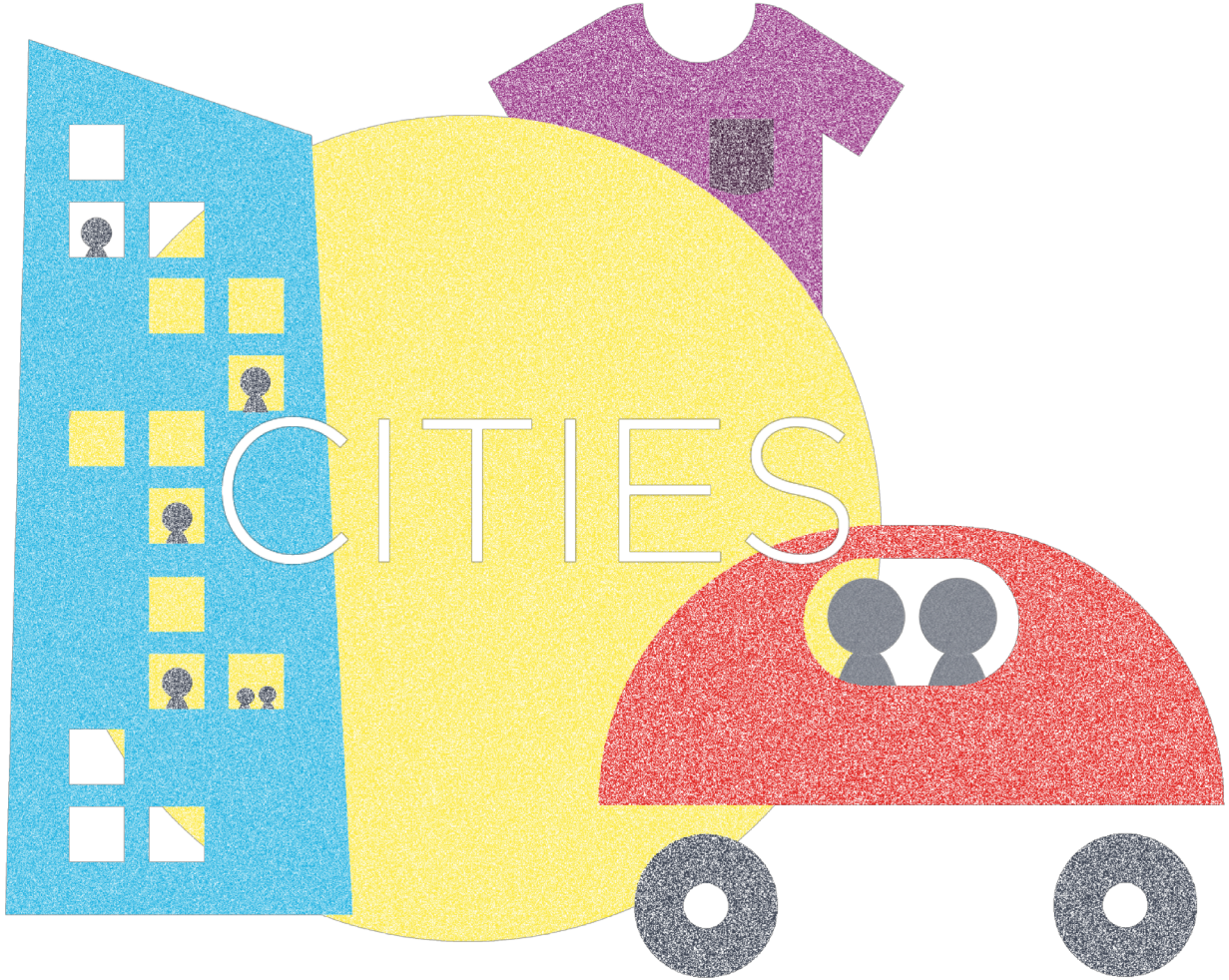

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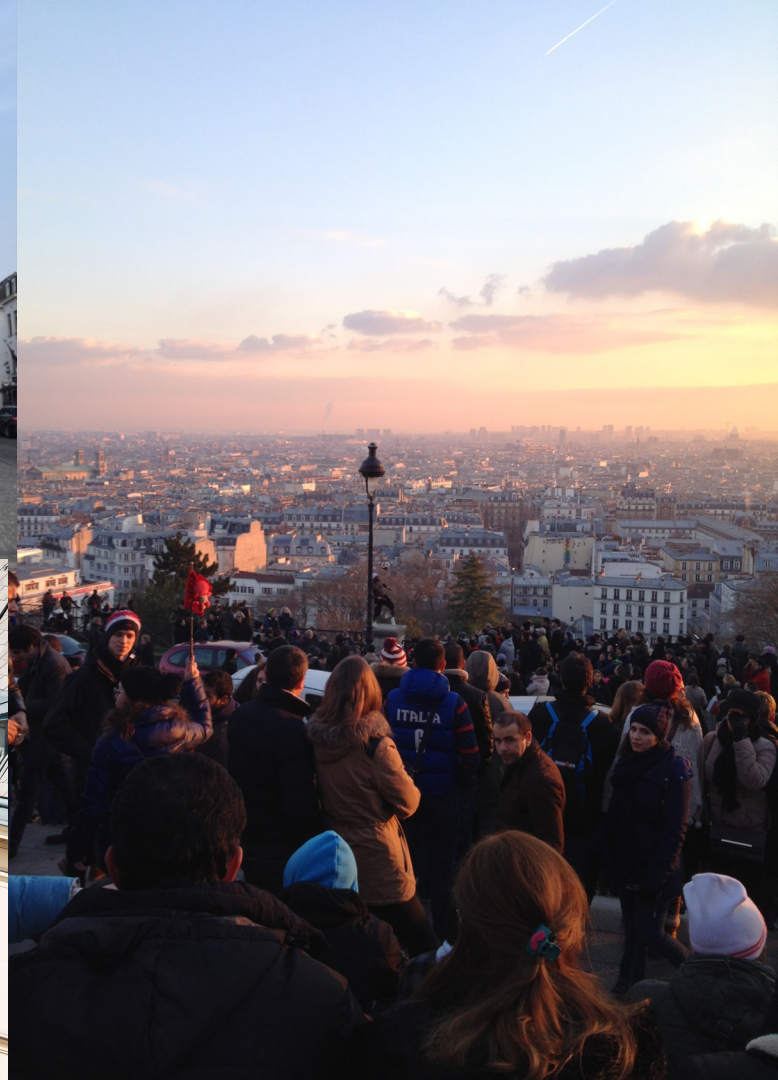
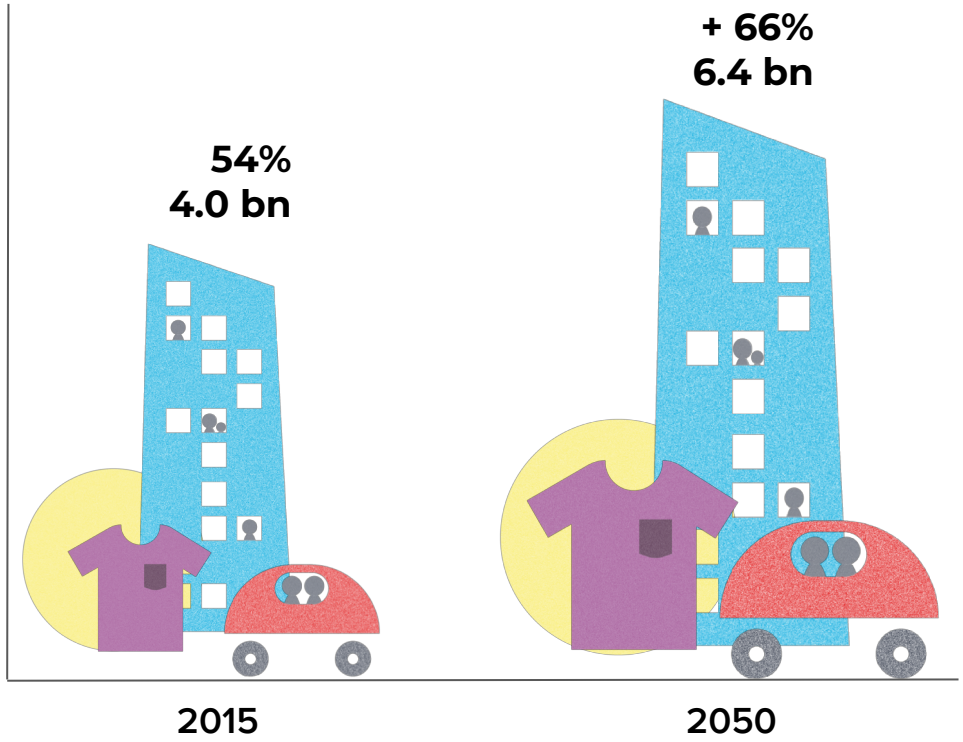
Please
Do not feed
the birds
It is an offence for
which you could be
fined up to £500.



WHY CITIES?



...account for

85% of global GDP generation

75% of global resource consumption

60-80% of global GHG emissions

>50% of global solid waste production

CITIES

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Module: Factsheets

CITY PRIORITIES ACROSS THE WORLD

CITIES

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Key city priorities

Themes across all plans:

- Affordable housing
- Efficient and accessible transport
- Economic growth, increased prosperity
- Jobs, good jobs, skills
- Good, healthy living conditions
- Strong community

Operationally:

- Sound city budgets

Many plans also highlighted:

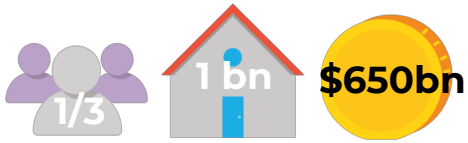
- Resilience to shock (weather, economic)
- Climate adaptation and reduced emissions
- Food security
- Increase density / counter urban-sprawl
- Green space, walkability
- Regional collaboration
- Being an international hub for a given area
- Education
- Equity
- Public safety

Other insights

Growth:

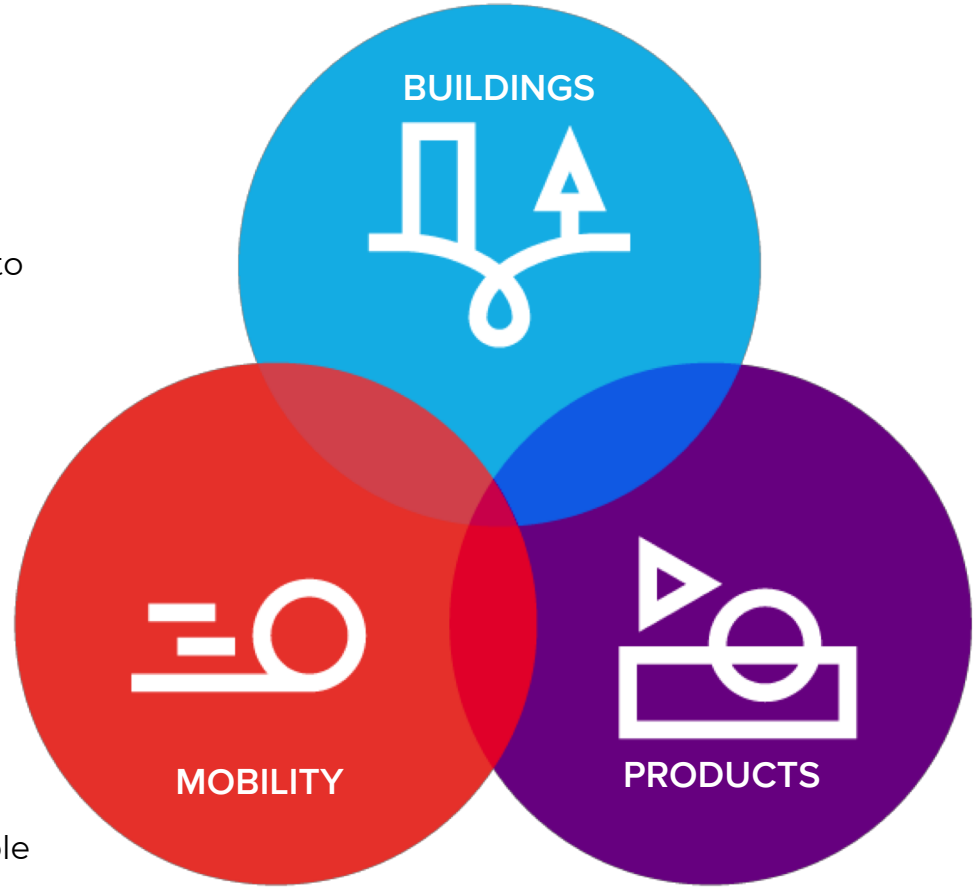
- Growth discussions are nuancing
- Traditional economic growth
- Good growth
- Better growth
- Positive growth
- ...
- Regenerative growth

THREE URBAN SYSTEMS AND CASE FOR CHANGE



By 2025 1bn new homes are needed worldwide, costing $650bn pa and 1/3 struggle to find affordable housing and 60% of office space is not in use during working hours

Congestion costs 2-5% of global GDP annually in lost time, wasted fuel, and increased cost of doing business. Yet only 1 in 5 car seats are in use on average and parking takes up valuable land



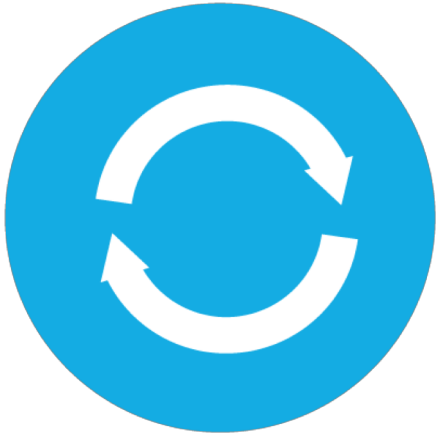
Up to 20% of municipal budgets are spent on waste management

75% of municipal solid waste can be discarded consumer goods, of which 80% is burned, landfilled or dumped due to poor design or lack of options

Factsheet module

THREE PRINCIPLES

What if we **designed out waste and pollution** from cities?



What if we **keep products and materials in use and maintain value**?

What if we **regenerate natural systems** in and around cities ?

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Planning
Designing
Making
Accessing
Operating & maintaining
CITIES
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PHASE	EXAMPLES OF CIRCULAR ECONOMY OPPORTUNITY
PLANNING	1. Planning compact cities – dense, mixed-use, and transit-oriented 2. Planning for local circular material flows
DESIGNING	1. Designing for adaptable and flexible use 2. Using collaborative design processes 3. Integrating material choices into design 4. Taking inspiration from nature
MAKING	1. Sourcing materials strategically 2. Building with resource-efficient construction techniques 3. Building 'buildings as material banks' (BAMB)
ACCESSING	1. Accessing residential space through shared-use 2. Accessing commercial space through shared use schemes
OPERATING AND MAINTAINING	1. Using smart technology to run buildings effectively 2. Using product-as-a-service models for building fit-outs 3. Adapting buildings for alternative uses 4. Refurbishing buildings to run them efficiently

BUILDINGS:

Commercial & Residential

MOBILITY:

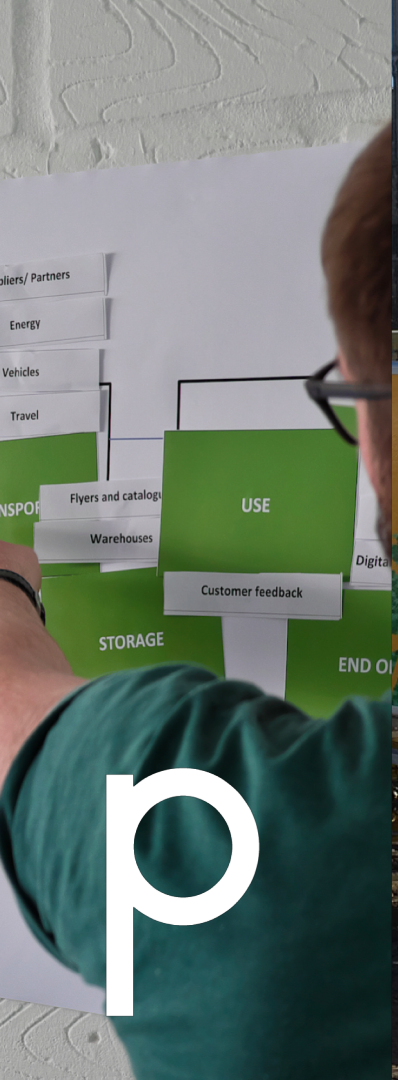
People, goods & infrastructure

PHASE	EXAMPLES OF CIRCULAR ECONOMY OPPORTUNITY
PLANNING	1. Compact city development for effective mobility 2. Urban freight strategies for effective reverse logistics and resource flows 3. Infrastructure for zero-emission vehicles and energy storage 4. Using big data solutions to optimise mobility systems
DESIGNING	1. Designing vehicles for adaptable and shared use 2. Design for zero-emission transport vehicles and energy grids 3. Designing transport infrastructure for adaptable use 4. Designing regenerative and energy positive, mobility infrastructure
MAKING	1. Sourcing infrastructure materials strategically 2. Manufacturing vehicles using resource-effective techniques 3. Building infrastructure with new construction techniques
ACCESSING	1. Alternatives solutions that reduce transport needs 2. Active and low-impact mobility solutions 3. Multimodal transport as an integrated service 4. Optimising freight capacity through shared solutions and distributed centres
OPERATING AND MAINTAINING	1. Minimising trip length, duration, and operational energy use via digital solutions 2. Mobility assets operated and maintained in new business models 3. Refurbishing and repairing vehicles to extend material cycles 4. New techniques for infrastructure operation and maintenance

PHASE	EXAMPLES OF CIRCULAR ECONOMY OPPORTUNITY
PLANNING	1. Supporting and incentivising better production (upstream) 2. Providing resource management infrastructure (downstream)
DESIGNING	1. Designing for reuse and multiple cycles 2. Designing to support efficient operation and maintenance 3. Designing in supply chain and product transparency 4. Open-source design to accelerate innovation, uptake, and customisation
MAKING	1. Sourcing locally abundant materials 2. Aligning digital manufacturing with circular economy principles 3. Increasing the distribution of manufacturing in line with circular economy principles
ACCESSING	1. Accessing products through product-as-a-service business models 2. Accessing pre-owned products through peer-to-peer models
OPERATING AND MAINTAINING	1. Empowering repair initiatives to extend product cycles 2. Refurbishing products for reuse

PRODUCTS:

Household goods, excluding consumables


Energy
Vehicles
Travel
Flyers and catalogu
Warehouses
USE
Customer feedback
STORAGE


DHL


LIBRARY
OF
THINGS
Open for borrowing
TUESDAY 10 - 4 pm
THURSDAY 10 - 4 pm
SATURDAY 10 - 4 pm
BECOME A
MEMBER FOR
FREE
SIGN UP

p d m a o

JOBS, SKILLS, AND INNOVATION

RESOURCE USE

COMMUNITY AND SOCIAL PROSPERITY

Open desk design desks and use digital technology to enable the manufacturing to occur locally and eliminate shipping. **Fab labs** is a movement to grow manufacturing in cities. **Materiom** is developing an open source material recipe book to support local material use.

Greater **diversification and localisation** of production and feedstock supply can support cities and their inhabitants in becoming more self-sufficient and resilient to changes in global markets.

Module: Factsheets

ECONOMIC PRODUCTIVITY

JOBS, SKILLS, AND INNOVATION

RESOURCE USE

WeWork has all types of users, from startups to corporates such as Microsoft and IBM. The **Hoffice** platform connects people who wants to work in shared home offices**. Home Share Int** brings young and elderly residents together for mutual benefits.., **3Space** turns vacant offices into maker spaces and incubators. **Spacious** opens up restaurants for co-working when not in use.

Vacant spaces are being put into use through a myriad of new solutions. Both supporting affordability while strengthening resident and business communities.

Module: Factsheets

ECONOMIC PRODUCTIVITY

HEALTH AND ENVIRONMENT

COMMUNITY AND SOCIAL PROSPERITY

Transport for London collects and releases anonymised transport data, helping commuters to save transport time worth GBP 15-58 million per year. **Whim** offers access to (almost) all types of transport through an integrated mobility-as-a-service scheme. **Routific** helps delivery companies cut routes by up to 40% with an algorithm based on how bees discover the shortest route between flowers.

Digitalisation and big data can help cities and transport providers in optimising transport services, making more effective solutions attractive.

Module: Factsheets

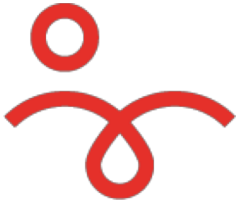
BROAD RANGE OF BENEFITS

Health & Environment

Economic productivity

Jobs, skills & innovation

Community & social prosperity



Resource use

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[Module: Factsheets]

CITIES ACROSS THE WORLD

Key city priorities

Themes across all plans:

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- Efficient and accessible transport
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Operationally:

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- Traditional economic growth
- Good growth
- Better growth
- Positive growth
- ...
- Regenerative growth

CITIES

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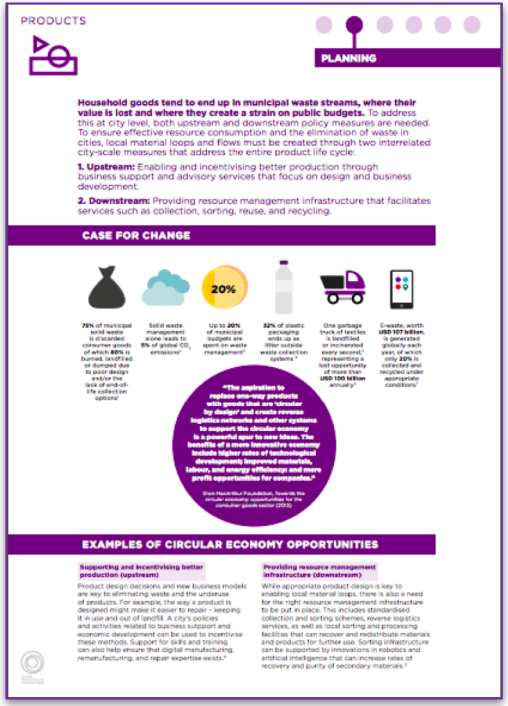
FACTSHEETS



PRODUCTS

PLANNING

Household goods tend to end up in municipal waste streams, where their value is lost and where they create a strain on public budgets. To address this at city level, both upstream and downstream policy measures are needed. To ensure effective resource consumption and the elimination of waste in cities, local material loops and flows must be created through two interrelated city-scale measures that address the entire product life cycle:

1. Upstream: Enabling and incentivising better production through business support and advisory services that focus on design and business development.

2. Downstream: Providing resource management infrastructure that facilitates services such as collection, sorting, reuse, and recycling.

CASE FOR CHANGE

75% of municipal solid waste is discarded consumer goods of which 80% is burned, landfilled or dumped due to poor design and/or the lack of end-of-life collection options[1]

Solid waste management alone leads to 5% of global CO_2 emissions[2]

Up to 20% of municipal budgets are spent on waste management[3]

32% of plastic packaging ends up as litter outside waste collection systems[4]

One garbage truck of textiles is landfilled or incinerated every second,[5] representing a lost opportunity of more than USD 100 billion annually[6]

E-waste, worth USD 107 billion, is generated globally each year, of which only 20% is collected and recycled under appropriate conditions[7]

"The aspiration to replace one-way products with goods that are 'circular by design' and create reverse logistics networks and other systems to support the circular economy is a powerful spur to new ideas. The benefits of a more innovative economy include higher rates of technological development, improved materials, labour, and energy efficiency and more profit opportunities for companies."

Ellen MacArthur Foundation, Towards the circular economy: opportunities for the consumer goods sector (2013)

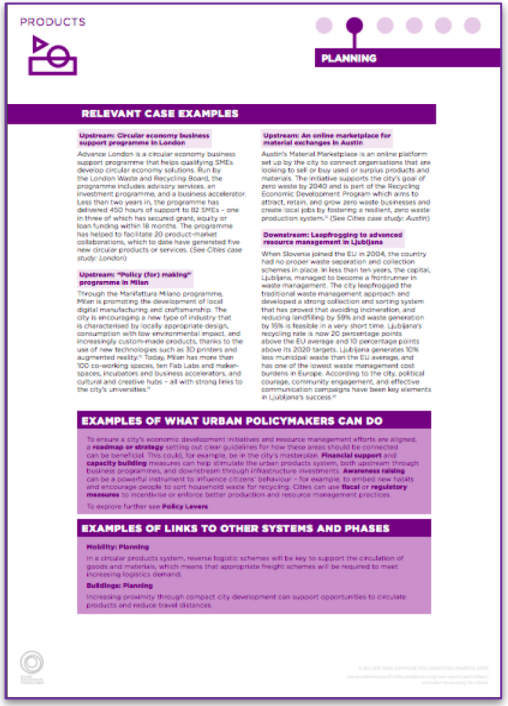
EXAMPLES OF CIRCULAR ECONOMY OPPORTUNITIES

Supporting and incentivising better production (upstream)

Product design decisions and new business models are key to eliminating waste and the undesirable consequences of products. For example, the way a product is designed might make it easier to repair – keeping it in use and out of landfill. A city's policies and activities related to business support and economic development can be used to incentivise these methods. Support for skills and training can also help ensure that digital manufacturing, remanufacturing, and repair expertise exists.[8]

Providing resource management infrastructure (downstream)

While appropriate product design is key to enabling local material loops, there is also a need for the right resource management infrastructure to be put in place. This includes standardised collection and sorting schemes, reverse logistics services, as well as local sorting and processing facilities that can recover and redistribute materials and products for further use. Sorting infrastructure can be supported by innovations in robotics and artificial intelligence that can increase rates of recovery and purity of secondary materials.[9]



PRODUCTS

PLANNING

RELEVANT CASE EXAMPLES

Upstream: Circular economy business support programme in London

Advance London is a circular economy business support programme that helps qualifying SMEs develop circular economy solutions. Run by the London Waste and Recycling Board, the programme includes advisory services, an investment programme, and a business accelerator. Less than two years in, the programme has delivered 450 hours of support to 82 SMEs – one in three of which has secured grant, equity or loan funding within 18 months. The programme has helped to facilitate 20 product-market collaborations, which to date have generated five new circular products or services. (See Cities case study: London)

Upstream: "Policy (for) making" programme in Milan

Through the Manifattura Milano programme, Milan is promoting the development of local digital manufacturing and craftsmanship. The city is encouraging a new type of industry that is characterised by locally appropriate design, consumption with low environmental impact, and increasingly custom-made products, thanks to the use of new technologies such as 3D printers and augmented reality.[1] Today, Milan has more than 100 co-working spaces, ten Fab Labs and maker-spaces, incubators and business accelerators, and cultural and creative hubs – all with strong links to the city's universities.[2]

Upstream: An online marketplace for material exchanges in Austin

Austin's Material Marketplace is an online platform set up by the city to connect organisations that are looking to sell or buy used or surplus products and materials. The initiative supports the city's goal of zero waste by 2040 and is part of the Recycling Economic Development Program which aims to attract, retain, and grow zero waste businesses and create local jobs by fostering a resilient, zero waste production system.[3] (See Cities case study: Austin)

Downstream: Leapfrogging to advanced resource management in Ljubljana

When Slovenia joined the EU in 2004, the country had no proper waste separation and collection schemes in place. In less than ten years, the capital, Ljubljana, managed to become a frontrunner in waste management. The city leapfrogged the traditional waste management approach and developed a strong collection and sorting system that has proved that avoiding incineration, and reducing landfilling by 59% and waste generation by 15% is feasible in a very short time. Ljubljana's recycling rate is now 20 percentage points above the EU average and 10 percentage points above its 2020 targets. Ljubljana generates 10% less municipal waste than the EU average, and has one of the lowest waste management cost burdens in Europe. According to the city, political courage, community engagement, and effective communication campaigns have been key elements in Ljubljana's success.[4]

EXAMPLES OF WHAT URBAN POLICYMAKERS CAN DO

To ensure a city's economic development initiatives and resource management efforts are aligned, a **roadmap or strategy** setting out clear guidelines for how these areas should be connected can be beneficial. This could, for example, be in the city's masterplan. **Financial support** and **capacitating** measures can help stimulate the urban products system, both upstream through business programmes, and downstream through infrastructure investments. **Awareness raising** can be a powerful instrument to influence citizens' behaviour – for example, to embed new habits and encourage people to sort household waste for recycling. Cities can use **fiscal** or **regulatory measures** to incentivise or enforce better production and resource management practices.

To explore further see **Policy Levers**

EXAMPLES OF LINKS TO OTHER SYSTEMS AND PHASES

Mobility: Planning

In a circular products system, reverse logistic schemes will be key to support the circulation of goods and materials, which means that appropriate freight schemes will be required to meet increasing logistics demand.

Buildings: Planning

Increasing proximity through compact city development can support opportunities to circulate products and reduce travel distances.

PRODUCTS

PLANNING

EXAMPLES OF BENEFITS

ECONOMIC PRODUCTIVITY

Creating new profit potential

Collected and sorted clothing has a profit potential of around USD 1,300 per tonne.[1]

Reducing material costs

Circular opportunities for fast-moving consumer goods could be as much as USD 700 billion per annum in material savings.[2]

HEALTH AND ENVIRONMENT

Reducing the environmental impacts on cities of the electronics industry

Better recycling, higher-value end-of-use options (e.g. remanufacturing), and performance-based business models in urban China's electronics and electric appliances industries could reduce emissions of CO_2 by 24 million tonnes and of particulate matter (PM2.5) by 11% in 2030.[3]

Reducing similar impacts of the textiles industry

In Chinese cities, implementing all circular economy opportunities in textiles could have a significant impact on reducing environmental impact costs, by USD 64 billion in 2030 and USD 112 billion in 2040.

RESOURCE USE

Reducing reliance on raw materials for electronics

Better recycling, higher-value end-of-use options (e.g. remanufacturing), and performance-based business models in urban China's electronics and electric appliances industries could reduce reliance on key virgin raw materials, such as precious metals, by 14% in 2040.[4]

Increasing e-waste recovery

Circular economy resource management infrastructure, optimised using AI solutions, could enable the recovery of USD 24 billion of additional value from reused, repaired, remanufactured or recycled devices, components and materials. AI can help capture a significant part of the total e-waste market, which is estimated to be USD 107 billion.[5]

Reducing reliance on raw materials for textiles

Stimulating automation and 3D printing, water and energy efficiency, and textile recycling would decrease the need for virgin materials and other primary resources in Chinese cities, while generating USD 48 billion in savings by 2040.[6]

JOBS, SKILLS, AND INNOVATION

Creating jobs from utilisation of municipal waste

On a European scale, reuse can create significant local employment: on average, 80 jobs could be created for every 1,000 tonnes of collected municipal solid waste. Europe-wide, 200,000 jobs could be created if 1% of total EU municipal solid waste were to be collected and sorted.[1]

Creating jobs and training in the collection and sorting of electronics

15 jobs and 110 training opportunities could be created for every 1,000 tonnes of electronics collected and sorted for reuse. In Europe alone this could amount to between 55,000 and 93,500 jobs.[2]

Creating jobs and training in textiles collection and sorting

Around 20 jobs could be created for every 1,000 tonnes of textiles collected and sorted for reuse, adding up to 120,000 jobs in Europe.[3]

Creating jobs in packaging waste management

In France, the sorting, collection, and recycling of packaging could generate more than 10,000 jobs.[4]

Creating jobs in packaging deposit-return-schemes (DRS)

The introduction of a DRS for beverage containers in the UK could generate between 3,000 and 4,300 jobs in collection and processing as well as an additional increase in the number of higher-skilled jobs.[5] In Germany, expansion of the DRS to all drinks containers could create 27,000 jobs.[6]

Generating higher salaries

Recycling a tonne of solid waste will pay USD 101 more in salaries and wages than disposing of it in landfill.[7]

The main driver is increased water recycling and treatment, which contributes 60% of the 2040 cost reductions.[8]

COMMUNITY AND SOCIAL PROSPERITY

Increasing access by reducing cost

By 2040, China's urban electronics and electric appliances industries, upstream and downstream circular economy measures could reduce total cost of access by nearly 14% compared with the current development path. This could therefore increase access to these goods for lower-income groups.[9]

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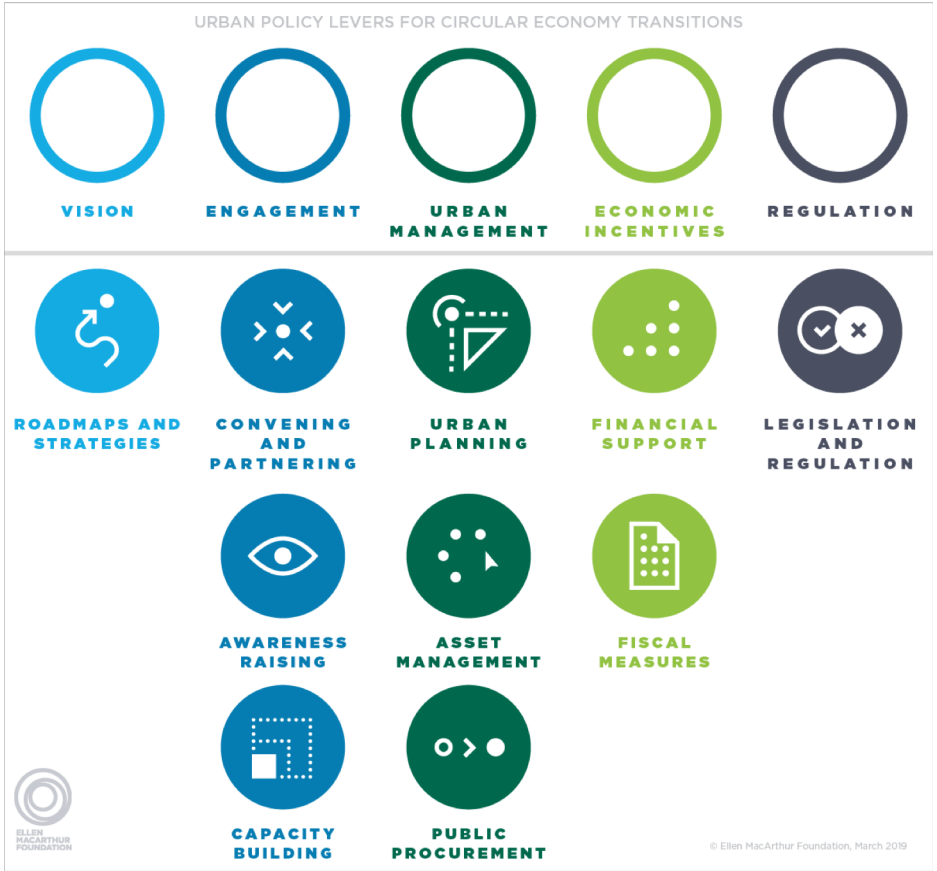
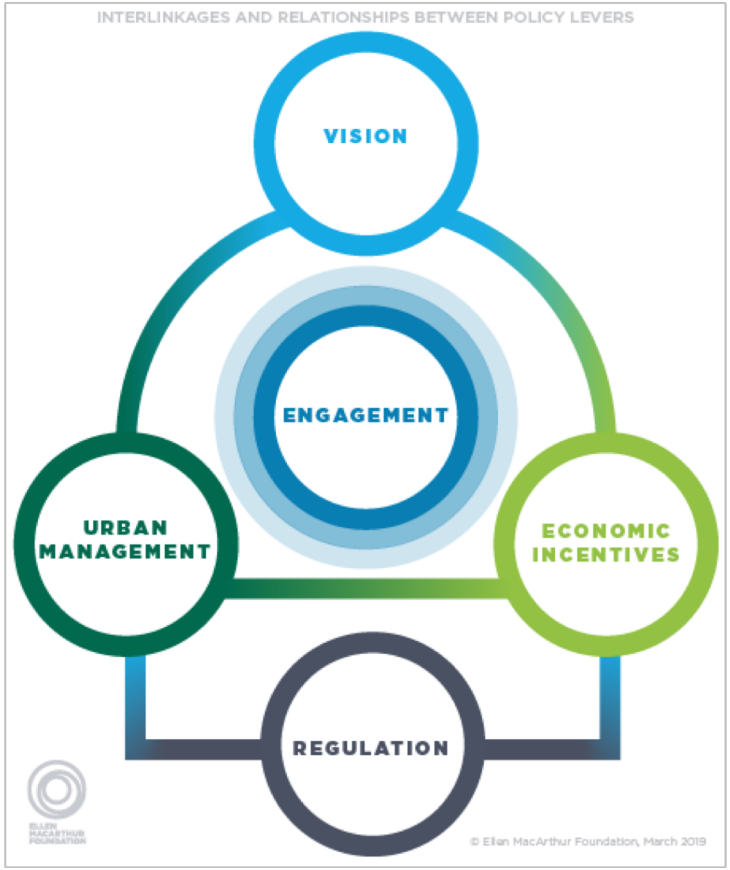
ROLE OF URBAN POLICYMAKERS





[Module: Policy levers]

11 CITY-LED CASE STUDIES

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CITIES

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SAN FRANCISCO

CRADLE TO CRADLE CARPETS FOR CITY BUILDINGS

Laying the groundwork for circular procurement

GOVERNANCE
Mayoral Council of the City and County of San Francisco

POPULATION
884,363

GDP
USD 143 billion

DENSITY
7,282 per km²

AT A GLANCE

THE INITIATIVE

In spring 2018, the City of San Francisco passed legislation that all carpets installed in city departments would be at least Cradle to Cradle Certified Silver and must not contain antimicrobials, fluorinated compounds, flame retardant chemicals, or other chemicals of concern. Similar requirements apply to carpet adhesives. Carpet tiles are to be used for ease of replacement and avoidance of waste. Additionally, both the carpet fibres and backing materials must contain minimum amounts of recycled materials, and ultimately be recyclable at end-of-use.

San Francisco led this initiative as part of its drive to reduce the amount of discarded carpets sent to landfill (currently over 80% in the USA), and ensure the well-being of visitors and staff in San Francisco City departments. From the outset it was important to ensure the process not only inspired material and business innovation but also allowed for a competitive bid process. It therefore required extensive research and stakeholder engagement.

TIME FRAME

Research began in summer 2016 and, following a period of consultation, the regulation was passed in Spring 2018.

FOCUS AREAS

By focussing on the built environment supply chain, San Francisco was able to work towards meeting environmental and material health goals within city buildings and create new opportunities for suppliers to win city contracts.

CORE TEAM & EXTERNAL PARTICIPANTS

The development of San Francisco's 'green carpet requirements' was a collaborative effort between: the Department of Environment's Zero Waste, Toxics Reduction, and Green Building teams, the Municipal Green Building Task Force, an external consultant from HDR (an architectural, engineering and consulting firm), and city staff involved in public procurement.

FINANCE

The research and execution of the regulation was financed from the Department of Environment's budget, ultimately derived from city refuse fees, and totalling approximately USD 15,000.

LEAD POLICY LEVERS

- ROADMAPS AND STRATEGIES
- CONVENING AND PARTNERING
- AWARENESS RAISING
- PUBLIC PROCUREMENT
- LEGISLATION AND REGULATION

For more see Policy Levers

MEASURING PROGRESS

It is early days in the life of San Francisco's green carpet regulations and as such environmental and economic benefits have not yet been calculated, however work is being undertaken to begin to paint the picture and quantify the amount of compliant carpet installed - 2018 data received from one supplier alone equates to 1,621 yards² (1,355 m²) of compliant carpet tile, for example.

Assisting this process, a system will be installed in 2019 to track compliant carpet purchases for all LEED certified city buildings. For non-LEED projects the city is investigating other options for capturing purchasing data, notably through its new financial and budgeting software system.

REFLECTIONS

Using the creation and implementation of regulation to open up new opportunities for suppliers and new standards in city procurement and asset management. Under the Environmentally Preferable Purchasing Ordinance, this regulation is mandatory. Its development has shown that more circular economy specifications are viable and can be used to develop the market and make material recycling and capture-for-reuse more common. The support of the legislation by the City and County of San Francisco's elected mayoral leadership and Board of Supervisors also encourages the development of similar initiatives that support the city's economic, environmental and social goals.

Collaborating with other city departments and manufactures to secure input, awareness and commitment. To secure changes in city purchasing practices it was important to work with other departments to ensure that the new standards provide sufficient compliant products to meet city departments' needs. The Department of Environment also continues to hold regular meetings with department purchasers to raise awareness of the ordinances under the Environment Code whilst also working with the informal champions network to support the implementation of the new regulation.

Engaging in robust research to understand product components, material transparency and the potential of standards and certificates. Identifying compliant products took many months, since the selected requirements extended beyond those of Cradle to Cradle Certified. To support the ongoing assessment of product compliance by city purchasing departments, it is hoped that third-party certifiers will continue to evolve their standards and material transparency in products will increase.

FOR MORE INFORMATION

Website: www.sfapproved.org
www.sfenvironment.org

Contact: Buygreen@sfgov.org

This case study is part of *Circular economy in cities*, Ellen MacArthur Foundation

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http://www.ellenmacarthurfoundation.org/our-work/activities/circular-economy-in-cities

Lorenzo Herrera Unsplash

JOBS, SKILLS, AND INNOVATION

RESOURCE USE

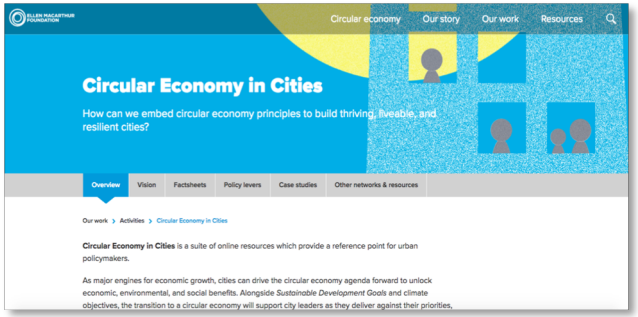
COMMUNITY AND SOCIAL PROSPERITY

Belo Horizonte is tackling e-waste, skills training and digital inclusion through a centres for remanufacturing.
7000 IT products were restored in the first 9 years, and 15,000 kg of post-use electronics have been diverted from landfill every year on average. Over 10,000 have benefitted from the training and inclusion. Module: Case studies

Refurbishing 1,000 tonnes of electronics creates 13 times more jobs than recycling the same amount.

Module: Factsheets

A SUITE OF ONLINE RESOURCES



Knowledge Partner

ARUP

Philanthropic Partner

MAVA
FONDATION POUR LA NATURE

Networks and resources

ACR+ | C40 Cities | Circle Economy | Circular Economy Club (CEC) | Eurocities | European Investment Bank (EIB) | Fab City Global Initiative | ICLEI – Local Governments for Sustainability | International Resource Panel | Organisation for Economic Co-operation and Development | United Nations Environment Programme | EU Urban Agenda Partnership on Circular Economy

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www.ellenmacarthurfoundation.org/our-work/activities/circular-economy-in-cities

CITIES

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A VISION FOR A CIRCULAR ECONOMY IN CITIES

OPPORTUNITIES IN BUILDINGS, MOBILITY, AND PRODUCTS

PLANNING

In cities that embed circular economy principles, there is greater proximity between where people live, work, and play. The air gets cleaner as vehicles switch to zero-emission engines and congestion reduces as shared transit increases. More people walk and cycle to work, boosting health and interactions with local businesses and communities. Valuable land previously dedicated to roads and car parks is freed up for green spaces, commerce, offices, houses, and recreation. The layout and design of cities also changes the way materials and products move around them. Instead of throwing materials 'away' to landfill or incineration, a new distributed system of resource management, nutrient flows, and reverse logistics makes the return, sorting, and reuse of products possible. Materials stay in use.

DESIGNING

In parallel to the urban plan, circular economy principles transform the design of elements within cities. Infrastructure, vehicles, buildings, and products are designed to be a combination of durable, adaptable, modular, and easy to maintain and repurpose. Nature inspires design. Materials are non-harmful, locally sourced and from renewable feedstocks where appropriate, and can be composted, recycled, and reused. Renewable energy powers cities.

MAKING

Buildings, vehicles, and products are assembled using techniques that design out waste. Local ingenuity and skill levels increase as focus is put on decentralised, distributed production within cities. Through digital material banks, the composition of buildings, vehicles, and products is known, enabling their repair and reuse. Products and parts are created on-demand and on-site, transforming construction methods and storage needs.

ACCESSING

People gain access to the things they need - be it space, products or transport - in new ways. This can be through sharing rather than owning, which can connect people to their neighbours and communities, or through product-as-a-service contracts. Modular designs allow for the reconfiguration of buildings and vehicles as needs change.

OPERATING AND MAINTAINING

Products are no longer used just once. People repair and refurbish their products. These activities occur at the individual, community, and commercial level. Vehicles and infrastructure, from roads to street lights, are operated and maintained so that materials, energy, and water are used effectively and can be reused and recycled. Buildings are refurbished, improving how they are used and operated. New possibilities and jobs emerge. Cities that embed circular economy principles become more thriving, liveable and resilient.

ELLEN MACARTHUR FOUNDATION

Business

Business-led collaboration & disruptive innovation are key to building a circular economy

CE100

Learning

The transition to a circular economy requires us to transform the way we create products, services, and systems, and is dependent on how we learn

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Systemic Initiatives

Transforming key material flows to scale the circular economy globally

NEW PLASTICS ECONOMY

MAKE FASHION CIRCULAR

CITIES AND CIRCULAR ECONOMY FOR FOOD

Institutions, Governments & Cities

Create the enabling conditions for a circular economy, set direction, and drive innovation and investment.

Insight & Analysis

We provide robust evidence on the benefits of a circular economy, showcasing the implementation of circular economy principles