1 Towards a circular economy: Key drivers

This chapter provides an overview of the main drivers of the circular economy in cities and regions, as result of the OECD Survey on the Circular Economy in Cities and Regions, desk research and interviews with several stakeholders within the OECD Policy Dialogues. It discusses why cities and regions are increasingly interested in transitioning from a linear to a circular economy.

Introduction

For cities and regions, the circular economy represents an opportunity to rethink production and consumption models, services and infrastructure. The circular economy is based on three principles: i) design out waste and pollution; ii) keep products and materials in use; and iii) regenerate natural systems (Ellen MacArthur Foundation, 2019[1]). Cities and regions have an important role to play in making this happen, as they are at the centre of key decisions determining economic growth, social well-being and environmental benefits. As such, the circular economy implies a systemic shift, whereby: *services* (e.g. from water to waste and energy) are provided making efficient use of natural resources as primary materials and optimising their reuse; *economic activities* are planned and carried out in a way to *close, slow and narrow* loops across value chains; and *infrastructures* are designed and built to avoid linear lock-in (e.g. district heating, smart grid, etc.). Both the OECD Principles on Urban Policy (OECD, 2019[2]) and the OECD Principles on Rural Policy (OECD, 2019[3]) mention the circular economy respectively as a means to encourage more efficient use of resources, and more sustainable consumption and production patterns, in large, intermediary and small cities, including at the neighbourhood level, and to strengthen the social, economic, ecological and cultural resilience of rural communities.

Being the places where people live and work, consume and dispose, cities and regions play a fundamental role in the transition to the circular economy. By 2050, the global population will reach 9 billion people, 55% of which will be living in cities, high-density places of at least 50 000 inhabitants (OECD/EC, 2020[4]). The pressure on natural resources will increase, while new infrastructure, services and housing will be needed. Already, cities represent almost two-thirds of global energy demand (IEA, 2016[5]) and release up to 70% of greenhouse gas (GHG) emissions (World Bank, 2010[6]). By 2050, urban dwellers will still be the most exposed to high concentrations of air pollutants (OECD, 2012[7]). Cities produce 50% of global waste (UNEP, 2013[8]). It is estimated that globally by 2050, the levels of municipal solid waste will double (IEA, 2016[5]; UNEP/IWSA, 2015[9]). A total of 80% of food is consumed in cities (FAO, 2020[10]). At the same time, water stress and water consumption will increase by 55% by 2050 (OECD, 2012[7]). Moreover, in cities, income inequalities are higher than in other places and rich and poor dwellers live often spatially separated with consequences on equal access to goods and services. The circular economy in cities and regions is expected to reduce negative impacts on the environment through pollution decrease, increased share of renewable energy and reduction of raw materials, water, land and energy consumption (EEA, 2016[11]), while potentially increasing resilience and enhancing opportunities for economic growth and jobs.

Cities and regions hold core competencies for most policy areas underlying the circular economy. This includes water, solid waste, build environment, land use or climate change. In the building sectors, for example, cities can operate buildings and housing, and enforce regulation on commercial and residential buildings, in favour of heating, cooling and efficient energy performance. For solid waste, cities exercise powers in collection, treatment, cleaning, as well as in communication and information. Cities have powers over water management, operating infrastructures and incentivising water efficiency, amongst others. Cities and regions can approve land use planning and policies, including zoning, redevelopment and regeneration, encourage farmers' markets and commercial urban food production and develop climate adaptation plans (C40, 2011[12]).

The potential of the circular economy to support sustainable cities, regions and countries still needs to be unlocked. Projections at the city level show environmental, social and economic impacts of the circular economy: for example, applying a circular economy approach to the construction chain in the city of Amsterdam (Netherlands) would decrease GHG emissions by half a million tonnes of CO_2 per year (C40 Cities, 2018[13]). In London (United Kingdom), the benefits from circular approaches applied to the built environment, food, textiles, electrical appliances and plastics are estimated at GBP 7 billion every year by 2036 (London Waste & Recycling Board, 2015[14]). About 50 000 jobs linked to the circular economy are estimated to be created in the Île-de-France region (City of Paris, 2019[15]). However, today, less than 10% of the global economy is circular (Circle Economy, 2020[16]). Unlocking the potential of the circular economy

in cities and regions implies going beyond solely technical aspects. It requires putting the necessary governance in place to create incentives (legal, financial), stimulating innovation (technical, social, institutional) and generating information (data, knowledge, capacities).

In the post-COVID-19 scenario, the circular economy can become the *new normal*. This unprecedented crisis highlighted the unsustainable nature of certain environmental and social trends and led to a reconsideration of current production and consumption patterns, including for mobility, material use and food. The circular economy can help address unsustainable trends and find adequate solutions towards a green recovery. In particular, cities and regions have a role to play in closing the loops, reducing waste, reusing resources and restoring ecosystems alongside long-term recovery measures for more resilient, sustainable and thriving societies. By reconfiguring material loops, the circular economy offers an example of resilience in the face of future crises. Human-centred cities could reduce private car use and regenerate green spaces. Organic waste could be transformed into high-quality fertiliser for local food production in rural areas. Buildings, made of traceable and recyclable materials, could absorb carbon dioxide, treat wastewater and produce energy (Raworth, 2020[17]). This will require a combination of natural and technological loops, incentives to create projects and profitable investment, conducive regulations and strong links with rural areas, in order to promote a cultural shift towards a more resourceful and less wasteful society (Romano, 2020[18]).

Defining the circular economy

There are many definitions of the circular economy. However, the basic assumption consists of designing out waste and pollution of the economic system. More than 100 definitions of the circular economy have been counted (Kirchherr, Reike and Hekkert, 2017[19]) (Box 1.1). The circular economy avoids materials being used once and forever gone, through: *closing* the loops by recycling and remanufacturing; *slowing* loops by increasing the working life of goods and products; and *narrowing* loops by using natural resources and goods more efficiently within the linear system (e.g. buildings and cars) (McCarthy, Dellink and Bibas, 2018[20]). When it comes to cities and regions, then the circular economy can be defined as a guiding framework whereby: *services* (e.g. from water to waste and energy) are provided making efficient use of natural resources as primary materials and optimising their reuse; *economic activities* are planned and carried out in a way to close, slow and narrow loops across value chains; and *infrastructures* are designed and built to avoid linear lock-in (e.g. district heating, smart grid, etc.).

Box 1.1. Examples of circular economy's definitions

- An economic system that replaces the end-of-life concept, with reducing, alternatively using, recycling and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim of accomplishing sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible consumers (Kirchherr, Reike and Hekkert, 2017[19]).
- The circular economy is one that has low environmental impacts and makes good use of natural resources through high resource efficiency and waste prevention, especially in the manufacturing sector, and minimal end-of-life disposal of materials (Ekins et al., 2019[21]).
- The circular economy is restorative and regenerative by design. Relying on system-wide innovation, it aims to redefine products and services to design waste out while minimising

negative impacts. A circular economy is then an alternative to a traditional linear economy (make, use, dispose) (Ellen MacArthur Foundation, 2018[22]).

- The circular economy is where the value of products, materials and resources is maintained in the economy for as long as possible by returning them into the product cycle at the end of their use, thus minimising the generation of waste (EC, 2015[23]).
- There are three different layers of circularity, with increasingly broad coverage: i) closing resource loops, which is defined relative to a traditional economic system; ii) slowing resource loops and materials flows; and iii) narrowing resource loops, which implies a more efficient use of materials, natural resources and products within the linear system (OECD, 2019[24]).

Source: EC (2015[23]), *Circular Economy – Overview*, https://ec.europa.eu/eurostat/web/circular-economy; Ellen MacArthur Foundation, (2018[22]), *What is a circular economy?, www.ellenmacarthurfoundation.org/circular-economy/concept* ; Ekins, P. et al. (2019[21]), *The Circular Economy: What, Why, How and Where*; McCarthy, A., R. Dellink and R. Bibas (2018[20]), "The Macroeconomics of the Circular Economy Transition: A Critical Review of Modelling Approaches", http://dx.doi.org/10.1787/af983f9a-en; OECD (2019[24]), *Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences*, https://doi.org/10.1787/9789264307452-en; Kirchherr, J., D. Reike and M. Hekkert (2017[19]), *Conceptualizing the Circular Economy: An Analysis of 114 Definitions*.

The circular economy is not a new concept but is now facing a *validity challenge period*. Metaphorically, the circular economy is the shift from the "cowboy" to the "spaceman" economy where resources are finite: while the cowboy economy is characterised by unlimited resources in an unexploited open system, the spaceship economy is a closed system with limited reservoirs for extraction and pollution, where humans must find their place "in a cyclical ecological system capable of continuous reproduction of material form" (Boulding, 1966[25]). Key concepts that define the circular economy today were developed already in the 1970s, consisting of the service-life extension of goods, and selling goods as services, as a logical step in a utilisation-focused economy in loops in order to increase the competitiveness of economic actors (Stahel, 1982[26]; Stahel and Reday-Mulvey, 1981[27]; Reday-Mulvey and Stahel, 1977[28]; OECD, 1982[29]). Formally introduced in the economic literature by Pearce and Turner (1990[30]), the concept of the circular economy has been found in several schools of thoughts from environmental and ecological economics, to regenerative design, performance economy and industrial ecology, amongst others (Frosch and Gallopoulos, 1989[31]; Lyle, 1994[32]; Erkman, 1997[33]; Korhonen et al., 2018[34]; Stahel, 2019[35]). Collaborative consumption and the sharing economy have contributed to the circular economy framework. According to Blomsma and Brennan (2017[36]), the circular economy is now facing its "validity challenge period" on its way to becoming a robust and consolidated concept, implying a radical shift in consumption and production patterns.

The circular economy is not an end per se but a means to an end. The circular economy provides an opportunity to do more with less, to better use available natural resources, to reduce waste generation in the first place and to transform waste into new resources, while promoting new forms of employment and tackling inequalities (e.g. access to sharing services). As such, while the environmental narrative, whereby less use of material implies reduced GHG emissions has been so far predominant in promoting the the circular economy, cities and regions are increasingly paying attention to the social and economic components as drivers for this transition.

Nowadays, the circular economy represents a new socio-economic paradigm for policymakers and a wide range of stakeholders. The circular economy is about economics, innovation and competitiveness. As such, it goes beyond waste management and recycling and implies changes in production and consumption models, eco-design and integrated planning. Industry, universities and governments can spur innovation to deal with the consequences of the accumulated legacy waste of the Anthropocene (such as plastic in the oceans) (Stahel, 2010[37]). Still, most companies focus on waste management in their internal processes and devote less innovation efforts on product design, to improve reuse, repair or maintenance (EEA, 2019[38]). On the other hand, cities and regions often interpret the circular economy as a synonym

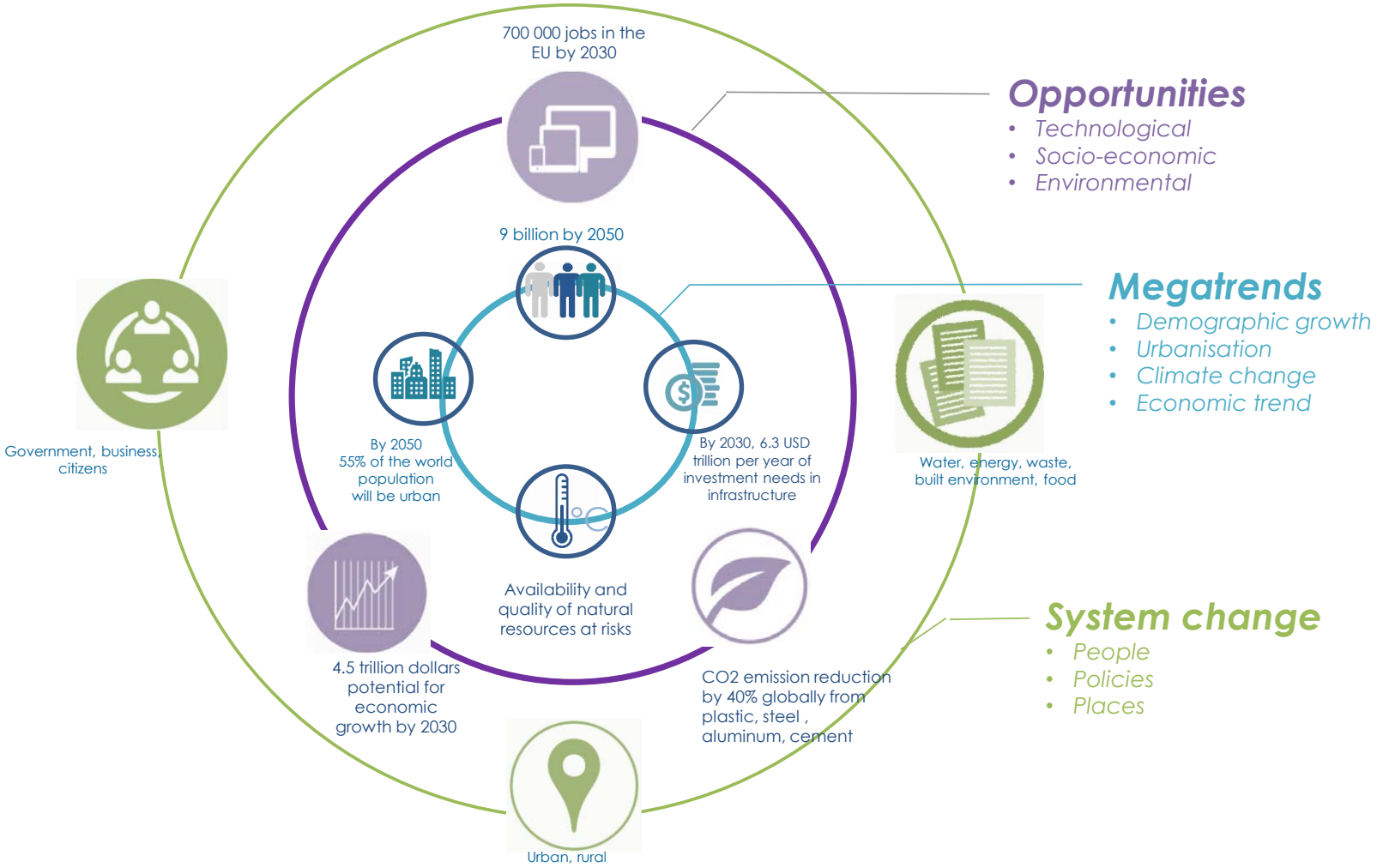
of recycling, missing the systemic perspective. The responses to the main challenges cities and regions are facing in terms of resource availability, GHG emissions and waste generation lie in the collective capacity to transition to a circular economy, an economic model that uses resources and materials rather than using them up (OECD, 2019[39]).

The circular economy can help drive sustainable development. By promoting a rethinking of business models consisting in designing more durable and recyclable products, reusing materials in the production cycle and fostering a more responsible consumption, the circular economy approach is an interesting implementation vehicle to Sustainable Development Goal (SDG) 12, pledging for more sustainable and responsible consumption and production patterns. Moreover, it is also equally relevant for the achievement of SDGs 6 (water), 7 (energy), 11 (sustainable cities and communities), 13 (climate action) and 15 (life on land).

The circular economy is transformative, systemic and functional. Projections show that shifting from a linear approach of "take, make and dispose" to a circular system is estimated to have USD 4.5 trillion potential for economic growth by 2030 (Accenture, 2015[40]). The circular economy could be worth as much as USD 700 billion in consumer material savings (Ellen MacArthur Foundation, 2013[41]). To make this happen, cities and regions would have to take into account the transformative, systemic and functional nature of the circular economy, which is expressed in this report by the 3Ps framework, *people, policies and places* (OECD, 2016[42]); Chapter 3; Figure 1.1). The circular economy is transformative as it implies a cultural shift towards different production and consumption pathways, and new business and governance models (*people*). It requires a holistic and systemic approach that cuts across sectorial *policies*, and a functional approach going beyond the administrative boundaries of cities to close, narrow and slow loops at the right scale (*places*). Starting from these considerations, the report is structured as follows:

- **Why**: Assessment of megatrends and opportunities as main drivers for cities and regions to transition from a linear to a circular economy (Chapter 1).
- **Who**: Analysis of who does what at various levels of government, as well as the role of key categories of stakeholders (Chapters 2 and 3).
- **What**: Mapping of the sectors that are mostly included in circular economy initiatives (Chapter 3).
- **Where**: Observations concerning the scale at which circular economy-related initiatives take place and interaction across urban and rural areas (Chapter 3).
- **How**: An appraisal of the main multi-level governance gaps to the circular economy in cities and regions (Chapter 4) and measurement frameworks (Chapter 5); zoom on policy responses and a self-assessment tool to factor in the existence and level of implementation of enabling conditions for transitioning to a circular economy (Chapter 6).

Figure 1.1. The analytical framework



Key drivers for the circular economy transition

According to the results of the OECD Survey on the Circular Economy in Cities and Regions, climate change, global agendas and economic changes are major drivers for surveyed cities and regions to transition to a circular economy (OECD Survey (2020[43]), Box 1.2). Major drivers for transitioning to a circular economy are environmental (climate change, 73%), institutional (global agendas, 52%) and socio-economic (changing economic conditions, 51%). Additionally, the circular transition is driven by job creation (47%), private sector initiatives (46%), new business models (43%), technical developments (43%) and research and development (R&D) (41%) (Figure 1.3). The word cloud in Figure 1.4 expresses the keywords respondents most associate with the circular economy in cities and regions, which are "climate change", "zero waste" and "innovation". The below section provides an in-depth description of these drivers.

Box 1.2. OECD Survey on the Circular Economy in Cities and Regions

The OECD Survey on the Circular Economy in Cities and Regions aimed at gathering data and information on:

- The current status of the circular economy in cities and regions, including common understanding, definitions and applications.
- The tools (including plans, legal and regulatory frameworks, economic instruments) to implement the circular economy in cities and regions.
- The main obstacles to the circular economy in cities and regions.
- The good practices available to date.

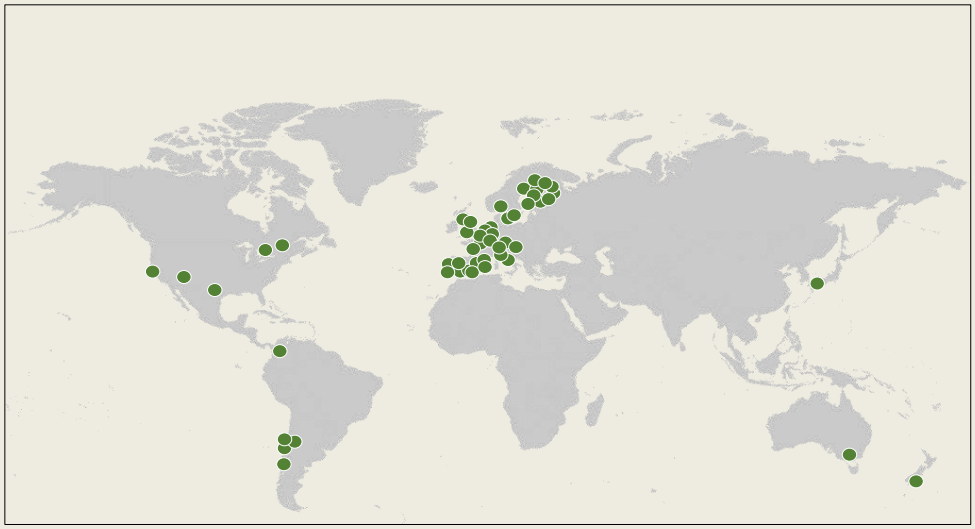
Launched in April 2019, the survey was submitted to more than 100 cities from OECD countries, through various network channels. Since October 2019, the survey has been extended to cities members of ICLEI – Local Governments for Sustainability. The survey has also been disseminated to the members of the Committee of Regions (CoR, ENVE) and Zero Waste Europe. By July 2020, a total of 51 responses were provided on a voluntary base by 47 cities, 1 regional county municipality and 3 regions, located in Europe (38), North and South America (10), Oceania (2) and Asia (1) (Figure 1.2; Annex 1.A). Almost two-thirds of the cities responding to the OECD survey are from the European Union (EU), representing 37% of the entire OECD Metropolitan Areas Database. The sample covers 6%[1] of the OECD Metropolitan Areas Database, which includes 668 metropolitan areas (11% for OECD member countries in Europe). As such, while the survey illustrate trends in a number of cities of OECD countries, the sample is not representative of the population of OECD or European cities.

Preliminary results were discussed during the 1st OECD Roundtable on the Circular Economy in Cities and Regions (4 July 2019, Paris, France), the OECD/European Commission (EC) seminar "Managing the transition to the circular economy" (5 July 2019, OECD, Paris), and the OECD webinars "Spotlight on the circular economy in cities and regions" and "What's new on the circular economy in cities and regions and how to measure circularity?" (31 March 2020).

Targeted respondents were primarily authorities in local administrations in charge of the circular economy in cities and regions such as: dedicated circular economy managers, officers of innovation agencies and other relevant actors with a mandate on the circular economy or likely to have one in the future; but also environmental, economic, waste or urban planning departments, CEOs of utilities, etc.

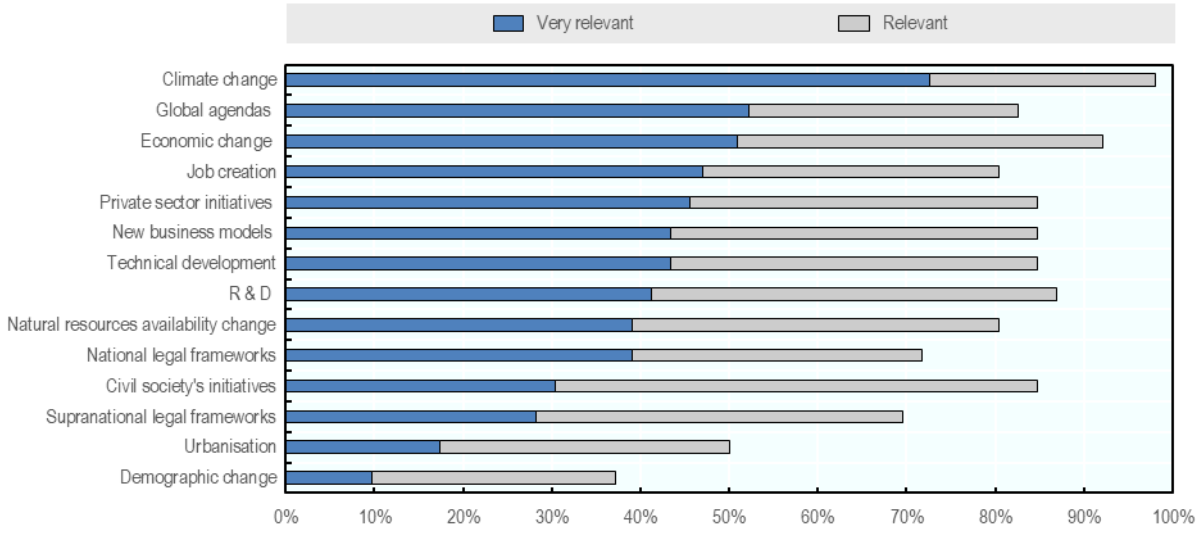
Cities and regions were invited to respond to the survey regardless of the level of maturity of circular economy strategies, initiatives, plans and programme.

Figure 1.2. Map of cities and regions surveyed



Note: Based on the 51 cities and regions that completed the OECD Survey on the Circular Economy in Cities and Regions.
Source (figure and box): OECD (2020[43]), *OECD Survey on the Circular Economy in Cities and Regions*, OECD, Paris.

Figure 1.3. Drivers of the circular economy in surveyed cities and regions



Note: Results based on a sample of 51 respondents that indicated the drivers being "Very relevant" and "Relevant".
Source: OECD (2020[43]), *OECD Survey on the Circular Economy in Cities and Regions*, OECD, Paris.

Figure 1.4. Keywords associated with the circular economy

Note: Results based on a sample of 51 respondents that were asked to choose the top 5 words most often associated with the circular economy. The answer is based on the following question: "Please indicate the top 5 words from the list suggested below you most often associate with circular economy in your context, ranking from 1 (most important) to 5 (less important)". Words could be selected out of 50 provided options.
Source: Own elaboration based on OECD (2020[43]), *OECD Survey on the Circular Economy in Cities and Regions*, OECD, Paris.

Environmental drivers

Climate change is a driver to the circular economy for 73% of surveyed cities and regions, as cities are both vulnerable to climate change impacts and contribute to climate risks. Cities contribute to 70% of GHG emissions (World Bank, 2010[44]). In order to achieve the objectives of the Paris Agreement under the United Nations Framework Convention on Climate Change to limit global warming to less than 2˚C and 1.5°C by 2030, emissions would have to be 25% and 55% lower than in 2018 respectively (UNEP, 2019[45]). The EU, within the framework of the EU Green Deal, aims to achieve an economy with net-zero GHG emissions (climate neutrality) by 2050. Additionally, within the 2030 Climate and Energy Framework, the EU includes energy targets and policy objectives for the period from 2021 to 2030, achieving at least a 32% share for renewable energy and 32.5% improvement in energy efficiency (EC, 2020[46]). The adoption of a circular economy framework in 5 key areas for cities (steel, plastic, aluminium, cement and food) could achieve a reduction of a total of 9.3 billion tonnes of GHG in 2050 (Ellen MacArthur Foundation, 2019[47]).

Materials management activities are directly or indirectly responsible for a significant share of GHG emissions in OECD countries. By 2060, total emissions are projected to reach 75 Gt CO_2-eq. of which materials management would constitute approximately 50 Gt CO_2-eq. Global material use is projected to more than double in 2060 (from 89 Gt in 2017 to 167 Gt). In addition, while recycling is projected to grow and become more competitive compared to the extraction of primary materials, its share remains ten times smaller than the share of mining. Consequently, there is a significant opportunity to potentially reduce emissions through effective materials management policies, prevention of material consumption, eco-design and reuse. These measures characterise the circular economy in cities and regions, for example in the built environment (OECD, 2019[24]).

Cities and regions are also part of the solution, as the majority of environmental and climate-related spending occurs at the subnational level. The transition from a linear to a circular economy gains growing relevance in relation to the future of investments and required infrastructure. Global investment in energy, transport, water and telecoms to support economic growth and development, are estimated at

USD 6.3 trillion per year by 2030 (OECD, 2017[48]). At the global level, the required infrastructure investment to meet the United Nations (UN) SDGs 6 (clean water and sanitation) and 7 (affordable and clean energy) for universal access to drinking water, sanitation and electricity is expected to reach USD 3.5 trillion (Oxford Economics, 2017[49]). As such, over half of the urban infrastructure that will exist in 2050 still has to be built. How this infrastructure is designed and developed will affect the way people will travel, buildings will be constructed and material repurposed, with the aim of reducing the use of fossil fuel and making heating and cooling more efficient. Between 2000 and 2016, subnational governments in 30 OECD countries were responsible on average for 55% of environmental and climate-related spending (OECD, 2019[50]). However, the climate-related investment represented 0.4% of gross domestic product (GDP) on average between 2000 and 2016.

The recovery phase following the COVID-19 crisis holds the potential for including circular economy principles in green policies and infrastructure. • The European Commission (EC) projects investment needs of additional EUR 260 billion per year to reach European Green Deal's goals (EC, 2019[51]). In order to transition towards a low-carbon economy, governments could encourage more efficient use of resources and more sustainable consumption and production patterns, notably by promoting circular economy to keep the value of goods and products at their highest, prevent waste generation, reuse and transform waste into resources (OECD, 2020[52]).

Institutional drivers

Global agendas are driving the transition to the circular economy for 52% of surveyed cities and regions. The circular economy approach can contribute to the achievement of the 2030 Agenda for Sustainable Development. While it is strictly linked to SDG 12 on sustainable and responsible consumption and production patterns (Box 1.3), other SDGs (e.g. 6, 7, 15) are also relevant for increasing sustainability in cities (SDG 11). The circular economy can also support the Paris Agreement under the UN Framework Convention on Climate Change since practices of reusing, recycling, sharing, amongst others, reduce GHG emissions and simultaneously address issues linked natural resources extraction and exploitation. Finally, the circular economy can support the implementation of the New Urban Agenda (2016), the European Green Deal and G20 initiatives on resource efficiency.

Box 1.3. The circular economy in cities and regions and Sustainable Development Goals

The 2030 Agenda for Sustainable Development, adopted in 2015 by UN member states, includes 17 SDGs. The aim of the 2030 Agenda is to set a 15-year-long plan to end poverty and other deprivations while implementing strategies that improve health and education, reduce inequality, promote economic growth and tackle climate change. The circular economy is an interesting implementation vehicle for various goals (Figure 1.5).

The OECD programme "A Territorial Approach to the SDGs" has developed a comprehensive indicator framework to measure where cities and regions stand on their SDG implementation path. Specifically, regarding SDG 12, the programme has identified three indicators to measure the progress of this goal (Table 1.2).

Figure 1.5. The circular economy in cities and regions and Sustainable Development Goals

The SDG 12 is composed of 11 targets and 13 indicators (Table 1.1).

Table 1.1. SDG 12 targets and indicators

	Targets		Indicators
12.1	Implement the 10-year framework of programmes on sustainable consumption and production, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries	12.1.1	Number of countries with sustainable consumption and production (SCP) national action plans or SCP mainstreamed as a priority or a target into national policies
12.2	By 2030, achieve the sustainable management and efficient use of natural resources	12.2.1	Material footprint, material footprint per capita and material footprint per GDP
		12.2.2	Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP
12.3	By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses	12.3.1	Global Food Loss Index
12.4	By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimise their adverse impacts on human health and the environment	12.4.1	Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement
		12.4.2	Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment
12.5	By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	12.5.1	National recycling rate, tons of material recycled

12.6	Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	12.6.1	Number of companies publishing sustainability reports
12.7	Promote public procurement practices that are sustainable, in accordance with national policies and priorities	12.7.1	Number of countries implementing sustainable public procurement policies and action plans
12.8	By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	12.8.1	Extent to which: i) global citizenship education and ii) education for sustainable development (including climate change education) are mainstreamed in: a) national education policies; b) curricula; c) teacher education; and d) student assessment
12.a	Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production	12.a.1	Amount of support to developing countries on research and development for SCP and environmentally sound technologies
12.b	Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products	12.b.1	Number of sustainable tourism strategies or policies and implemented action plans with agreed monitoring and evaluation tools
12.c	Rationalise inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimising the possible adverse impacts on their development in a manner that protects the poor and the affected communities.	12.c.1	Amount of fossil-fuel subsidies per unit of GDP (production and consumption) and as a proportion of total national expenditure on fossil fuels

Source: UN (2020[53]), *Goal 12: Sustainable Development Knowledge Platform*, https://sustainabledevelopment.un.org/sdg12 (accessed on 7 February 2020).

Table 1.2. OECD indicators for a territorial approach to SDG12

Goal	Indicator description	Subnational scale	Source	Desired direction
SDG 12. Responsible consumption	Municipal waste rate (kilos per capita)	TL2 and functional urban area (FUA)	OECD Regional Database (TL2) and Eurostat (FUA)	Negative
	Percentage of municipal waste that is recycled	TL2	OECD Regional Database	Positive
	Number of motor road vehicles per 100 people	TL2 and FUA	OECD Regional Database (TL2) and Eurostat (FUA)	Negative

Note: FUAs are economic units characterised by a city (or core) and a commuting zone that is functionally interconnected to the city. A city is a local administrative unit (i.e. LAU for European countries, such as the municipality, local authorities, etc.) where at least 50% of its population live in an urban centre. An urban centre is defined as a cluster of contiguous grid cells of 1 km^2 with a density of at least 1 500 inhabitants per km^2 and a population of at least 50 000 inhabitants overall.
The Territorial Level 2 (TL2) in the OECD classification refers to regional administrative regions officially established in each country.
Source: OECD (2020[54]), *A Territorial Approach to the Sustainable Development Goals: Synthesis report*, https://doi.org/10.1787/e86fa715-en; OECD (2020[55]), *Functional Urban Areas by Country*, https://www.oecd.org/cfe/regional-policy/functionalurbanareasbycountry.htm.

For almost 40% of surveyed cities and regions, national and supranational legal frameworks are proving important impetus towards a circular economy in cities and regions. This is, for example, the case of the European Circular Economy Package (EC, 2015[56]; 2018[57]), the New Circular Economy Action Plan (EC, 2020[58]) (Box 1.4). In Japan, the legislative framework for establishing a "sound material-cycle society" promotes the life-cycle and zero emissions economy (Japanese Ministry of the Environment, n.d.[59]).

Box 1.4. European Commission's measures for a circular economy

In December 2015, the EC adopted the *Closing the Loop - An EU Action Plan for the Circular Economy* package to support the EU's transition to a circular economy. The initiative was designed to contribute to "closing the loop" of product lifecycles, through recycling and reuse.

The package included the EU Action Plan for the Circular Economy, which focused on 54 actions targeting the whole life cycle of products (e.g. production, consumption, waste management and secondary raw materials); on five priority areas (plastics, food value chain, critical raw materials, construction and demolition, biomass and bio-based products and the review of fertilisers legislation), as well as on four legislative proposals amending the following legal acts:

- Waste Framework Directive
- Landfill Directive
- Packaging Waste Directive
- Directives on end-of-life vehicles, on batteries and accumulators and waste batteries and accumulators, and on waste electrical and electronic equipment.

In January 2018, the EC adopted new measures for the circular economy:

- EU Strategy for Plastics in the Circular Economy, to transform the way plastic products are designed, produced, used and recycled. By 2030, all plastic packaging should be recyclable.
- A communication (COM (2018) 32 final) on options to address the interface between chemical, product and waste legislation.
- A monitoring framework on progress towards a circular economy at the EU and national levels.
- A "Report on Critical Raw Materials and the Circular Economy" that highlights the potential to make the use of the 27 critical materials in our economy more circular.

On March 2019, the EC reported on the implementation of the action plan launched in 2015, assessing that all 54 actions had been delivered or implemented. According to the EC, the implementation of the Circular Economy Action Plan accelerated the transition to a circular economy in Europe with the following results:

- Increase of 6% of circular employment between 2012 and 2016.
- New business opportunities and development of new markets, as in 2017, circular activities (e.g. repair, reuse or recycling) generated around EUR 155 billion in value-added in the EU-28, 17% higher than in 2011.
- Increased recycling of municipal waste during the period 2008-16.

The *Reflection Paper Towards a sustainable Europe by 2030*, launched by the EC in 2019, argues that the circular economy should be made one of the backbones of the EU's industrial strategy. Furthermore, "A European Green Deal", one of the six priorities for the EC for 2019-24, includes the circular economy as one of the headline ambitions for 2019-20 and set the zero net GHG emissions target by 2050.

On March 2020, the EC also adopted a New Circular Economy Action Plan as one of the building blocks of the European Green Deal. The initiative aims at boosting the production of sustainable products, empowering consumers, focusing on sectors with a high circularity potential (e.g. information and communication technology [ICT], batteries, packaging, food, construction, textiles and plastics) and ensuring less waste. The initiative presents an outline with new measures to be taken between 2020 and 2022 and includes a section on cities and regions. Applying circular economy measures in Europe is expected to increase the EU's GDP by an additional 0.5% by 2030 and create approximately 700 000 new jobs. In cities and regions, the proposed European Urban Initiative,[2] the Intelligent Cities Challenge Initiative,[3] and the Circular Cities and Regions Initiative[4] are expected to provide assistance to cities. Furthermore, the circular economy will be included among the priorities of the Green City Accord, the movement of European cities to engage in action towards meeting the EU's environment objectives.

Source: EC (2019[60]), *Private Investments, Jobs and Gross Value Added Related to Circular Economy Sectors*, https://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=cei_cie010&language=en; EC (2015[61]), EC Circular *Economy Action Plan*, https://ec.europa.eu/environment/circular-economy; EC (2019[62]), *Towards a Sustainable Europe by 2030*, https://ec.europa.eu/commission; European Parliament (2019[63]), *Briefing: Hearings of European Commissioners-designate*, http://www.europarl.europa.eu/.

A number of bottom-up initiatives are stimulating governmental actions towards the circular economy in surveyed cities and regions. This is the case of the region of Lapland (Finland), where the circular economy started to be implemented as a business sector initiative in 2012. To spur competitiveness of industry, linked to the resilience of the region, the industrial sector (e.g. bio-forest, forestry, mining and steel among others) sought support from public authorities concerning the reuse of by-products and residues. The request was well received by the local authorities, which started a discussion on the circular economy, providing technical assistance and promoting collaborations. Increasingly, a number of international organisations, umbrella organisations and foundations are supporting cities and regions in their transition to a circular economy with regards to business and citizen initiatives (e.g. Ellen MacArthur Foundation, C40, Climate KIC, ICLEI, Eurocities, European Investment Bank, etc.).

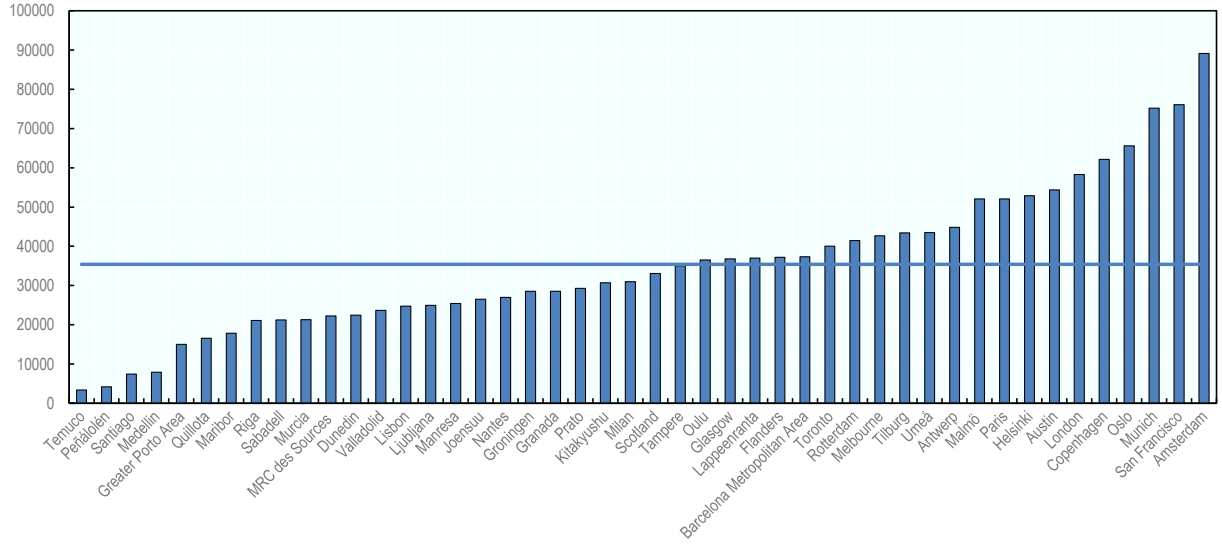
Socio-economic drivers

Socio-economic changes

Changing economic conditions represent a major driver towards the circular economy for 51% of respondents (OECD, 2020[43]). The COVID-19 crisis has put the world on standby, unlike any other economic, social and climate crisis, resulting in a very significant GDP loss for 2020 (4.5% (OECD, 2020[64]). Still, cities are engines of economic growth: projections show that a group of 600 cities will generate nearly 65% of the world's economic growth by 2025 (McKinsey Global Institute, 2012[65]) and that cities tend to generate more income per capita as they increase in size (Bettencourt et al., 2007[66]). While pursuing economic growth, resource efficiency should be improved, as expressed by the concept of *decoupling* (Box 1.5).

Figure 1.6. GDP per capita of surveyed cities and regions

In EUR per capita per year



Note: Data are provided by 46 cities and regions. They refer to the corresponding administrative level to the city or region responding to the Survey (Annex 1.A). Average GDP: EUR 35 380/capita/year. Data refer to most recent available year, which ranges from 2012 to 2019: 2012 [Oslo (Norway)], 2015 [Greater Porto Area (Portugal), Medellin (Colombia), MRC des Sources (Canada), Nantes (France), Peñalolén (Chile), Prato (Italy), Santiago (Chile), Temuco (Chile) and Valladolid (Spain)], 2016 [Antwerp (Belgium), Copenhagen (Denmark), Flanders (Belgium), Glasgow (United Kingdom), Kitakyushu (Japan), Manresa (Spain), Munich (Germany), Oulu (Finland), Riga (Latvia), Rotterdam (Netherlands) and Umeå (Sweden)], 2017 [Amsterdam (Netherlands), Austin (United States), Barcelona Metropolitan Area (Spain), Granada (Spain), Joensuu (Finland), Lisbon (Portugal), Ljubljana (Slovenia), Malmö (Sweden), Milan (Italy), Paris (France), Sabadell (Spain), San Francisco (United States), Tampere (Finland) and Tilburg (Netherlands)], 2018 [Dunedin (New Zealand), Groningen (Netherlands), Helsinki (Finland), Lappeenranta (Finland), London (United Kingdom), Maribor (Slovenia), Melbourne (Australia), Quillota (Chile), Scotland (United Kingdom) and Toronto (Canada)] and 2019 [Murcia (Spain)].
Source: OECD (2020[43]), *OECD Survey on the Circular Economy in Cities and Regions*, OECD, Paris.

Urban GDP per capita can influence the level of domestic material consumption (DMC). DMC per capita has shown a descending trend in most OECD countries since 2000 and the material consumption in the OECD area remains at 19 Gt per year (16% less than in 2005). However, by 2060, the global average per capita income is projected to reach current OECD levels (USD 40 000) with consequences on material use, which is projected to grow by 1.5% per year over the same period (OECD, 2019[67]). At urban level, material consumption in the world is expected to grow from 40 billion tonnes in 2010 to 90 billion tonnes in 2050. (UNEP, 2019[68]). Some scholars suggest that urban DMC per capita is significantly correlated to urban GDP per capita (Malcolm Baynes and Kaviti Musango, 2017[69]). In particular, the emerging middle class is likely to double its share of global consumption from one-third in 2019 to two-thirds by 2050 (Ellen MacArthur Foundation, 2019[47]), with impacts on the increase in domestic consumption and carbon emissions (World Economic Forum, 2017[70]; Wiedenhofer et al., 2016[71]). Other projections show that one billion inhabitants living in cities will reach the global consuming class[5] by 2025. (McKinsey Global Institute, 2012[65]). In the absence of new measures, material consumption by the world's cities will more than double, evolving from 40 billion tonnes in 2010 to approximately 90 billion tonnes by 2050 (World Economic Forum, 2018[72]). Figure 1.6 shows the GDP per capita in cities and regions that have responded to the OECD survey.

The circular economy can also increase competitiveness through production savings and material reuse. According to the European Environmental Agency (EEA), the increase in competitiveness through production savings is estimated at EUR 600 billion in the EU-27 by 2030 (EEA, 2016[73]). Some activities,

such as those related to the construction and food sector, are projected to bring relevant economic benefits in terms of added value. Projections show that in the city of Amsterdam, for example, strategies for material reuse can bring about a value of EUR 85 million per year within the construction sector and EUR 150 million per year with more efficient organic residual streams (Eurocities, 2017[74]).

Box 1.5. Defining decoupling

The concept of *decoupling* is frequently used to describe an improvement in resource efficiency, usually at the aggregate level of an economy. The literature distinguishes a broad variety of decoupling classifications (e.g. relative decoupling, absolute decoupling, economic decoupling and physical decoupling).

Relative decoupling refers to the condition that takes places when both the value of economic output and the quantity of resource inputs are growing, with the former increasing faster than the latter.

However, absolute decoupling refers to a situation where the value of economic output is growing and the amount of resource inputs used is being diminished. For example, Target 8.4 of SDG 8 on decent work and economic growth includes the absolute decoupling of materials use and environmental degradation from GDP growth.

Source: OECD (2019[24]), *Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences*, https://doi.org/10.1787/9789264307452-en.

Job creation is a driver for 4% of surveyed cities and regions. Between 2012 and 2018, the number of jobs related to the circular economy in the EU increased by 5% to reach around 4 million (EC, 2020[75]). Circularity can be expected to have a positive net effect on job creation provided that workers acquire the skills required by the green transition (EC, 2020[58]). Moving from fossil fuel to renewable energy, from landfill to reuse, remanufacturing and recycling, to clean mobility, amongst others, implies changes in the future of jobs, skills, social and economic models. Yet, the transition should be "just" by taking into account people's social well-being, quality of life and equity. It is estimated that by 2030, the number of additional jobs would exceed 75 000 in Finland, 100 000 in Sweden, 200 000 in the Netherlands, 400 000 in Spain and half a million in France. This is due to the fact that an economy favouring repair, maintenance, upgrading, remanufacturing, reuse, recycling of materials and product-life extension, is more labour intensive than both mining and manufacturing of a linear economy (Wijkman and Skånberg, 2017[76]).

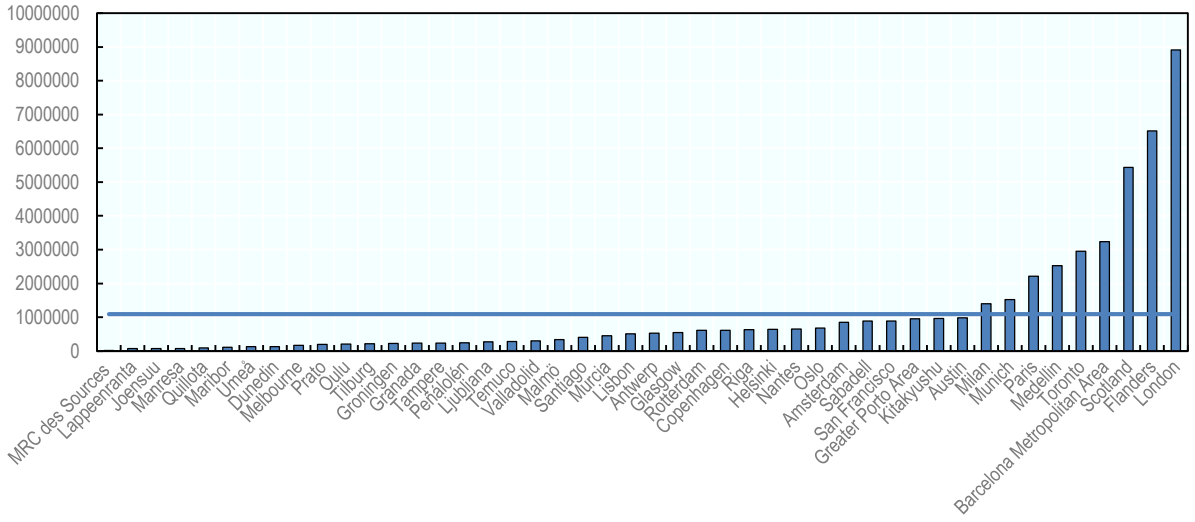
Population

A growing population and higher living standards will drive higher levels of waste production and resources consumption. By 2050, the global population will reach 9 billion people. The proportion of the global population living in cities is projected to reach 55% by 2050 (OECD/EC, 2020[4]). This transition will require a significant expansion of existing cities, as well as the construction of new cities (UNEP, 2018[77]). The total population of the 612 FUAs (see definition in Box 1.3) has grown by 11% between 2005 and 2018 (OECD, 2020[78]). Moreover, the number of new cities of intermediate size is growing rapidly. Between 1990 and 2015, the number of new cities of at least 100 000 inhabitants increased by 1 644 (OECD, 2019[79]). These trends will require the use of biomass, metals, non-metallic materials and fossil fuels to address the needs of food, housing, energy and infrastructure. Cities and regions that responded to the OECD survey represent cities of all size (Figure 1.7): a total of 20% of the sample are cities and regions with more than 1 million inhabitants, 32% with between 500 000 and 1 million and almost half of the sample (48%) represent cities and regions with less than 500 000 inhabitants (Annex 1.A). Regarding waste generation from households, Figure 1.8 presents data from cities and regions that completed the OECD

survey: 17% generate more than 500 kg/per inhabitants/year, 20% remains below 300 kg/per inhabitants/year, 26% between 400 and 300 kg/per inhabitants/year and 37% between 500 and 400 kg/per inhabitants/year. A person living in the OECD area generates on average 520 kg of municipal waste per year (2020); this is 30 kg less than in 2000 but still 20 kg more than in 1990 (OECD, 2020[80]).

Figure 1.7. Population size of surveyed cities and regions

In number of inhabitants



Note: Data are provided by 46 cities and regions. They refer to the corresponding administrative level to the city or region responding to the Survey (Annex 1.A). Average population: 1 089 789 inhabitants. Data refer to the most recent available year, which ranges from 2015 to 2020. 2015 [Barcelona Metropolitan Area (Spain), Kitakyushu (Japan) and Rotterdam (Netherlands)], 2016 [Paris (France) and Maribor (Slovenia)], 2017 [Flanders (Belgium), Granada (Spain), Greater Porto Area (Portugal), Joensuu (Finland), Munich (Germany), Nantes (France), Peñalolén (Chile), Quillota (Chile), San Francisco (United States), Santiago (Chile) and Temuco (Chile)], 2018 [Amsterdam (Netherlands), Austin (United States), Copenhagen (Denmark), Dunedin (New Zealand), Glasgow (United Kingdom), Groningen (Netherlands), Helsinki (Finland), Lappeenranta (Finland), Ljubljana (Slovenia), Lisbon (Portugal), London (United Kingdom), Malmö (Sweden), Manresa (Spain), Melbourne (Australia), Milan (Italy), Oulu (Finland), Scotland (United Kingdom), Tampere (Finland), Tilburg (Netherlands), Toronto (Canada), Umeå (Sweden) and Valladolid (Spain)], 2019 [Medellin (Colombia), MRC des Sources (Canada), Murcia (Spain), Oslo (Norway), Prato (Italy), Riga (Latvia) and Sabadell (Spain)] and 2020 [Antwerp (Belgium)].
Source: OECD (2020[43]), *OECD Survey on the Circular Economy in Cities and Regions*, OECD, Paris.

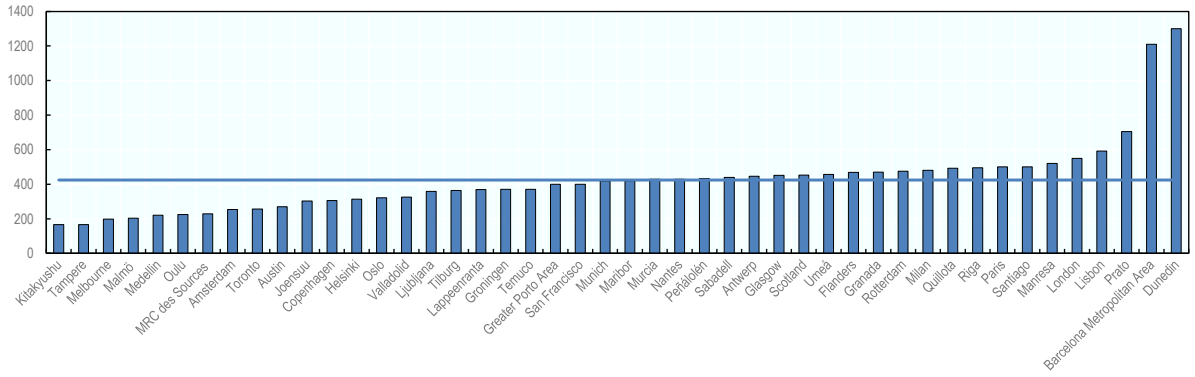
The trend in terms of household size decrease implies less material efficiency. The number of people per household in the EU declined from 3.3 persons in 1960 to 2.36 in 2015, while the OECD average in 2015 stood at 2.46 (OECD, 2020[81]). The share of 1-person households reached 41% in Germany, 38% in the Netherlands and 36% in France in 2018 (Ortiz-Ospina, 2019[82]). The ageing population is one of the drivers of this trend. In OECD countries, the population older than 65 years increased from less than 9% in 1960 to 17.2% in 2018 and is expected to achieve 28% in 2050. By then, this range will represent at least one-quarter of the total population (OECD, 2017[83]). Older generations (population aged 80 and above) are expected to more than double in OECD countries, from 4.6% in 2017 to 10.1% in 2050 (OECD, 2019[84]). The decreasing household size will imply more appliances and installations and an increasing need for housing (EEA, 2015[85]).

Population density is a key factor in areas such as waste management, energy consumption and material consumption, which are relevant for the circular economy. More densely populated countries consume on average less materials. This is the case of Germany, Italy, the Netherlands and the United Kingdom in the EU (EEA, 2015[85]). Regarding the local level, as carbon emissions are closely associated with urban density and structure, compact cities can contribute to reducing GHG emissions by decreasing the new

construction of roads, sewers, water lines and other infrastructure (Ellen MacArthur Foundation, 2019[47]; UNEP, 2018[77]). Studies suggest that there is a correlation between energy consumption efficiency and population density (Morikawa, 2012[86]). Furthermore, density also plays a key role in the waste sector of cities, as low population density might be a limiting factor to achieve higher recycling rates, as the costs of waste collection and transportation are higher in less populated areas. However, a high population density can be a limiting factor, as it requires a more efficient waste management system due to sanitation problems and the scarcity and cost of land (Matsunaga and Themelis, 2002[87]; Montevecchi and Reisinger, 2014[88]).

Figure 1.8. Household waste generation per capita in surveyed cities and regions

In kg per inhabitant per year.



Note: Data are provided by 46 cities and regions. They refer to the corresponding administrative level to the city or region responding to the Survey (Annex 1.A). Average household waste generation: 424 kg/inhabitant/year. Data refer to most recent available year, which ranges from 2014 to 2019: 2014 [Medellin (Colombia)], 2015 [Rotterdam (Netherlands)], 2016 [Antwerp (Belgium), Barcelona Metropolitan Area (Spain), Copenhagen (Denmark), Helsinki (Finland), Milan (Italy), Nantes (France), Prato (Italy) and Tampere (Finland)], 2017 [Dunedin (New Zealand), Flanders (Belgium), Granada (Spain), Joensuu (Finland), Melbourne (Australia), Munich (Germany), Paris (France), San Francisco (United States), Scotland (United Kingdom), Umeå (Sweden) and Valladolid (Spain)], 2018 [Amsterdam (Netherlands), Austin (United States), Glasgow (United Kingdom), Greater Porto Area (Portugal), Groningen (Netherlands), Kitakyushu (Japan), Lappeenranta (Finland), Lisbon (Portugal), Ljubljana (Slovenia), Malmö (Sweden), Manresa (Spain), Maribor (Slovenia), MRC des Sources (Canada), Oslo (Norway), Oulu (Finland), Peñalolén (Chile), Quillota (Chile), Riga (Latvia), Sabadell (Spain), Santiago (Chile), Tilburg (Netherlands) and Toronto (Canada)] and 2019 [London (United Kingdom), Murcia (Spain) and Temuco (Chile)].
Source: OECD (2020[43]), *OECD Survey on the Circular Economy in Cities and Regions*, OECD, Paris.

Technological trends

New business models, technical developments and R&D represent a driver for more than 40% of surveyed cities and regions. New business models in cities are flourishing, from reverse logistics, reuse, leasing and sharing (Chapter 2). Increasingly, cities are considering green infrastructure and decoupling alternatives, such as new electric vehicles, solar panels, smart-grids, retrofitting of buildings, recycling facilities as part of their circular vision (Wijkman and Skånberg, 2016[89]). Many cities and regions host industrial symbiosis processes and clusters, based on the principle that what is waste for one is an input for others. Industrial symbiosis in Kalundborg (Denmark) fosters eco-innovation amongst eight public and private companies to reuse water and energy and recycle materials. In Sweden, the roadmap for industrial symbiosis makes a connection with the urban symbiosis. While the industrial symbiosis allows resources exchanges across companies, urban symbiosis looks at mutual and beneficial exchanges of resources within urban areas and across industries. The Metropolitan Project of Industrial Symbiosis in the Barcelona Metropolitan Area (Spain) co-ordinates industrial symbiosis projects with circular economy initiatives. The Industrial symbiosis in Drummond (Canada) is a network of local companies exchanging resources, such as waste materials, by-products, equipment, space or even energy. Some companies participating in the industrial

symbiosis sell their production waste rather than pay to dispose of it, thus making a double economic profit (OECD, 2020[43]). Nevertheless, increasing recovery, reuse, remanufacturing and recycling of metals, polymers and electronic waste, for example, require large investments and R&D for technological innovation. Discussions of whether solutions are technologically feasible and at which scale are likely to lead towards a second-best state, before being able to realistically achieve an economy that is circular.

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Notes

[1] Methodological note: Answers from three regions are not included. The OECD Metropolitan Areas Database does not include metropolitan areas for the following survey respondents: Dunedin (New Zealand), Joensuu (Finland), Kemi (Finland) and Velez-Malaga (Spain). The Barcelona Metropolitan Area (Spain) and Sabadell (Spain) are included within the Functional Urban Area of Barcelona (Spain). The communes of Peñalolén (Chile) and Santiago (Chile) are included within the Functional Urban Area of Santiago (Chile).

[2] European Urban Initiative: https://ec.europa.eu/regional_policy/en/newsroom/news/2019/03/20-03-2019-european-urban-initiative-post-2020-the-commission-proposal (accessed 31July 2020).

[3] Intelligent Cities Challenge: https://www.intelligentcitieschallenge.eu/ (accessed 31July 2020).

[4] Circular Cities and Regions Initiative (CCRI): https://ec.europa.eu/research/environment/index.cfm?pg=circular (accessed 31July 2020)

[5] Consuming class is defined as those individuals with an annual income of more than USD 3 600 or USD 10 per day at purchasing power parity (PPP), using constant PPP USD (McKinsey Global Institute, 2012[65]).

Annex 1.A. Key data from surveyed cities and regions

The table below provides a snapshot of the key data collected across cities and regions participating in the OECD Survey on the Circular Economy in Cities and Regions. Data are provided by 44 cities and 2 regions. They refer to the corresponding administrative level to the city or region responding to the survey (Annex A). Four dimensions are represented: level of GDP, population size, the share of recycled waste and CO_2 emissions. The table also reports on the existence or not of a circular economy strategy. Further information on the strategies will be provided in Chapter 2.

Annex Table 1.A.1. Survey responses legend

GDP	Above EUR 50 000 +++	EUR 50 000-30 000 ++	Below EUR 30 000 +	
Population	Above 1 M ▲▲▲▲	1 000 000-500 000 ▲▲▲	500 000-250 000 ▲▲	Below 250 000 ▲
Waste recycled of total waste generated by households	Above the average (31.8% of waste recycled of total waste generated by households) +		Below the average (31.8% of waste recycled of total waste generated by households) -	
Co2 emission	Above the average (5.9 T CO_2/capita/ year) +		Below the average (5.9 T CO_2/capita/ year) -	
Circular economy strategy	Yes	Not yet, but under development	No	

Annex Table 1.A.2. Key data from surveyed cities and regions

Waste generation from households	Cities and regions	Country	GDP (EUR)	Population	Waste recycled of total waste generated by households	CO_2 emissions T CO_2/capita/year	Circular economy strategy
More than 500 kg/inhabitant/year	Dunedin	New Zealand	+	▲	-	+	NOT YET
	Barcelona Metropolitan Area	Spain	++	▲▲▲▲	-	-	YES
	Prato	Italy	+	▲	+		YES
	Lisbon	Portugal	+	▲▲	-	+	NOT YET
	London	United Kingdom	+++	▲▲▲▲	-		YES
	Manresa	Spain	+	▲	+		NO
	Paris	France	+++	▲▲▲▲	-		YES
401-500 kg/inhabitant/year	Santiago	Chile	+	▲▲	-		NOT YET
	Riga	Latvia	+	▲▲▲	-	-	NOT YET
	Quillota	Chile	+	▲	-	-	NOT YET
	Milan	Italy	++	▲▲▲▲	+	-	NOT YET
	Rotterdam	Netherlands	++		-		YES
	Granada	Spain	+	▲			NOT YET
	Flanders	Belgium	++	▲▲▲▲	+	+	YES
	Umeå	Sweden	++	▲	-		NOT YET
	Scotland	United Kingdom	++	▲▲▲▲	+		YES
	Glasgow	United Kingdom	++	▲▲▲	-		NOT YET
	Antwerp	Belgium	++	▲▲▲	+	-	NOT YET
	Sabadell	Spain	+	▲	+	-	NOT YET
	Peñalolén	Chile	+	▲	-		NOT YET
	Nantes Metropolitan Area	France	+	▲▲▲	-		YES
	Murcia	Spain	+	▲▲		-	NOT YET

Waste generation from households	Cities and regions	Country	GDP (EUR)	Population	Waste recycled of total waste generated by households	CO_2 emissions T CO_2/capita/year	Circular economy strategy
	Maribor	Slovenia	+	▲		+	YES
	Munich	Germany	+++	▲▲▲▲	+	+	NOT YET
301-400 kg/inhabitant/year	Greater Porto Area	Portugal	+	▲▲	-	-	NOT YET
	San Francisco	United States	+++	▲▲	+		NOT YET
	Temuco	Chile	+	▲▲	-	-	NO
	Groningen	Netherlands	+	▲			NOT YET
	Lappeenranta	Finland	++	▲	+	-	NOT YET
	Tilburg	Netherlands	++		+		YES
	Ljubljana	Slovenia	+	▲▲▲		+	NOT YET
	Valladolid	Spain	+	▲▲▲		-	YES
	Oslo	Norway	+++	▲▲▲	+		NOT YET
	Helsinki	Finland	+++	▲▲▲	+	-	YES
	Copenhagen	Denmark	+++	▲▲▲	+	-	YES
	Joensuu	Finland	+		+	+	NO
150-300 kg/inhabitant/year	Austin	United States	+++		-		YES
	Toronto	Canada	++	▲▲▲▲	-		NOT YET
	Amsterdam	Netherlands	+++		-	-	YES
	MRC des Sources	Canada	+	▲	-		YES
	Oulu	Finland	++	▲	+	+	NOT YET
	Medellin	Colombia	+	▲▲▲▲	-	-	NOT YET
	Malmö	Sweden	+++	▲▲	+	-	NO
	Melbourne	Australia	++	▲	-	+	YES
	Kitakyushu	Japan	++	▲▲▲	-	+	NO
	Tampere	Finland	++	▲		-	NO

Note: Results based on a sample of 46 cities and regions and desk research for the latest year with available data. From the 51 respondents to the survey, Kemi (Finland), North Karelia (Finland), Phoenix (United States), Turku (Finland) and Vélez-Málaga (Spain) have not been included due to lack of data availability.
Average of waste recycled of total waste generated by households: 31.8%. Cities and regions provided data from different years: 2014 [Medellin (Colombia)], 2015 [Prato (Italy)], 2016 [Antwerp (Belgium), Barcelona Metropolitan Area (Spain), Copenhagen (Denmark), Helsinki (Finland), Joensuu (Finland), Nantes (France) and Quillota (Chile)], 2017 [Amsterdam (Netherlands), Dunedin (New Zealand), Flanders (Belgium), Manresa (Spain), Melbourne (Australia), Munich (Germany), Paris (France) and Umeå (Sweden)], 2018 [Austin (United States), Glasgow (United Kingdom), Greater Porto Area (Portugal), Kitakyushu (Japan), Lappeenranta (Finland), Lisbon (Portugal), Malmö (Sweden), Milan (Italy), MRC des Sources (Canada), Oslo (Norway), Oulu (Finland), Riga (Latvia), Rotterdam (Netherlands), Sabadell (Spain), San Francisco (United States), Scotland (United Kingdom), Tilburg (Netherlands), Toronto (Canada)], 2019 [London (United Kingdom), Peñalolén (Chile), Santiago (Chile) and Temuco (Chile)].
Average of CO_2 Emissions: 5.9 T CO_2/capita/year. Cities and regions provided data from different years: 2010 [Munich (Germany) and Valladolid (Spain)], 2012 [Sabadell (Spain)], 2013 [Milan (Italy)], 2014 [Barcelona Metropolitan Area (Spain) and Temuco (Chile)], 2015 [Dunedin (New Zealand), Flanders (Belgium), Riga (Latvia), Maribor (Slovenia), Medellin (Colombia) and Murcia (Spain)], 2016 [Antwerp (Belgium) and Copenhagen (Denmark)], 2017 [Lisbon (Portugal), Oulu (Finland), Quillota (Chile), Lappeenranta (Finland), Joensuu (Finland), Amsterdam (Netherlands), Kitakyushu (Japan) and Tampere (Finland)] and 2018 [Greater Porto Area (Portugal), Helsinki (Finland), Ljubljana (Slovenia), Malmö (Sweden) and Melbourne (Australia)].
Santiago refers to the Commune of Santiago (Chile), located in the Santiago Metropolitan Region (Chile).
Source: OECD (2020[43]), *OECD Survey on the Circular Economy in Cities and Regions*, OECD, Paris.