regulatory instruments themselves, they are integral components of effective and evidence-based regulatory and policy frameworks. Indeed, regularly assessing the impact of the different measures (regulatory, legislative, but also others mentioned in this report) and making needed adjustments is an essential factor in achieving the desired vision of making a city waste-free.[38] Waste auditing and reporting instruments are key tools that cities can use to monitor progress, enabling them to measure whether their goals and milestones of reducing waste generation are feasible.

- **Monitoring** the effectiveness of circular and waste prevention practices requires a continuous collection of new data that is perhaps not currently included in existing databases, for example, related to circular strategies such as repair or reuse—both of which remain typically difficult to measure. To do so, expanding data availability through statistical surveys and aligning with a broader European measurement framework for urban circularity will be crucial.
- **Evaluation** should consist of a more detailed process through which the outcomes and impacts of different waste prevention interventions are analysed. The ultimate intention here is to determine the effectiveness of the regulatory instruments that are in place, for instance, in the amount of waste generated, but also looking at it from a cost-benefit analysis, for example

YES-YES STICKERS (AMSTERDAM)	SINGLE-USE PLASTIC LEGISLATION IN MONTREAL	ADVOCACY TO NATIONAL-LEVEL GOVERNANCE (SAN FRANCISCO)
The Yes-Yes sticker policy change has been adopted by seven Dutch municipalities so far and aims to reduce the large amounts of waste generated by flyers. People can indicate their interest in receiving flyers with stickers in their letter boxes. This practice ranges from an opt-out No-No policy to an opt-in Yes-Yes case. Research on this measure's effects indicated a significant decrease in waste without influencing the shopping habits of the people. Hence, this policy did not influence the interests of industry stakeholders that used this advertisement method but constituted an environmental win with zero economic costs.	Montréal's City Council recently passed a by-law that prohibits the distribution of several single-use plastics in Montréal grocery stores and restaurant services (food courts, food trucks, schools and employee cafeterias, vending machines), whether for on-site consumption, takeout or delivery. Businesses who refuse or fail to comply will be subject to fines ranging $400-4000 depending on the type of establishment and or the number of offences.	It is true that city governance can influence limited parts of the legislative national framework. Even though actions are important within their jurisdiction, national governance must, on multiple occasions, be reformed to support change. Thus, municipalities and cities should pressure and advocate for such changes. The city of San Francisco has followed this approach to push to establish an extended producers' responsibility legislation in order to reduce universal waste. This waste stream includes electronics and hazardous waste like mercury-containing items, and according to this approach, producers assume responsibility for the management of post-consumer products.

3. Business support and incentives

DESCRIPTION

For households to transition toward zero-waste lifestyles, they must find businesses in the city that offer services and products designed with minimal waste generation in mind. Indeed, overcoming the existing linear model cannot rely solely on changing consumption patterns but should also include a fundamental transformation of production methods and value chains. This will necessitate a collective effort from various stakeholders, including businesses, SMEs, startups, and other economic actors, to reshape their operations, business models, and product offerings and contribute to a less wasteful eco-conscious society.

Businesses hold significant responsibility for waste prevention, particularly in the product design phase. Concepts like ecodesign and circular design are instrumental in creating products with reduced use of raw materials and longer lifespans. This approach applies not only to products and packaging but also to service provision, aiming to achieve zero waste operations. It encompasses various product categories, effectively reducing waste streams, including consumables, food waste, and packaging waste.

MEASURES CITIES CAN USE

Municipal support encompasses a range of incentives to encourage businesses to adopt circular practices and prevent waste generation. These incentives may include direct financial support, such as grants and subsidies, collaborative frameworks, and fiscal incentives like tax reductions or fines. For example:

- **Financial incentives** can be used to motivate businesses to change their practices. These can include grants and subsidies, providing financial support for the initial investment needed to transition to waste reduction and circular practices. Such practices foster innovation and enable stakeholders to initiate the transition without bearing all the investment costs. Then, tax incentives can offer tax breaks and credits to businesses adopting eco-friendly and waste-reducing technologies; and low-interest loans can be offered designed to facilitate businesses in implementing waste-reduction measures.[39]
- **Providing spaces in the city.** City governments can bolster businesses that can offer zero-waste options to citizens by providing different spaces across the urban area:
  - By leveraging **intermittent or meanwhile use of underutilised buildings,** local governments can provide facilities rent-free or for an affordable short-term lease so that eco-conscious startups and entrepreneurs have a conducive environment for innovation and sustainability.
  - By establishing **Circular Economy Hubs**, cities can foster interconnected networks that unite businesses, startups, and entrepreneurs. These hubs act as platforms for businesses to share their waste reduction data and strategies, fostering competition and learning, and driving innovation among a diverse range of stakeholders, enriching the consumer experience with sustainable choices.
  - **Promote industrial symbiosis and Eco-Industrial Parks**, encouraging businesses to co-locate and share waste reduction resources and technologies. This approach emphasises the vital concept of matching companies within industrial clusters, enabling them to exchange residues, by-products, or waste heat and water—for a more waste-conscious industrial landscape. Such collaboration yields significant cost savings by reducing feedstock expenses for one company and waste management costs for another. Moreover, these eco-industrial parks and zones create a conducive environment for reducing overall waste generation and resource consumption, which can lead to more sustainable, affordable, and eco-friendly products for households.
- **Certification and recognition programs for best practices.** Through Eco-Certifications, cities establish rigorous recognition systems, motivating businesses to embrace sustainable waste-reduction practices. Municipalities can endorse already existing certification programs or create new stamp systems to distinguish and promote such businesses.[40] Furthermore, Awards and Recognition initiatives celebrate businesses excelling in waste reduction and circular economy endeavours, setting examples for others. Not only does this enhance these businesses' public exposure, but

it also serves as inspiration for others to follow suit. As a result, this approach can effectively tap into consumers' values and willingness to support environmentally responsible choices.[41]

- **Collaborative initiatives.** Cities can establish **business incubators and accelerators** focusing on nurturing circular economy startups. These programs offer guidance, resources, and mentorship, empowering startups to develop innovative solutions for waste reduction. Additionally, fostering **public-private partnerships** between local government and businesses creates a platform for joint efforts in developing effective waste reduction strategies. Such partnerships facilitate the exchange of best practices and collective problem-solving.

KEY CONSIDERATIONS

Companies have various motivations to adopt circular practices, including aligning with sustainability agendas, reducing costs, forming strategic partnerships, responding to shifting consumer preferences, and fulfilling corporate social and environmental responsibilities. Nevertheless, challenges such as competitive markets, endowment effects, rapid production cycles, and a lack of practical expertise can halt the transition. While it is true that not all challenges can be solved by municipalities alone, their role is essential in providing resources and incentives to kick-start this transition.[42] [43] [44] A collaborative approach with both stakeholders and municipal authorities can create a more enabling environment for waste prevention practices to prosper and become the norm. This includes, for instance, providing the space needed for companies that want to explore furniture leasing or rewarding businesses that want to shift to zero-waste packaging.

BUSINESS TRANSFORMATION PROGRAMME (LONDON)	MATCHMAKING COMPANIES IN CAPE TOWN	BE CIRCULAR PROGRAMME (BRUSSELS)
In London, the Business Transformation programme seeks to nurture a vibrant ecosystem of circular businesses, support job creation and resilient economic growth. London-based SMEs are supported to create attractive circular products and services through offering advice, grants, matchmaking and community services. The programme helps companies either adopt circular practices or mainstream their business model and scale up their efforts. The goal was to reduce waste and increase recycling rates, repair, sharing and renting across the city. Besides channelling grant funding, insights and circular business success stories are published to guide and inspire other actors.	The Western Cape Industrial Symbiosis Program is Africa's first Industrial Symbiosis project and supports the transition to a circular economy by enabling manufacturing companies to exchange under-used resources that usually end up as waste. This city-funded project is a free facilitation service that helps companies identify mutually beneficial opportunities to exchange resources. The matchmaking exploits new opportunities for the companies and creates a supply and demand chain for secondary materials within the industrial sector. The project has diverted more than 104,900 tonnes of waste from landfills so far while creating 218 economy-wide jobs	The Be Circular program in Brussels supports the transition of retail businesses to embrace circularity and reduce the very high amounts of waste generated in the city. The goals of the project are to promote local resources and increase the city's resource efficiency, boost entrepreneurship and create new job opportunities. During this program, more than 2,000 individuals will be trained in person and even more online to meet these goals. Workshops were held to co-create meaningful and context-specific solutions able to practically foster the transition. An online platform allows the different stakeholders to exchange information and report progress. Financial support was also provided, directly and indirectly, through awareness raising and wider services like on-site lawyers. Until now, more than 200 businesses have been coached and supported through the implementation of a circular approach, and more than 1400 individuals have been trained.

4. Circular public procurement

DESCRIPTION

Cities can play a significant role in supporting waste prevention and reduction through **Circular Public Procurement (CPP)**.[45] CPP is the process of acquiring products and services with a view to optimally use products, parts and materials throughout their lifetime. It goes beyond traditional Green Public Procurement—primarily focused on reducing the environmental impact of products and services purchased by the public sector—by actively seeking to make material flows more circular within different value chains, taking a more regenerative approach to resource use and waste reduction. By means of circular procurement, not only can institutions drastically reduce the environmental impacts, such as waste generation, associated with their consumption, but they can also integrate circular principles to lead by example for other stakeholders by changing market demand, supporting circular innovation, underpinning investment in the private sector, creating new business models and products. All these factors ultimately contribute to stimulating the production of circular products and delivery of circular services, which contribute to minimising overconsumption and waste generation.[46]

MEASURES CITIES CAN USE

CHOOSING THE RIGHT CIRCULAR PROCUREMENT MODELS

To influence waste prevention in cities, circular procurement contracts should prioritise integrating products and services into a wider circular economy system that considers the entire value chain. This holistic approach is highly effective in reducing waste generation from the outset, despite its potential complexity.[47] Circular procurement can be implemented at different levels:

- **Product level.** This level focuses on the specific products being purchased and considers factors like materials used (including recyclable or recycled materials), composition, and resource efficiency. For instance, this requires that materials included in the products being procured are identifiable and traceable or that they can be disassembled at their End-of-Life.
- **Supplier level.** At this level, the procurement process looks at the relationship between procurers and suppliers. It encourages suppliers to incorporate circularity measures into their processes and products to minimise waste generation. This can include designing products for repair, disassembly, or remanufacturing, offering take-back systems, and facilitating reuse or resale of items to third parties.
- **System level.** This is the broadest perspective, considering the full range of contractual methods from a life-cycle viewpoint. It includes supplier take-back agreements, public-private partnerships, and product-as-a-service models. For example, municipalities can procure a printing contract on a pay-per-copy basis in order to avoid buying and having to maintain and dispose of the equipment.

Defining the right criteria for waste prevention
When you define performance criteria based on circular economy principles that target waste prevention (e.g., designing for reuse, rethinking), businesses will need to offer innovative solutions that adhere to these principles. This approach helps procurement play a role in optimising material use across supply chains and reducing waste from the very beginning.[48] In the context of waste prevention, procurement criteria should therefore encompass considerations like product durability, resource efficiency, and the potential for reuse, refurbishment, and retrofitting.[49] Examples of such criteria include:

- *Durability criteria* can be met by demanding certain material quality and durability standards or certifications, or by demanding a guarantee over a certain period of time, or the possibility of ordering spare parts in the future. The durability of products contributes to lifetime extension, which is arguably one of the most effective measures to directly prevent waste generation, and also to move away from new products that are planned and designed to become obsolete.
- *Refurbish criteria* consist of choosing to maintain and refurbish office furniture in municipal buildings instead of buying new items. This means that the call for tenders should be formulated to attract companies that can provide maintenance services, as opposed to furniture retailers.
- *Reuse criteria* can be integrated by demanding the delivery of products in reusable packaging. This is particularly important for food products and obviously, a preventive measure that can mitigate the generation of food waste from poor packaging handling and packaging waste directly.

KEY CONSIDERATIONS

ENSURE THAT CIRCULAR TENDERING IS ADOPTED ACROSS ALL MUNICIPALITY DEPARTMENTS

To ensure the success of Circular Public Procurement (CPP) in a municipality, it is essential that this approach is embraced across all municipal departments concurrently. This requires adequate municipal organisation and cross-department ownership. The presence of separate budgets, fragmented project management, and departmental silos can structurally impede the efficiency of CPP. To mitigate these issues, it's crucial to establish a well-organised internal organisation and framework for CPP implementation. Additionally, all municipal departments should cooperate and strive towards circular tendering, appointing heads responsible for shared optimal results during the period of product or service usage across each municipality department.

For further guidance, the European Commission has, since 2017, defined and updated a set of Green Public Procurement criteria, with a reinforced emphasis on circularity dimensions, that range across over 20 product categories.[50] Similarly, the Dutch government has put in place a sustainable procurement criteria tool that municipalities and other organisations can access to gain insight about criteria across nearly 50 different product groups, among which circular economy is a key theme.[51]

Read more about Circular Public Procurement here:
Ellen MacArthur Guide for Circular Public Procurement for Cities
Circular Procurement In 8 Steps

PROMOTING CIRCULAR FURNITURE IN DANISH MUNICIPALITIES

In 2012, Denmark's central procurement agency implemented a four-year program to provide sustainable and circular office furniture to over 60 municipalities. Procurement criteria for these products were based on the Nordic Swan eco-label, encompassing aspects such as the chemicals used in manufacturing, coating, or colouring processes, as well as the potential for material separation and recovery at the end of the product's life cycle. Additionally, the program mandated that at least 70% of bio-based materials (wood and timber) should be either recycled or certified as sustainably sourced timber. Through this framework-based approach, significant cost savings of up to 26% compared to prevailing market prices were realised while also expanding the market for sustainable furniture products.

CIRCULAR PROCUREMENT TO CUT FOOD WASTE IN TURKU, FINLAND

The city of Turku, Finland, is also a great example of how a municipality has used circular procurement to support circular food systems, in particular, to cut down food waste and related emissions in municipal establishments. Turku's contracted kitchen facilities cater to a wide range of customers in the context of public institutions (educational, care homes, administrative buildings...). In total, 3,4 million meals are delivered to care facilities and 5,4 million to the educational sector, which under a conventional and linear model, was responsible for large amounts of food and packaging waste. In response to this issue, the City's strategic procurement department set new tenders and procurement criteria based on changing diets towards more plant-based, healthier and seasonal meals with the objective to substantially reduce food loss but also become more efficient in the consumption of resources (e.g. energy and water).

PORTO DEVELOPED CIRCULAR PROCUREMENT GUIDELINES

Porto organised workshops to involve municipal services, tourism, and social sector stakeholders in improving tender and procurement processes to reduce waste, in particular in food services. These workshops increased awareness and helped align these procurement guidelines across different public departments and private entities, especially from the tourism sector. Porto's progress in circular procurement through the CityLoops project led to a Sustainable and Circular Public Procurement Policy, which will soon be fully integrated across municipal services.

Waste prevention criteria in circular public procurement

Food products. In the realm of food procurement, cities can leverage circular principles by promoting regenerative agriculture and local, seasonal consumption patterns. By fostering shorter and more direct supply chains between producers, suppliers, and consumers, cities can minimise food waste and losses. Embracing locally and seasonally produced foods reduces the likelihood of waste generation, steering away from extensive globalised food networks.

Consumables. Cities have a multitude of opportunities to engage in circular procurement for consumables. This includes purchasing second-hand furniture, refurbished IT equipment, and the adaptive reuse of idle public building spaces. Moreover, municipalities can shift from procuring physical products to procuring the "use" or "functionality" of specific items through product-as-a-service contracts. For example, for capital equipment goods like public authority vehicle fleets, various schemes like leasing or pay-per-use can be adopted. This approach encourages circular business models, extends product and material lifespans, reduces operational costs, and ultimately prevents waste generation.

Packaging: Packaging plays a significant role in plastic pollution, and municipalities can address this issue in their procurement contracts. By eliminating items that contribute to plastic waste, such as single-use plastics, and exploring alternatives like reuse, refill, and return, cities can take proactive steps to reduce plastic waste from the start.

Built Environment. In public procurement related to buildings and infrastructure, circular criteria can be specified to mandate the use of secondary materials in new construction, renovation, and maintenance projects. This approach encourages the adoption of more sustainable and circular building practices.

Textiles: Circular procurement criteria can stimulate the purchase of circular industrial clothing by local governments that can either be leased or second-hand. This not only aligns with environmental objectives but also creates a demand for circular textiles, prompting market participants to produce and offer circular workwear.

5. Awareness and education

DESCRIPTION

While the most impactful ways to change behaviour lie in changing the surroundings in which citizens operate, educating and raising awareness among citizens about waste-free living is still an important instrument that cities can use.[52] Indeed, individuals play a vital role in the circular transition, and, as consumers, they are key advocates of waste reduction.[53] While the limelight often falls upon governmental and corporate stakeholders for waste prevention measures, the pivotal role that individuals play should not be underestimated. Circular cities must acknowledge individuals as collaborators, foster a shared sense of ownership, and encourage active participation. This can empower residents with knowledge and motivation to reduce waste and help them understand circular economy principles and their alignment with broader sustainability goals.[54]

MEASURES CITIES CAN USE

Cities can initiate multiple actions and leverage available tools to raise awareness about waste prevention:

- **Promote city branding for 'Zero waste cities':** Cities can utilise their unique image and branding to attract tourists and instil a culture of waste reduction among citizens. Leveraging their distinct identity, cities can position themselves as 'Zero Waste Cities' to draw visitors and encourage residents to conform to this waste-conscious identity. Public awareness campaigns, delivered through diverse media channels, can inform residents about the importance of waste reduction, how to integrate it into their lives, and its positive impacts. This educational approach can also emphasise the potential benefits that waste prevention measures can have for individuals, intertwining the city's identity with sustainable living.[55] Additionally, **public art and installations** strategically placed throughout the city offer a unique opportunity to both raise awareness and educate the public while also celebrating arts and culture, reinforcing the waste-conscious brand.
- **Organise community workshops and events:** Organise workshops, seminars, and community events to teach residents about waste reduction techniques and provide practical tips. Events such as themed festivals, music concerts, and competitions, combined with waste prevention speeches and interactive activities, offer creative ways to engage and motivate individuals to participate.[56] Finally, cities can offer **waste audits** to households, highlighting the volume and types of waste they produce and suggesting improvements for waste reduction.
- **Integrate waste prevention into school programs:** Incorporate circular economy and waste prevention subjects into school curricula, reaching students at various education levels. At higher education levels, courses about the circular economy are available in different parts of the world, including the Netherlands (e.g. Amsterdam University [57], HAN University [58] and others). By instilling these concepts from an early age, students can disseminate their knowledge within their families and communities.[59]
- **Develop interactive digital engagement:** Develop user-friendly websites, apps and social media that offer waste reduction information, event schedules, and resource-sharing tools for residents. These methods not only offer examples and insights but also generate valuable data for analysis to enhance engagement tools and methods.[60]
- **Nudging learning by doing:** Organise living labs, workshops, and innovative settings where individuals can implement or observe waste prevention measures in action, fostering experiential learning. These people-centred pilots contribute to promoting good practices and spreading awareness in the context of waste prevention.[61] Organising people-centred maker spaces pilots has highly contributed to other circular economy causes like waste management.[62] Such settings and lessons learned can be used in the waste prevention context as well to spread awareness and promote good practices.
- **Integrate the circular economy into other outreach programs**, such as those addressing climate change and biodiversity conservation. This approach contextualises waste prevention, engages a larger audience, and accelerates behavioural change by aligning it with other sustainability goals.
- **Supporting innovation and knowledge sharing:** Create an enabling environment for testing innovative waste prevention practices. Encourage research programs, knowledge exchange, interdisciplinary collaboration, and cooperation between the scientific sector and society to advance waste prevention initiatives.

KEY CONSIDERATIONS

Behavioural change is a long-term and difficult-to-achieve process which cannot solely depend on raising awareness. Attitude change alone has a low effect on behavioural change if the system in which individuals are called to make decisions does not change accordingly. Namely, it should always be accompanied by changes in infrastructure and policies that support and enable desired behaviours. Adjusting peoples' surroundings can normalise waste prevention behaviours and make them convenient, influencing the pace and efficiency of behavioural change. It is important to note that policy development can also benefit from behavioural insights and expertise.[63] Thus, a comprehensive approach that combines systemic changes with empowering individuals to leverage these changes is essential. What is also important, then, is that individual frame policy reforms should not oppose, crowd out or hamper systemic changes.[64]

Among (groups of) citizens, a certain change in this phase is already underway. For example, an increase is observed in the number of local loan and repair companies, product reuse through thrift stores, new forms of service provision, and online sharing platforms. Overall, the presence of these changes demonstrates a positive momentum and sets the stage for cities to leverage and accelerate waste prevention efforts, capitalising on the growing interest and commitment within their communities.

Addressing waste prevention is a complex challenge as it stems directly from the consumption choices of linear modern societies, influenced by individual behaviours and systemic structures. Current social norms are still rooted in an outdated model of overconsumption, associating one's possessions with identity and status. These norms must evolve to align with a system that promotes sustainability and material sufficiency, embracing waste prevention. To counteract social pressure and normalise waste-free practices, efforts such as raising awareness, education, and cultivating environmental values become, therefore, essential complementary efforts for local governments to system and infrastructure change.[65]

HOUSEHOLD CHALLENGE IN KIEL (GERMANY)	GO ZERO WASTE APP IN SPAIN	ZERO WASTE AMBASSADOR PROGRAMME IN ANN ARBOR (U.S.)	WASTE WISE SCHOOLS ACROSS WESTERN AUSTRALIA
In Germany, Kiel took the pioneering step of launching the inaugural Zero Waste household challenge, with the goal of inspiring, educating, and motivating citizens to conserve resources in their daily lives. Over the course of four weeks, the project introduced a distinct theme each week (focusing on food, clothing and consumption, bathroom and hygiene, and leisure on the go) for participants, accompanied by initial steps, as well as a wealth of practical tips and tricks to help them embark on a waste-free lifestyle.	Spain has introduced a cutting-edge digital tool known as the "Go Zero Waste" app, designed to bolster the implementation of circular policies among its citizens. This innovative platform leverages incentives and gamification elements to engage and motivate individuals. It not only offers valuable information on waste reduction and minimising environmental impact but also encourages proactive participation in addressing local challenges, such as sharing and repairing, thus contributing to a more sustainable and eco-conscious society.	Ann Arbor's A²ZERO Ambassadors Program brings together and trains interested community members in circular and sustainable practices, empowering them to become change agents within their families, peer groups, and neighbourhoods. These ambassadors play a vital role in fostering climate change awareness and contributing to the realisation of the city's decarbonisation objectives[68]	Waste Wise School Program in Western Australia actively practises the 3Rs – Reduce, Reuse, Recycle, instilling eco-friendly values in students and the school community. This program aligns with the Western Australian Curriculum Framework, offering support for waste management infrastructure, resources, professional development, and curriculum materials. It empowers schools and community partners to plan, implement, and maintain waste reduction projects.

Leveraging nudges and behavioral economics for effective waste prevention

The utilisation of nudges rooted in behavioural economics principles plays a pivotal role in the context of waste prevention, presenting a remarkable avenue for encouraging desired behaviours.[66] These nudges involve employing subtle, cost-effective interventions that influence individuals' choices without resorting to explicit regulations or financial incentives.[67] Instead, they ingeniously modify the structure and context within which choices are made.

Examples include:

- **Managing options:** Simplify the number of disposable products available or sizes, encouraging individuals to opt for reusable items or to consume less.
- **Framing Techniques:** Present information that emphasises the long-term benefits of waste prevention, encouraging more sustainable consumption habits.
- **Information Provision:** Offer clear and concise data about the environmental impact of single-use items and the advantages of waste reduction.
- **Spatial and Digital Design:** Organise community swap events in high-traffic areas and employ digital campaigns highlighting the benefits of reducing waste.
- **Attention-grabbing techniques:** Use eye-catching signage at stores, prompting customers to choose products with minimal packaging, to draw attention and encourage waste-preventing decisions.

Note: Individual behaviour targeting nudges should not be considered a replacement or alternative to systemic changes but complementary actions. Excessive waste generation is a societal problem that cannot be solved without systemic change.

Synergies and contradictions

The above-mentioned instruments are not stand-alone measures and should be addressed in a holistic and complementary manner to gain multiple co-benefits and address the associated barriers. Urban and spatial planning creates the physical infrastructure and environment for circular practices, while regulations and legislation ensure compliance. Business support and circular procurement stimulate the circular economy, and awareness and education engage and empower citizens to participate actively. Together, these instruments can accelerate the transition to a more sustainable, waste-free, and circular society.

Synergies include:

- For example, to achieve a comprehensive shift in supply and production chains, strong **business support** is essential. Businesses face numerous challenges, including global market competition, which municipalities cannot control. However, creating a conducive environment can still encourage waste reduction efforts. **Urban planning** plays a crucial role in this process by enabling synergies and achieving various goals. Many waste prevention activities require advanced logistics, facilities, and networking space. Therefore, efficient and forward-thinking urban planning is vital to efficiently implement this vision and support stakeholders in making the transition.
- Moreover, enforceable **laws and regulations** are crucial for ensuring that businesses and individuals adhere to circular practices. When integrated with other instruments, such as **circular public procurement** and **awareness and education**, they can create a legal framework that compels businesses to adopt circular practices and helps residents understand their rights and responsibilities regarding waste prevention.
- Then, **circular procurement**, when integrated with **urban planning** and **regulations**, can create a market for circular products and services, leading to the development of circular economy solutions by various actors and promoting waste prevention in a front-edge stage of the life-cycle process directly.[69] It also reinforces **awareness** and education efforts by demonstrating the government's commitment to responsible consumption and production.
- Finally, when residents are **educated** about the benefits of waste reduction and circular practices, they are more likely to support and participate in circular initiatives promoted by urban planning, regulations, financial incentives, and circular procurement.

However, when developing interventions, it is important to always keep in mind a few potential **contradictions** or any negative side effects:

- **Contradicting incentives.** For example, waste prevention aims to a reduction in waste generation, which might decrease the economic incentives for certain waste management sectors like incineration or even recycling of certain materials and components. This can create a contradiction in the waste management system as reduced waste may lead to under utilising existing infrastructure, potentially affecting jobs and the economic viability of these sectors. Stakeholders must consequently reinvent their activities, adapting to new roles in the system to actively contribute to and support the evolving changes, a shift that some have already begun to consider.
- **Social equity and inclusion:** The implementation of digital solutions to promote waste prevention, such as online payment systems and data centres for digitization, may inadvertently exclude certain segments of the population, such as older individuals who may not be tech-savvy or those without access to digital resources.
- **Negative side effects:** While waste prevention is generally beneficial for the environment, there can be unintended negative consequences. For example, shared consumption can reduce waste, but it may lead to increased transportation and associated CO_2 emissions. Digitisation can reduce paper waste but requires energy for data centres. Avoiding excessive packaging can encourage food waste if products spoil more easily. Balancing these trade-offs and considering the broader environmental impact is essential in waste prevention strategies.
- **Behavioural challenges:** Changing consumer behaviour to adopt waste prevention practices can be challenging. Even with the best-intentioned policies and initiatives, there may be resistance or apathy among the public, which can be a contradiction to the goals of waste prevention.

In short, waste prevention should always be placed in the broader context of waste management and environmental behaviour.[70]

Conclusion

The importance of waste prevention has been strongly emphasised in different frameworks,[71] underscoring the pressing need to reimagine our lifestyles and consumption patterns, particularly within the context of cities—global hotspots of both consumption and waste generation. Despite this urgent call, local authorities predominantly channel their resources and efforts into improving waste treatment and recycling instead of aiming at curbing waste generation through proactive prevention measures.

As the Netherlands embraces the target of a fully circular economy, waste prevention will be key to achieving the target, and cities will play a pivotal role in envisioning a waste-free future. They can integrate the right measures and facilitate the necessary behavioural and systemic changes to work towards it.

Cities can start their journey toward waste prevention by leveraging the following key opportunities:

1. **Leverage the newly introduced *Omgevingswet,* offering support for:**
   - Pioneering urban planning that designs a different urban fabric needed to implement a waste-free city.
   - Establishing robust logistical networks to underpin novel systems.
2. **Cultivate a vibrant and innovative business ecosystem.**
   - Fostering beneficial partnerships and industrial symbiosis relations to innovate and reduce their waste collectively.
   - Instituting certifications and recognition programs.
   - Deploy new facilities and use public space to promote circular options.
3. **Strategically use regulatory and legislative instruments.**
   - Design economic instruments like deposit return schemes to motivate waste-preventing behaviours.
   - Take bolder action with bans and restrictions on troublesome materials.
4. **Catalyze societal buy-in.**
   - Initiate a cultural shift required to embrace a lifestyle founded on material-sufficiency.
   - Promote learning by doing through interactive workshops and diverse forms of engagement.
   - Facilitating knowledge-sharing platforms.

By leveraging the key instruments and action points highlighted in this report, cities can construct a beneficial strategy for their specific contexts to initiate systemic change and achieve waste prevention for a more circular and sustainable future.

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