OECD Regional Outlook 2019

LEVERAGING MEGATRENDS FOR CITIES AND RURAL AREAS

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BETTER POLICIES FOR BETTER LIVES

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Foreword

The fourth edition of the *OECD Regional Outlook: Leveraging Megatrends for Cities and Rural Areas*, comes at a timely moment when regional disparities have become the focus of significant public attention. In underperforming regions, persistent gaps in socio-economic outcomes have led to growing discontent with the political and economic status quo. The distinct geography of discontent that has emerged has provided a powerful reminder of the urgency to address regional inequalities.

The publication of this edition of the *Regional Outlook* also coincides with the 20th anniversary of the OECD Regional Development Policy Committee. Since its creation in 1999, the committee has consistently argued for place-based policies to ensure that all regions use their full economic potential and reduce regional inequalities. Today, this recommendation has become an integral part of the OECD policy package and is more important than ever.

Place-based policies can effectively address the diversity of economic, social, demographic, institutional and geographic conditions across regions. They target specific territories and provide the tools that traditional structural policies often lack in order to address the region-specific factors that cause economic and social stagnation. They also ensure that a wide range of sectoral policies, from transport and education to innovation and health, are co-ordinated with each other and meet the specific needs of different regions across a country – from remote rural areas to the largest cities.

Global megatrends related to technological, demographic and environmental changes will increase the importance of place-based policies in the future. These trends are affecting all OECD regions today and their effects will only grow stronger. While these megatrends are well-known, their regional dimension is rarely discussed. Yet, as this report points out, their effects are far from uniform within countries. By discussing how regional policy can respond to these asymmetric impacts, this report fills a critical gap.

With the right policies, global megatrends will offer tremendous opportunities to revive productivity growth, reduce inequalities, improve quality of life and increase sustainability. For example, new technologies will increase the importance of knowledge-based services that are predominantly located in cities. Yet, rural areas can benefit from the distance-mitigating effects that autonomous vehicles, drone deliveries, 3D printing and better communication technologies will offer. However, if policy makers do not take appropriate action today, global megatrends can contribute to an increase of regional inequalities and will divide countries further into thriving regions and those that are left behind.

This *Regional Outlook* aims to serve as a guide to help policy makers at all levels of government to leverage global megatrends. It analyses the likely range of scenarios that will be confronted in the future by different regions and, insofar as possible, presents steps that policy makers can already take today to shape the next generation of regional policies.

The *Regional Outlook*'s Policy Forum section (Part II) allows senior decision makers and distinguished scholars to present first-hand perspectives on regional responses to global megatrends. It provides a unique perspective on what needs to be done to future-proof regional policy, in order to deliver better lives for our populations.

Angel Gurría
OECD Secretary-General

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Readers Guide

Typologies of regions with respect to population or other functions

Cities An individual city is defined by an administrative border of a local government. A functional urban area (see below) encompasses more than the urban core of the main city. In this report, for simplicity, a city refers to a functional urban area, and if of large size, is referred to as a metropolitan area (see below). Where the term refers to an administrative city, this will be made explicit.

Functional regions are geographic areas defined by their economic and social integration rather than by traditional administrative boundaries. A functional region is a self-contained economic unit according to the functional criteria chosen (for example, commuting, water service or a school district).

Functional urban areas are defined as densely populated municipalities (urban centres) and adjacent municipalities with high levels of commuting towards the densely populated urban centres. Commuting zones, according to a definition developed by the OECD and the European Union. Functional urban aread can extend across administrative boundaries. The OECD tracks functional urban areas of 50 000 inhabitants and more.

Metropolitan areas are defined as those functional urban areas with a population of over 250 000. There are 628 metropolitan areas in the 33 OECD countries with data; of these, 99 had a population greater than 1.5 million in 2016.

Regions (TL2 and TL3) are classified by the OECD into two territorial levels that reflect the administrative organisation of countries. The OECD's large regions (TL2) represent the first administrative tier of subnational government, such as the Ontario region in Canada. OECD small (TL3) regions are contained within a TL2 region. For example, the TL2 region of Aquitaine in France encompasses five TL3 regions: Dordogne, Gironde, Landes, Lot-et-Garonne and Pyrénées-Atlantiques. In most cases, TL3 regions correspond to administrative regions, with the exception of Australia, Canada, Germany and the United States.

TL3 regional typology TL3 regions have been classified as: predominantly urban (PU), intermediate (IN) and predominantly rural (PR) based on the percentage of regional population living above certain thresholds of population densities. The terms urban, intermediate and rural are used to refer to these categories. An extended typology distinguishes between regions that are predominantly rural and close to a city, and predominantly rural regions that are remote. The distinction is based on the driving time to the nearest urban centre with at least 50 000 inhabitants for a certain share of the regional population. Due to lack of information on the road network, the predominantly rural regions in Australia, Chile and Korea have not been classified as remote or close to a city.

Acronyms and abbreviations

ADAC	*Allgemeiner Deutscher Automobil-Club* General German Automobile Club
AI	Artificial intelligence
AR	Augmented reality
AV	Autonomous vehicle
CHF	Swiss franc
COP21	21st Conference of the Parties (within the United Nations Framework Convention on Climate Change)
DLT	Distributed ledger technology
EC	European Commission
ESPON	European Observation Network for Territorial Development and Cohesion
EU	European Union
EUR	Euro
GBP	British pound
GDP	Gross domestic product
GHG	Greenhouse gas
GHSL	Global Human Settlement Layer (produced by the European Commission)
GIH	Global Infrastructure Hub
GIS	Geographic Information System
GPS	Global positioning system
GVC	Global value chain
ICT	Information and communications technologies
IoT	Internet of Things
JRC	Joint Research Centre (European Commission)
LAC	Latin America and the Caribbean
LIDAR	Light detection and ranging
MENA	Middle East and North Africa
MW	Megawatt
NDC	Nationally determined contribution (within the United Nations Framework Convention on Climate Change)
NGO	Non-government organisation
NUTS	Nomenclature of units for territorial statistics
OECD	Organisation for Economic Co-operation and Development
PIAAC	Programme for the International Assessment of Adult Competencies (OECD)
PIT	Personal income tax
PPP	Purchasing power parity / public-private partnership
R&D	Research and development
RCP	Representative Concentration Pathway (adopted by the Intergovernmental Panel on Climate Change)
RDPC	Regional Development Policy Committee (OECD)
SDG	Sustainable Development Goals (of the United Nations)
SISA	*Sistema de Incentivos por Serviços Ambientais* Acre's State System of Incentives for Environmental Services (Brazil)
SME	Small and medium-sized enterprise
SPFM	Subnational pooled finance mechanism
SWOT	Strengths, weaknesses, opportunities, threats
TL2	Territorial Level 2
TL3	Territorial Level 3
USD	US dollar
VAT	Value added tax
VR	Virtual reality

Executive summary

Place-based policies can address weak economic growth and public discontent

Since its foundation in 1999, the OECD Regional Development Policy Committee has made the case for place-based policies to help all regions use their full economic potential. Place-based policies are an indispensable complement to structural economic policies because structural economic policies do not consider specific regional factors adequately.

Adopting place-based policies is particularly urgent in light of large and persistent inequalities in regional performance in many OECD countries. On average, productivity in the least productive region of a country is 46% lower than productivity in its most productive region. Moreover, in one-third of OECD countries, productivity growth has been concentrated in a single, already highly productive, region that is usually home to the country's largest city, further increasing regional imbalances. Due to limited labour mobility, workers in many regions are therefore stuck in jobs that are less productive than they could be.

The effects of regional inequality have been compounded by the global financial crisis and subdued growth in most OECD countries in recent years. Together, these factors have led to growing public discontent with the political, economic and social status quo. Place-based policies can help to overcome public discontent not only because they promote economic development, but by valorising local cultures and traditions, they can help counter feelings in some regions of being "left behind" or that they "do not matter".

In addition to the effects from globalisation and the discontent it has generated in certain geographies, going forward, place-based policies will have to anticipate and address the region-specific impacts of three types of global megatrends:

1. digitalisation, automation and other technological changes
2. demographic changes, including urbanisation, ageing and migration
3. climate change and resource scarcity.

These megatrends will not affect countries uniformly, but differ from region to region. Adequate policy responses need to address this diversity, for example by targeting new investments and adjusting multi-level governance systems to make them more responsive to regional conditions.

Automation and other disruptive technologies will reshape economies and societies in all regions

Artificial intelligence, autonomous vehicles, 3D printing and other new technologies are important drivers of productivity growth that ultimately ensure rising living standards. They will change where people live and how they work and communicate with each other. However, they also result in automation that will lead to major job reallocation across sectors and places. Estimates show that the number of jobs at high risk of automation varies between 4% and 39% across OECD regions.

Regions, especially those with a large share of jobs at risk of automation, need to develop policies to equip workers with skills that are less likely to be automated and that are adaptable to new job profiles. Depending on the types of jobs lost and created in a given region, different combinations of skills development and firm upgrading will be required.

Automation will be felt especially strongly in rural areas because these areas rely disproportionally on manufacturing and have a low share of services in their economy. In contrast, many emerging technologies, such as autonomous vehicles, unmanned aerial vehicles, additive manufacturing and virtual reality technology, can benefit rural areas because they will reduce the disadvantages due to low density and long distances. New technologies can also improve service delivery in rural areas and policy makers should facilitate their adoption.

Large cities are likely to benefit the most from the growing importance of knowledge-intensive activities due to technological change. However, skill polarisation in jobs can lead to growing intra-urban inequalities between high-skilled and low-skilled workers. For successful urban areas, the biggest challenge will be to ensure that continued economic success does not lead to rising costs of living, which are a burden especially for the poorest, but increasingly also for the middle class. Ensuring housing affordability is a key element to meet this challenge.

Big data analytics, the Internet of Things, civic technology, virtual reality and other technologies can be used to build smart cities, transform public service delivery and facilitate citizen participation at the local level. Local governments should adapt these technologies while addressing the associated risks, for example related to privacy and the exclusion of marginalised groups.

Regional demography will change due to ageing, urbanisation and migration

Urbanisation is progressing across the globe. The share of urban population is growing in most OECD countries, but growth is higher in low- and middle-income countries. Across the globe, there were 5 799 cities with more than 100 000 inhabitants in 2015, providing a home to approximately 3 billion people.

While some cities and regions are growing strongly, others are shrinking. New projections show that of the OECD regions for which data are available, 57% are expected to lose population by 2050. This will shrink tax bases and make it more difficult to provide public services. Such challenges can be mitigated by automation and the use of new technologies for service provision, and policy makers in ageing and shrinking regions should use the possibilities of new technologies strategically.

Migration can mitigate population ageing because migrants tend to be younger than average in most regions. Policies to integrate migrants should be adapted to the profile of regions and of local migrant communities and have to involve a wide range of local stakeholders, including businesses and non-governmental organisations.

Demographic change will have asymmetric effects on subnational public finances within countries. It will affect rural remote areas particularly negatively, both on the spending and on the revenue side. Demographic developments and other megatrends, such as digitalisation, may also fundamentally change regions' tax bases via shifts in labour markets and business incomes, as well as changes in land values and housing prices. Subnational taxation and equalisation mechanisms will need to be adjusted accordingly.

Subnational governments are important actors in fighting climate change

The dominant environmental megatrend over the coming decades is climate change. Regional and local governments play a key role in fighting climate change and adapting to it, not least because they make 64% of all climate-related public investment.

Subnational governments pursue some of the most committed policies to fight climate change. Where their scope is limited by funding and capacity challenges, national governments should provide the necessary legal and financial means to allow subnational governments to pursue ambitious policies. To reflect the prominent role that subnational governments play in fighting climate change, their contributions to carbon emission reductions should be made more explicit through targets.

Global megatrends entail new investment needs

The current level of total investment is less than half of what is required to prepare for new technologies and address challenges such as ageing and climate change adequately. Subnational governments, which, on average, are responsible for 57% of public investment in OECD countries, will be leading actors in scaling up investments and ensuring a high return on them. To maximise fiscal capacity for investment, subnational governments should also seek external private financing where this option is appropriate.

Multi-level governance systems have to be adapted to meet future demands

Multi-level governance systems need to be strengthened and made more flexible to reflect regional disparities. Many OECD countries have moved towards asymmetric decentralisation in recent years. This trend is likely to continue and can help to adapt governance to differences in regional, metropolitan and local conditions and capacities.

Experimental governance that embeds learning-by-doing and trial and error processes into policy design can help governments to develop better approaches to address different local needs. Such approaches can be combined with asymmetric decentralisation, for example to develop new governance solutions for metropolitan areas.

Understanding future trends is essential to develop good policies. Across the OECD, national and subnational governments use several instruments to future-proof regional policy, ranging from data-driven forecasts to flexible foresight exercises. Using a broad range of tools is desirable to prepare for a wide range of plausible – although by definition uncertain – scenarios over different time horizons.

Part I. Regional policies to address global megatrends

Chapter 1. Rethinking regional development policies

This chapter argues that persistent economic inequalities across regions need to be addressed by place-based policies. It explains how productivity gaps across regions emerge and shows how uniform policies at the national level can have different effects across regions. The chapter argues that persistent regional inequalities have led to rising discontent with the economic, social and political status quo in lagging regions. In some cases, this discontent has been reinforced by growing cultural differences between economically successful urban regions and other regions that are lagging behind. Policy makers seeking to address this geography of discontent have to use place-based policies that target the region-specific factors behind persistent regional inequalities.

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The OECD regional policy paradigm at 20 years

Regional policy as a distinct policy area developed in most OECD countries in the 1950s and 1960s, a period of relatively strong economic growth, fiscal expansion and low unemployment. It was motivated by widening regional disparities that emerged as a consequence of rapid industrialisation and urbanisation. When introduced, the principal objective of regional policy was greater equity and balanced development. Public interventions were supposed to facilitate the economic development of lagging regions by encouraging demand. The main instruments used were redistribution through financial transfers by the national government accompanied by large-scale public investments, especially in lagging regions (OECD, 2010[1]).

During the 1970s and early 1980s, successive economic shocks and changes in the global economy led to the emergence of geographical concentrations of unemployment in many OECD countries, and regional policy evolved rapidly to address this new challenge. The focus of regional policy was extended to not only to reduce disparities in income and infrastructure, but also disparities in employment. Policies aimed at affecting supply conditions and thereby influencing industrial location decisions, with respect to existing firms and new investments (OECD, 2010[1]). This brought a much stronger focus on subsidies to firms, either to support ongoing activities or to attract new jobs and investment to areas of high unemployment.

Until the late 1980s, regional policy focused predominantly on regional investment aid and infrastructure support, with policy interventions heavily targeting designated geographical areas that were often underdeveloped. In the European Union, Cohesion Policy also mainly focused on infrastructure development until the 1980s, assuming that infrastructure was a main bottleneck to regional economic convergence (OECD, 2010[1]).

However, in spite of sustained government efforts, regional disparities did not decrease significantly. Starting in the 1980s, growing pressure on public finances made large allocations for regional programmes politically unsustainable. In response to the poor outcomes of regional programmes, the idea of market failure was complemented by an argument of co-ordination failures that suggested a new approach to policy making. Regional policy evolved from top-down, subsidy-based interventions designed to reduce regional disparities into much broader policies designed to improve regional competitiveness (OECD, 2010[1]).

The new objective of regional policy necessitated a thorough rethinking of the policy instruments and tools that were used within regional policy. The recognition that a new paradigm for regional development was needed led to the creation of the OECD Regional Development Policy Committee (RDPC) in the late 1990s and its three working parties: the Working Party for Rural Policy, the Working Party on Urban Policy and the Working Party on Territorial Indicators. Its work complements the OECD Local Employment and Economic Development Programme (LEED) that exists since 1982.

An evolving consensus – 20 years of policy discussion within the OECD Regional Development Policy Committee

The RDPC was created in 1999 in recognition that changing economic and social conditions were giving rise to new regional development policies. Its first years focused on changing the paradigm of regional development policy from redistribution to regional competitiveness. It made clear that regional policy needed to rectify past mistakes to be more effective, mainly avoiding top-down policies based on large subsidies and the artificial creation of economic and technological hubs, disconnected from local assets. This shift

included promoting investment to leverage regional opportunities as well as a focus on multi-sectoral approaches and multi-level governance, underpinning a dynamic vision to *promote growth in all regions* (OECD, 2012[2]).

Regional development as a horizontal "policy of policies"

The 2008 financial crisis and its severe economic and social consequences marked an inflection point. The short-term need for counter-cyclical policies highlighted the role of public investment. Within the RDPC, it brought renewed attention to how regional development strategies can help to better target public investment. Notably, 57% of all public investment is made by subnational governments. Ultimately, these discussions helped pave the way for the development of the OECD *Recommendation of the Council on Effective Public Investment across Levels of Government*.

Box 1.1. Key takeaways from two decades of work of the OECD Regional Development Policy Committee (I)

Why do regional development policies matter?

Regional development policy at the national level does not consist of a fixed set of policies. Rather, it consists of strategies to support the coherent implementation of various policies. These strategies depend on other elements: various sectoral policies (housing, transport, employment, economic development, innovation, energy, welfare, education, land use, etc.), the regional and local governments with whom they share policy competences, as well as the private sector and citizens themselves. In this context, the OECD Regional Development Policy Committee has helped to articulate the added value of regional development policies, and distilled high-level learnings on "what works".

- People's well-being is strongly influenced by where they live and work, and there are considerable differences across territories. In fact, the OECD's *Regional Well-being Database* shows that regional gaps are wider when considering multidimensional measures of living standards instead of income alone. This diversity of local realities calls for a diversity of policy responses, delivered at the appropriate scale.
- Within OECD countries, the most productive region is, on average, almost twice as productive as the least productive region. And, while across the OECD a few large regions make outsized contributions to aggregate growth, the combined contribution of the remaining regions still accounts for approximately two-thirds of growth. Leveraging the growth potential of all places creates a double dividend of both increased aggregate productivity and inclusion. At the same time, an approach that values regional diversity is key for making our societies more resilient to future challenges.

In parallel, the policy debate opened up to other stakeholders (international organisations, non-governmental organisations, the private sector, OECD partner countries) in recognition of their importance for regional development. Its scope also expanded to include issues such as innovation and entrepreneurship, climate change, skills, and demographic change. Regional development policy is therefore a "policy of policies", mobilising multiple policy

fields to support regional development together with the mission to "address the regional dimension of core issues that OECD governments are addressing".

Putting people at the centre of inclusive and sustainable growth

By shining a spotlight on growing disparities, the 2008 financial crisis led to a greater emphasis on equity as an objective for regional development. In this context, there has been a debate on place-based versus people-based approaches, i.e. whether policies should target specific geographic territories or focus on groups of people without having an explicit territorial dimension. As will be discussed in the subsequent section, there is a need for both. In particular, targeting people is more effective if it is done at the appropriate scale and takes into account geographic specificities (OECD, 2011[3]).

The dual approach of targeting spaces and people has been visible in the subsequent work of the OECD. By highlighting regional well-being, people are placed at the centre of policy making (OECD, 2016[4]). In parallel, the question of geographic scale has been addressed through several streams of work, including ongoing statistical work to define functional urban areas in order to facilitate international comparisons of metropolitan areas and encourage policy making "at the right scale". This has lead, for example, to the finding that administrative fragmentation carries a productivity penalty for metropolitan areas, and to the further work on urban-rural linkages.

Box 1.2. Key takeaways from two decades of work of the OECD Regional Development Policy Committee (II)

What works for regional development?

The long-term vitality of communities depends not only on economic growth and competitiveness, but also on residents' well-being, inclusion and environmental sustainability. A modern vision for regional development works across these objectives, leveraging complementarities and managing trade-offs as needed.

- In the face of geographic diversity, one-size-fits-all policies are doomed to fail. Building on endogenous factors of growth can help get communities on a long-term path of inclusive and sustainable growth. For example, the Regional Development Policy Committee (RDPC) has helped to modernise rural policy. It has shown which rural regions have been able to narrow the productivity gap with urban areas and helped to shift the logic of policy interventions in rural areas from a focus on agriculture to strengthening the inherent capacity of rural areas across economic sectors.
- Scale matters, and it is functional areas rather than administrative boundaries that are important for the implementation of many polices. The RDPC has empirically documented the productivity penalty that results from administrative fragmentation in metropolitan areas, and has shown that strengthening urban-rural linkages can generate economic, social and environmental dividends for both urban and rural residents alike.

- Subnational governments are responsible for 57% of public investment in the OECD. Effective multi-level governance mechanisms and adequate subnational capacities are essential not only for regional development policies, but also for policies with a place-based component, such as investment, infrastructure, land use, water, etc. The OECD *Recommendation of the Council on Effective Public Investment across Levels of Government* provides concrete guidance for how this can be done.
- Subnational data and governance indicators should underpin an evidence-based approach to diagnosing challenges, developing strategies and implementing policies at the right scale. The RDPC has helped to meet this demand through its *Regional Database*, *Regional Well-being Database*, *Metropolitan Database*, the delineation of comparable functional urban areas, the Observatory of Subnational Finance, the Metropolitan Governance Survey and the Water Governance Indicators.

The productivity slowdown and the impact of traditional structural reforms on regional productivity

One of the most important economic trends in OECD countries over the past decades has been the decline in productivity growth in most advanced economies. Across the OECD, annual labour productivity growth in the seven years after the crisis (2010-16) was 0.9%. This is only half the annual labour productivity growth of 1.8% during the seven years before the crisis and even further below historical averages in many OECD countries (OECD, 2018[5]). Furthermore, in many countries, this productivity growth was generated by only a few regions, whereas the remaining regions recorded no productivity growth or even declining productivity. The slowdown and divergence in productivity growth is problematic for several reasons: it reduces the rate of wage growth that is sustainable in the long term; if low productivity growth rates persist, it may also become harder to service public debts.

An important and long-standing pillar of OECD recommendations to address the productivity slowdown has been the call for reforms of structural policies. These policies have received their name because they provide the structure in which the economy operates. They concern a wide range of legal frameworks and regulations, such as tax policy, labour market policy, competition policy, education policy, trade policy and many other policy areas.

An overarching objective of structural policy is to set the conditions for long-term productivity growth and economic stability. The key focus lies on providing incentives to economic actors such as firms and workers that encourage them to engage in productive activities – that together maximise economic output and growth. Furthermore, structural policies try to prevent abusive actions and rent-seeking behaviour such as the creation of monopolies, and to limit activities with negative externalities. They also address equity concerns, such as income distribution. Last but not least, many structural policies target the public sector, for example to ensure that public budgets are sustainable, public spending is efficient and the public administration responsive to the needs of businesses. Table 1.1

provides an overview of structural policies that have been identified as targets for reform in the OECD's *Going for Growth* work (OECD, 2018[6]).

Table 1.1. Target areas for structural reforms

Policy areas targeted by the OECD's *Going for Growth* structural reform recommendations

Skills development	Business dynamism and the diffusion of knowledge	Social cohesion and labour market dynamism
R&D and innovation	Physical and legal infrastructure	Health sector efficiency
Higher education, vocational education	Tax structure	Minimum wage and wage bargaining systems
Primary and secondary education	Barriers to trade and foreign direct investment	Labour market regulations
	Sector-specific regulatory burden	Labour taxation
	Economy-wide regulations	Housing policies
		Social benefits
		Active labour market policies
		Better integration of immigrants and minorities
		A more gender-inclusive labour market

Source: OECD (2018[6]), *Economic Policy Reforms 2018: Going for Growth Interim Report*, https://dx.doi.org/10.1787/growth-2018-en.

Most structural policies affect supply-side factors in the economy. Since it takes time until businesses adjust to a new structural environment after a reform, the short-term effect of structural reforms on economic growth is often small or even negative. Therefore, structural reforms play only a secondary role in managing cyclical fluctuations of the economy. Yet, structural reforms have important long-term consequences, because they affect the long-term growth potential of an economy. Even if structural reforms increase annual growth only by a little, the cumulative effect of slightly higher growth rates over many years has strong consequences for income levels in the long term.

Most structural reforms do not consider regional disparities in productivity

Most structural policies are place-blind. This means they apply uniformly across the entire territory of a country and do not change from region to region. Labour market regulations, for example, are usually identical throughout all parts of a country. They might depend on the characteristics of a worker, such as his or her job or income level, but they are independent from where a worker lives within a country. Exceptions to this rule exist primarily in some federal countries, where the federal states have authority over important dimensions of structural policy.

The place-blind nature of structural policies is often unavoidable and mostly desirable. Diverging product market regulations or large cross-regional differences in tax policies, for instance, would make it more difficult for firms to do business throughout a country. Thus, structural policies are for a good reason place-blind. However, the place-blind nature of structural policies limits their potential to address severe differences in economic outcomes across regions. Furthermore, it means that some structural policies set at the national level are not optimal for specific regional contexts.

Not all regions are equally affected by structural reforms

The fact that most structural policies are place-blind does not imply that they are also place-neutral. In other words, it does not imply that structural policies have the same effects

on all regions of a country. This can be illustrated by an example. Many structural policies in recent decades aimed at liberalising trade. It is well-documented that trade liberalisation is in aggregate positive for a country, but not all regions benefit equally from it. In many OECD countries, trade liberalisation benefited cities that are providers of tradable services, but harmed regions with strong manufacturing profiles that faced new competition from abroad (Autor, Dorn and Hanson, 2013[7]).

Due to the one-size-fits-all nature of structural policies, it is difficult to use them to address concerns that exist only in some parts of a country. Given the sizeable differences in economic structure and economic performance across regions, structural policies that are a good fit for one part of a country might not be a good fit for another part of the country. For example, tax incentives to convert industrial brownfield sites could be an appropriate structural policy for regions that undergo industrial transitions. However, in booming cities, such tax incentives might only create windfall gains for landowners as the conversion of brownfield sites could be profitable without further incentives.

The fact that structural policies do not take regional conditions into account implies that further policies are needed to address regional disparities. As discussed in the following section, there are large differences in productivity levels and productivity growth rates in many OECD countries. Labour mobility, i.e. the ability of people to move from economically lagging to economically successful regions, is not enough to buffer the effects of regional imbalances. Place-based policies are required to respond to large and persistent inequalities across regions.

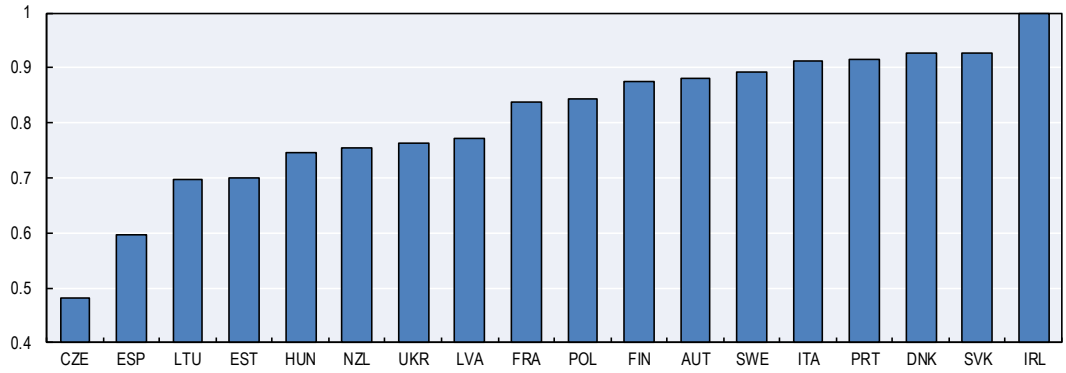
Productivity differences across regions are large and persistent

In most OECD countries, economic performance across regions varies strongly. On average, labour productivity in the worst performing region in an OECD country is 46% lower than labour productivity in the best performing region of the country. In some OECD countries, the difference between the best and worst performing regions is more than 60%. Likewise, unemployment rates usually differ by a factor of three or more across regions within the same country (see Figure 1.11).

Such differences would be less of a concern if they were temporary and regions that are lagging behind quickly caught up with more productive ones. However, differences are highly persistent. Figure 1.1 shows that in most countries, the ranking of regions by productivity levels in 2000 and 2015 was very similar. In most countries, the Spearman coefficient is above 0.7, which indicates that regions did not move up or down the productivity ranking much. Notable exceptions are Spain, and in particular the Czech Republic, which has a Spearman coefficient of less than 0.5, implying a significant degree of change in its regional ranking.

Figure 1.1. Persistence in within-country differences in productivity levels

Within-country Spearman rank-correlation of regional productivity levels, 2000 and 2015



Notes: This graph shows the persistence of productivity differences across regions within a country. The higher the value, the higher the persistence in the ranking of regions by productivity level. Note that persistence in differences is not necessarily related to the overall magnitude of differences. Thus, even in countries that have a high degree of persistence in regional productivity levels, the actual differences across regions might be small.
Source: Calculations based on OECD (2019), *OECD Regional Statistics* (database), https://doi.org/10.1787/region-data-en.

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Productivity growth in OECD countries tends to follow two growth models

When analysing how productivity has grown across regions within countries since 2000, two growth models become apparent. Seventeen out 31 OECD countries with available data have followed a regionally distributed productivity growth model (Table 1.2). Countries in this category had less than 50% of total productivity growth occurring in regions at the productivity frontier (i.e. in the most productive regions of the country accounting for at least 10% of employment). In these countries, differences in productivity growth rates across regions were usually gradual and no single region stood out. Moreover, among the regions with high productivity growth, there were often several with low productivity levels. As a consequence, regional productivity converged, or at least did not diverge further, countries with distributed growth models.

In contrast, 14 out of 31 OECD countries followed regionally concentrated productivity growth models. In these countries, regions at the productivity frontier contributed more than 50% to the overall productivity growth in the country. Thus, regional disparities in productivity levels widened in these countries. Table 1.2 provides an overview of the countries that fall in each of these two categories.

Figure 1.2 illustrates the difference between regionally distributed and concentrated growth models for six countries. Countries on the left-hand side of the figure follow a distributed growth model, whereas those on the right-hand side follow a concentrated growth model. Two patterns are notable. First, the defining difference between the two categories is easily visible. In countries with concentrated growth models, regions at the productivity frontier contribute disproportionally to aggregate productivity growth. Second, and perhaps more surprisingly, in countries with concentrated productivity growth, there is also a clear gap between the region with the highest contribution to productivity growth and all remaining regions. In contrast, productivity growth contributions in countries with distributed growth falls gradually across regions and few large gaps are visible.

Table 1.2. Regional growth models, 2000-16

Classification of countries in regionally distributed and regionally concentrated growth models

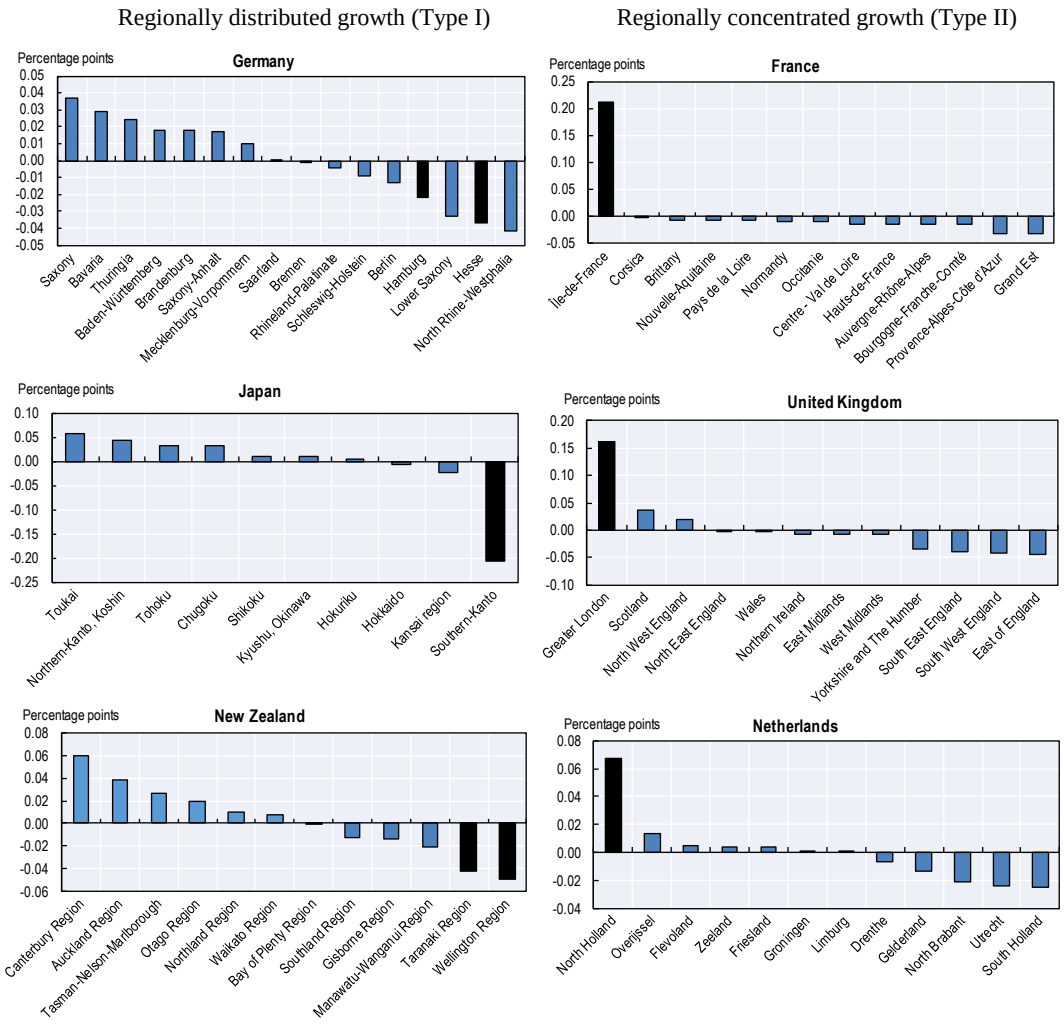
Regionally distributed productivity growth model (Type I)	Regionally concentrated productivity growth model (Type II)
Austria	Australia
Belgium	Czech Republic[2]
Canada	Denmark
Chile	Estonia
Germany	Finland
Hungary[1]	France
Italy	Greece
Japan	Ireland
Latvia	Korea
Lithuania	Netherlands
Mexico	Norway
New Zealand	Slovak Republic
Poland	Sweden
Portugal	United Kingdom
Slovenia	
Spain	
United States	

Notes: Countries are classified as having a regionally distributed growth model if the contribution of regions at the productivity frontier (i.e. the most productive regions that together contain at least 10% of the country's employment) to overall productivity growth is less than 50%, or if productivity growth in frontier regions is negative. If the contribution of the frontier to overall productivity growth is more than 50%, the country is classified as having a regionally concentrated growth model. The contribution to productivity growth of a region is calculated as the difference between the actual productivity growth in a country and the productivity growth rate of the country excluding the region.
1. Between 2000 and 2016, Hungary moved from being a concentrated to being a distributed country.
2. Between 2000 and 2016, the Czech Republic moved from being a distributed to being a concentrated country.
Source: Calculations based on OECD (2019), *OECD Regional Statistics* (database), https://doi.org/10.1787/region-data-en.

One possible explanation for the differences in productivity growth could be differences in employment growth. At regional or national levels, there is often an inverse relationship between employment and productivity in the short term. For example, during economic downturns, average labour productivity increases while employment declines. Firms shut down less productive parts of their business and some firms with low productivity levels go out of business entirely. This process reduces employment, but at the same time the average productivity level goes up because some of the least productive firms and workers are not included in the average anymore. Likewise, average productivity can decline during booms when firms hire additional workers that are less productive than those workers already in employment.

If countries with concentrated growth models were adding employment predominantly outside of their most productive regions, while countries with distributed growth models were adding employment predominantly in highly productive regions, it could explain the observed pattern. However, this effect does not seem to be the driving mechanism behind the observed pattern. First, the negative relationship between productivity and employment holds primarily in the short term. Countries with concentrated growth models had not only high productivity growth rates in their most productive regions, but also high employment growth rates.

Figure 1.2. Illustration of productivity growth models, 2000-16



Notes: Each bar represents the difference between the actual productivity growth in a country and the productivity growth rate of the country excluding the region. Black bars show the most productive regions of a country at the productivity frontier.

Source: Calculations based on OECD (2019), *OECD Regional Statistics* (database), https://doi.org/10.1787/region-data-en.

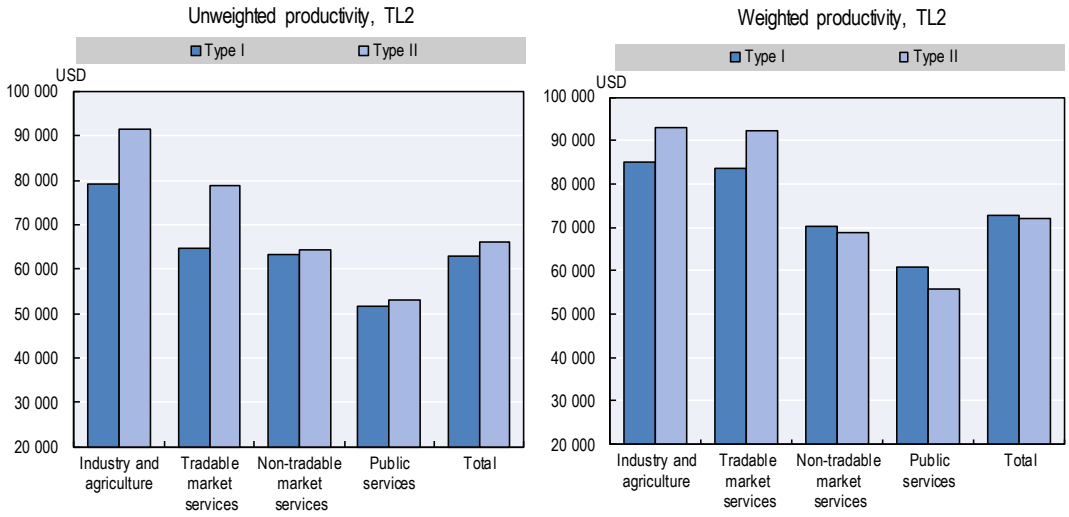
StatLink https://doi.org/10.1787/888933922061

Is there a trade-off between high productivity and equally distributed productivity?

There is tentative evidence that productivity levels are higher in countries that have a regionally concentrated model of productivity growth than in countries that have a regionally distributed model of productivity growth (Figure 1.3)[1]. In the manufacture of goods and in the provision of market services (i.e. those services that are sold in a market for profit), TL2 regions[2] in countries with concentrated productivity growth are 10% more productive (Figure 1.3, right panel). For non-market services, i.e. those produced by the public sector or other not-for-profit actors, there does not appear to be the same difference in productivity levels between the two groups of countries.

Figure 1.3. Productivity in manufacturing and market services is higher in countries with concentrated productivity growth

Labour productivity (gross value added per worker) in TL2 regions by sector, 2016



Notes: Data for 2016 or most recent year available. Labour productivity is gross value added in constant 2010 USD at constant PPPs divided by employment.
Source: Calculations based on OECD (2019), *OECD Regional Statistics* (database), https://doi.org/10.1787/region-data-en.

StatLink https://doi.org/10.1787/888933922080

At this point, it is too early to judge whether there is a causal relation between the regional growth model of a country and its overall productivity level. The data suggest that there are important differences in productivity levels between the two groups of countries, but it cannot be ruled out that these differences are a coincidence that is driven by other factors or by chance. Yet, this is an important question for further analysis. If it turns out that productivity levels in countries with regionally distributed growth models are systematically lower, policy makers would need to find mechanisms to reduce this gap and to create productivity growth everywhere without incurring a productivity penalty.

Economic theory can only partly explain large and persistent productivity and employment differences across regions

Some differences in economic performance across regions within a country are expected and seem largely unavoidable. A key dimension in this respect is the difference between cities and less densely populated parts of a country. A higher density of potential customers, suppliers and workers as well as of various forms of infrastructure brings economic benefits that make firms in dense places more productive than firms in less dense places. This effect increases with population size. On average, firms in larger cities are more productive than firms in smaller cities. Moreover, cities, and especially large cities, tend to attract industries that are more productive than other industries, no matter where they are located. For example, firms that provide knowledge-intensive services are often highly productive and locate predominantly in large cities (OECD, 2018[8]). Such differences in the sectoral composition increase productivity differences between cities and rural areas even further.

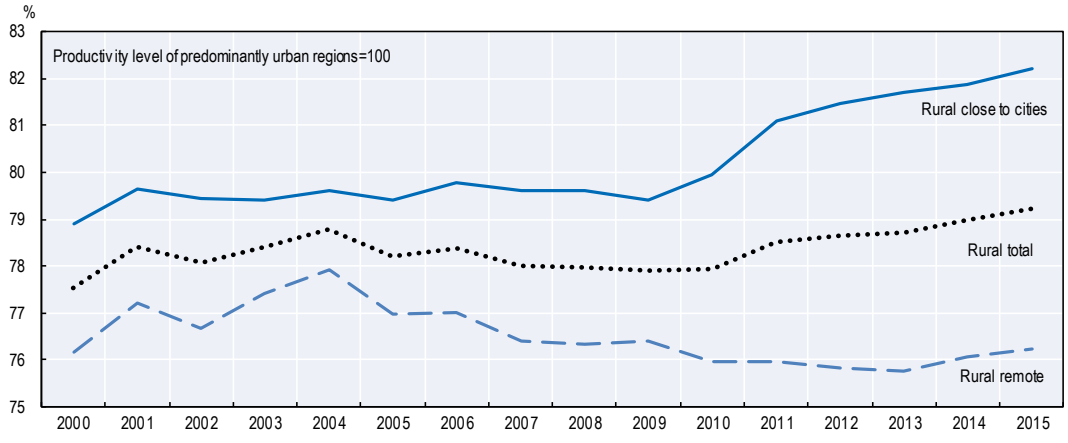
The agglomeration economies created by cities can have advantages for the entire country. Cities have higher productivity levels than other parts of a country partly because they generate more innovations. This increases productivity growth in cities, but also benefits the rest of the country because innovations eventually spill over to other regions. Innovations that originate in cities can thus translate into higher productivity growth throughout the country.

Such benefits of cities are clearly documented, and economic theory can, in most cases, explain why they exist. Yet, many theories that explain productivity differences across regions also predict that the disparities between the most productive cities and lagging regions should not become too wide. The above-mentioned knowledge spillovers from highly productive places should raise productivity in less productive ones. Large differences in unemployment should be prevented by labour mobility that allows workers to move to regions where they find jobs (Rodríguez-Pose, 2018[9]). Capital mobility should ensure investment where it is needed. In such a world, urban agglomerations would push the productivity frontier forward, while other regions would keep pace without lagging too far behind.

In reality, regional disparities do not follow such a benign pattern. On average, productivity in rural areas is less than 80% of the average productivity in urban areas within the same country (Figure 1.4). As discussed above, the gap between the most productive regions and those lagging behind is growing in many countries. Moreover, regions hit by shocks such as the decline of a dominant industry often suffer from decades of economic depression. Often, productivity levels in lagging regions are low and unemployment rates above the national average (see Figure 1.11), indicating an underutilisation of regional resources. This is particularly a problem in remote rural areas. While rural areas close to cities could reduce some of the gap with urban areas, Figure 1.4 shows that no such convergence process has occurred in remote rural regions.

Figure 1.4. Productivity gaps between rural and urban regions have narrowed, but only for those close to cities

Labour productivity in predominantly rural TL3 regions as a ratio of productivity in predominantly urban TL3 regions, 2000-15



Note: Productivity is measured with the GDP per worker at place of work in TL3 regions, computed for 23 EU countries with predominantly rural (381 regions, in which 148 remote) and predominantly urban regions (365 regions). The productivity for each type is an average of the regions..
Source: Calculations based on OECD (2019), *OECD Regional Statistics* (database), https://doi.org/10.1787/region-data-en.

StatLink https://doi.org/10.1787/888933922099

Cross-regional disparities imply a need for place-based policies

If economic performance across regions converged as expected by basic economic theory, there would be little need for regional development policies that go beyond structural policies. Policy makers could aim at optimising the overall policy environment through structural reforms without having to focus on specific places, because lagging regions would catch up automatically.

However, large gaps in economic performance and high persistence of inter-regional differences imply a failure of automatic convergence of regions. This raises the question of how policy makers can ensure the catching-up of lagging regions. Current disparities strain social cohesion and residents in lagging regions expect policy makers to provide solutions that do not require decades to be effective.

Place-based regional development policy provides a solution to help all regions use their full economic potential. The approach is motivated by the observation that regions differ not only in their economic performance, but also in the factors that are responsible for this performance. Each region has a specific set of strengths and weaknesses that makes it different from most other regions (see Table 1.3 for examples). The objective of place-based policy is to allow regions to use their strengths for endogenous economic development.

Table 1.3. Examples of regional strengths

Dimension	Specific strength
Economic	– Existing industrial clusters – Specific skills among the workforce – Specialised supplier base – Large customer base
Geographic	– Resource availability – Availability of cheap renewable energy – Strategic location (e.g. along transport corridors) – Climate – Natural beauty
Institutional	– Well-functioning/flexible institutions – Collaborative culture of working together
Culture	– Language skills – Traditions that can be marketed (e.g. local cuisine) – Entrepreneurial traditions
Knowledge-based	– High-quality research institutions – Research specialisation in valuable niches – Well-functioning co-operation between research institutions and the private sector
Infrastructure	– Transport infrastructure (e.g. ports, airports) – High-speed data connections – Tourism infrastructure

Notes: This table provides examples of regional strengths, but is not nearly exhaustive. A key challenge in place-based regional development is to identify the unique set of strengths of a region to use it productively.

Place-based regional development policy aims at using existing regional strengths productively for regional development while addressing specific weaknesses that form bottlenecks to economic development. It involves a wide range of actors from within the region and usually requires the implementation of several complementary policies in parallel. For example, a region that bases its development strategy on a culinary tradition might not only have to ensure that the infrastructure exists so that perishable goods can reach important markets on time, it also has to adapt its education system to train skilled workers in the

food-processing industry. In parallel, it might have to offer advice and training to owners of small food producers on how to export; and it needs to foster the creation of business associations that can market food from the region nationally and internationally.

The example of developing a food-processing industry can also serve as an illustration of the various actors involved in place-based regional development policy. Major infrastructure is often provided by the national government. Adapting education policies within the region involves universities, various levels of government, employers and unions. Advice and training on how to export is often provided by business development agencies that are controlled by regional governments. Business associations fund and co-ordinate marketing campaigns. Thus, the successful implementation of such a hypothetical regional development strategy would require co-ordination among at least two levels of government, a governmental agency and three non-governmental actors.

Place-based policies are often designed for functional areas instead of administrative jurisdictions. In many places, administrative boundaries between regions do not correspond to the economic linkages throughout a territory. For example, there are important connections between core cities and their surrounding commuting zones, between rural and urban areas, and between neighbouring regions in different countries. In these cases, the boundaries of local, regional or national jurisdictions do not reflect these linkages. Effective place-based policies need to be co-ordinated across these administrative boundaries to target the entire functional area.

As discussed at the outset of this chapter, modern place-based regional policy does not imply persistent subsidies to lagging regions, nor does it emphasise any particular policy measure, such as infrastructure investments. Instead, it describes a set of co-ordinated policy measures that involves stakeholders from within and outside the region and is adapted to the specific conditions of a region. As highlighted by Iammarino, Rodríguez-Pose and Storper (2018[10]), equity is a major policy objective of modern place-based regional policy, but it is not aimed to be achieved through permanent transfers from productive to unproductive regions. Instead, the objective of modern place-based regional policies is to ensure equity by helping regions to utilise their economic potential by increasing employment and productivity. Modern place-based policies can also counteract a race-to-the-bottom among regions within a country. Rather than having regions trying to undercut each other, for example at the expense of tax revenues or environmental and labour standards, place-based policies offer regions a productive way to compete with each other while lifting the economic performance of the entire country. Table 1.4 provides an overview of the key characteristics of modern place-based policies for regional development.

Importantly, place-based policies are not a substitute for appropriate structural policies. Instead, they are a complement to structural policies. Place-based policies can provide the degree of regional specificity to economic policy that is needed to fully utilise the potential of all regions, but that cannot be provided by structural policies alone. However, place-based policies cannot replace a well-designed structural policy environment provided at the national level.

Finally, it should be emphasised that place-based policies for regional development are desirable not only from a regional perspective. Lagging regions have levels of economic activity that are well below their potential, both in terms of employment and productivity. This not only affects the regions themselves, but also has important consequences for national aggregates, such as national tax revenues. By using place-based policies in lagging regions, national governments have an important complement to structural policies that can contribute to increasing aggregate economic performance.

Table 1.4. Characteristics of modern place-based regional policy

	Regional policy characteristics
Problem recognition	Low productivity (levels and growth); underused regional potential; lack of regional competitiveness; inter-regional and inter-personal inequality.
Objectives	Increasing productivity growth; delivering high-quality of life and well-being to people across economic, social and environmental dimensions.
General policy framework	Tapping underutilised regional potential through regional programming; building on existing strengths; developing regional innovation systems.
Spatial orientation	All regions within a country are targeted with policies adapted to each region.
Actors	All levels of government; relevant non-governmental stakeholders (public, private, academia, non-governmental organisations).
Unit for policy intervention	Interventions should consider both administrative and functional geographies where appropriate. Functional geographies cover the areas in which people live, work and interact (e.g. rural-urban linkages, functional urban areas, cross-border regions, etc.).
Time dimension	Should provide a stable long-term policy environment while responding adequately to newly emerging challenges and opportunities.
Policy fields	Context-specific; considering all relevant policy areas and regional characteristics (economic, geographic, demographic, social, cultural, etc.).
Focus	Endogenous development based on local assets and knowledge.
Instruments	Broad range of instruments, including targeted investment in human capital (e.g. higher education, vocational training, early childhood education, etc); infrastructure investments; support for business development (e.g. business incubators, credit provision, etc.); research and innovation support; co-ordination between non-governmental actors (businesses, universities, etc.).
Operational approach	Encourages policy co-ordination across sectors, levels of government and jurisdictions; and promotes participation and dialogue with private stakeholders and citizens.

Source: Revised and updated from OECD (2010[1]), *Regional Development Policies in OECD Countries*, https://dx.doi.org/10.1787/9789264087255-en.

Reaping the benefits from globalisation requires place-based development strategies

Globalisation has reinforced the need for place-based policies. Increasingly mobile flows of goods, capital and information have led to an unprecedented integration of economies across the world. Yet, instead of eliminating differences across regions, the opposite effect has occurred. While aggregate effects from trade have been beneficial, the differences in outcomes across regions are substantial. In some regions, trade shocks have led to rising unemployment and prolonged economic decline (Autor, Dorn and Hanson, 2013[11]). These uneven outcomes have led to a backlash against globalisation that risks undoing many of the benefits of closer international economic integration. Only place-based policies can address the downsides from trade without threatening the benefits from trade.

The rise of exports from China

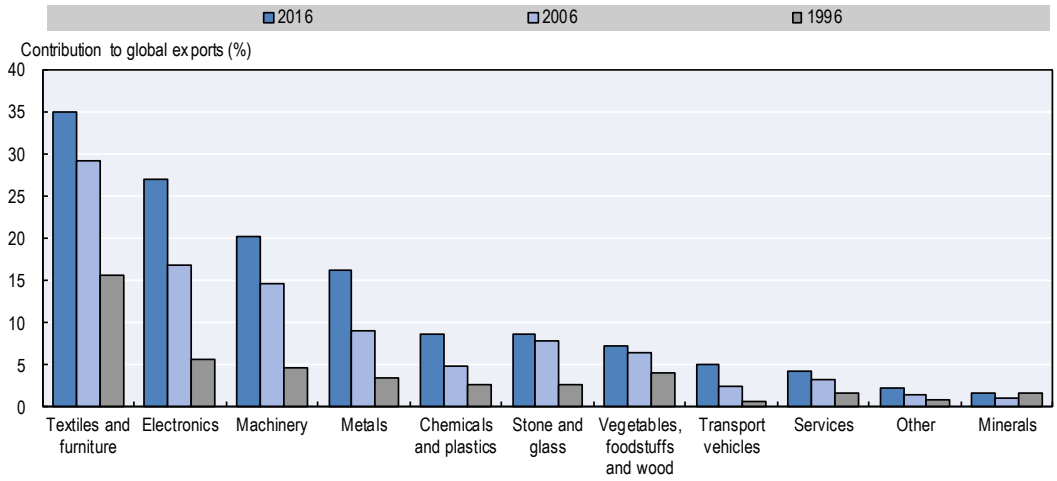
Globalisation is not a new phenomenon. Supported by improvements in transport technologies and infrastructure, global trade started to grow significantly during the 19th century (Federico and Tena-Junguito, 2017[12]). This trend was only halted by the onset of World War I and the Great Depression in the 1920s. Trade resumed a clear upward trend from 1970 onwards with higher growth rates than those achieved during the 19th century (Federico and Tena-Junguito, 2017[12]). Since 1980, world trade has grown on average nearly twice as fast as world production (WTO, 2013[13]). An increasing number of international trade agreements supported growing trade. Throughout the 1980s, less than 50 agreements where in place. By 1995, the World Trade Organization recorded 116 active

agreements and a decade later the number had reached 240. With 485 active agreements in 2018, the number had more than doubled again.[3] Figure 1.7 shows that this has benefited especially exports from low and middle income countries.

A major factor in the development of global trade in recent decades has been the rapid development of the People's Republic of China (hereafter "China") that lifted hundreds of millions of people out of poverty. Initially, China's development was driven by products with low levels of technological complexity such as textiles or furniture, as well as tasks in the production of complex products that are less knowledge-intensive (e.g. final assembly). Chinese firms have not stopped as mere suppliers of intermediates and assemblers of final goods. There is a concerted agenda by both national and local governments to upgrade industries to become competitive at the global technological frontier. This is evident in places like Shenzhen, a small fishing village in the 1970s and today a megacity with more than 18 million inhabitants. The city became one of China's first special economic zones in 1979 and has rapidly moved from providing assembly to being home to some of China's most productive and innovative companies. In 2016, Shenzhen accounted for almost half of all China's international patent applications and R&D spending in Shenzhen already accounts for 4.13% of gross domestic product (GDP), comparable to the R&D intensity of the top 5% of OECD TL2 regions.[4]

Figure 1.5. The rise of China in global exports

Percentage of global exports by the People's Republic of China



Source: Calculations based on Center for International Development (2018), *Atlas of Economic Complexity*, http://atlas.cid.harvard.edu (accessed on 20 November 2018).

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Consumers reap the biggest gains from globalisation

The strongest gains from trade accrue to consumers. However, the benefits are unevenly distributed and depend on the consumption baskets of different income groups. As richer households tend to consume more imported goods, any decrease in prices that stems from greater openness to trade creates larger benefits for them than for lower income households. For example, evidence from the opening of foreign supermarkets in Mexico shows welfare gains of around 6% of initial household income. The benefits are largely driven by foreign retailers charging, on average, 12% less for identical products than domestic stores, as well

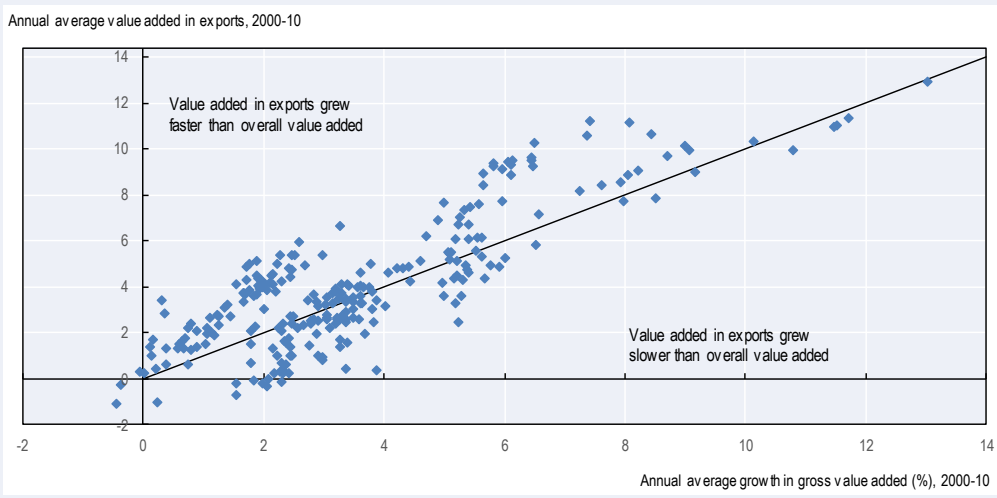
as offering five times the number of products. These gains were strongest for the richest income groups in Mexico, who gained about 50% more than the poorest as they switched more of their consumption to foreign retailers (Atkin, Faber and Gonzalez-Navarro, 2018[14]).

Box 1.3. Global value chains: Trade in products becomes trade in tasks

Since the 1980s, firms have started to break production processes into even smaller steps. Where before finalised goods were traded that were produced using local and imported raw inputs, today firms utilise local cost advantages to implement individual steps in different regions and countries (Grossman and Rossi-Hansberg, 2008[15]). This "trade in tasks" is captured by the concept of "global value chains" (GVCs), in which each place contributes part of the value added of a product. The focus thereby shifts from selling high value-added products to providing the tasks within the value chain that provide the highest value added.

Many fast-growing regions benefited from GVCs. Almost all regions that had annual growth rates in value added of more than 6% recorded growth in value added from GVCs that was even higher than their overall growth in value added (Figure 1.6). In contrast, no clear relationship between growth in value added from GVCs and overall growth in value added exists for regions with slower growth rates.

Figure 1.6. Value added in exports grew faster than gross value added in high-growth regions



Notes: Nominal annual average growth in value added for European TL2 regions. The solid line indicates equal growth rates for value added in exports and gross value added.
Source: Calculations based on data provided by Los, B. and W. Chen (2016[16]), "Global value chain participation indicators for European regions".

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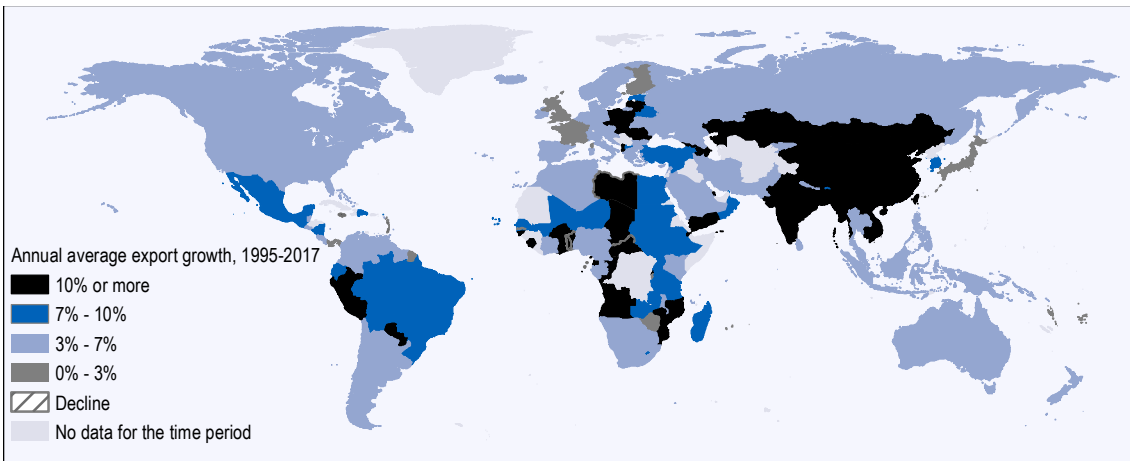
Global value chains increase the importance "governance" of production processes. The high degree of co-ordination across different actors, regions and countries requires sophisticated management of the value chain, which is typically within the hands of a multinational enterprise – the lead firm in the global value chain. Lead firms are those that govern their global-scale supplier networks, through combining products and services from subsidiaries (via greenfield or brownfield foreign direct investment) and contractual partners (Altomonte et al., 2013[17]).

To benefit from global value chain integration, regions must identify their advantages and build on them. This can be done by becoming hubs of knowledge and competencies, with sufficient institutional capacity to anticipate changes in global flows of production. It also involves setting the right framework conditions for development, in particular through four elements. First, the public and private sectors have to develop capabilities to adapt and integrate innovation and new technologies. Second, various stakeholders should aim at creating networks both within the region and, strategically, outside the region with places that have complementary capabilities. Third, engaging local stakeholders through participative governance mechanisms to ensure information sharing a common agenda within the region is essential. Fourth, it is important to ensure policy coherence across different policy fields, i.e. not just trade policy, but economic development, educational, investment, etc. and across levels of government (Labory and Bianchi, 2018[18]).

Gains from trade for consumers also have a spatial dimension. Households in larger cities spend a larger percentage of their income on local services and in particular on housing, and are hence less affected by the price of imported goods. The devaluation of the British pound in the run up and following the announcement and outcome of the referendum to stay in or leave the European Union has spurred price increases in the country. Inflation affected all income groups, but the effects were particularly strong for populations in less urban regions in the North of England and Northern Ireland (Breinlich et al., 2017[19]).

Figure 1.7. Exports have grown rapidly in nearly all countries

Growth in exports between 1995 and 2017 measured in USD



Notes: Growth for the period 1995-2017 or closest years available. Countries with no data before 2001 or after 2009 are excluded. The presented data and map are without prejudice to the status of or sovereignty over any territory, or to the delimitation of international frontiers and boundaries.
Source: Calculations based on IMF, "Export of Goods", *International Financial Statistics* (Annual) (database), http://data.imf.org.

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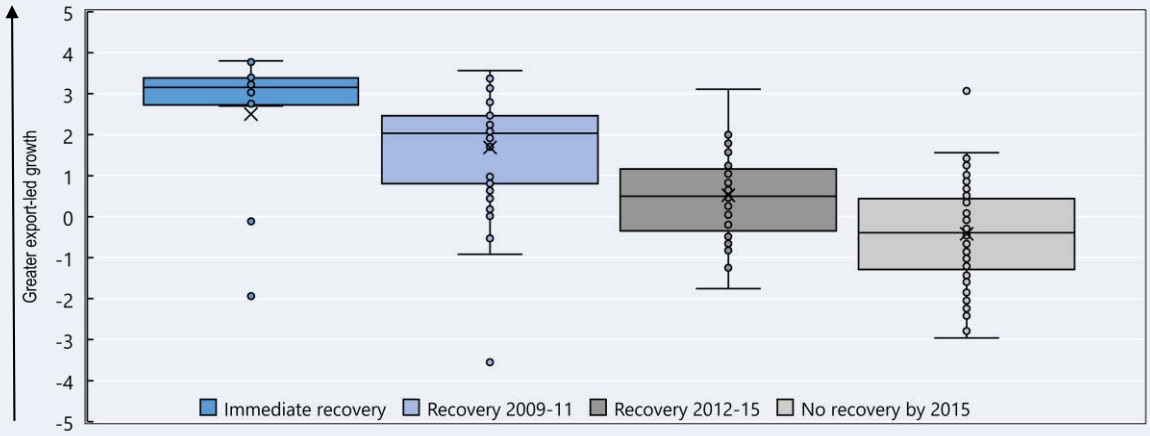
Box 1.4. Export-led growth led to faster recovery during the financial crisis

In the aftermath of the financial crisis, regions with strong export performance were doing better than most regions. The small number of regions that did not suffer any measurable economic setback from the 2007-08 crisis had, on average, an annual average growth rate in value added from exports that was more than 3 percentage points higher than the growth rate in overall gross value added. The average growth difference was about 2 percentage points for regions that returned to pre-crisis per capita income levels by 2011, 0.5 percentage points for those that recovered by 2015 and negative for the remaining regions that remained below pre-crisis levels in 2015 (Figure 1.8).

Figure 1.8. Regions where growth was driven by exports recovered faster from the crisis

Growth in value added from export minus total growth in value added by time it took regions to recover from the 2007-08 crisis



Notes: A region recovered from the crisis when real per capita GDP (in constant 2010 USD) was at least as high as in 2007-08. The box-and-whiskers plots show the difference in the annual average growth rate of value added in exports and gross value added (nominal values) between 2000 and 2010 for 243 European NUTS2 regions. The box shows the interquartile range, the long bar the unweighted average and the small "whiskers" the maximum and the minimum (excluding outliers).
Sources: Calculations based on OECD (2018[8]), *Productivity and Jobs in a Globalised World: (How) Can All Regions Benefit?*, https://dx.doi.org/10.1787/9789264293137-en; Los, B. and W. Chen (2016[16]), "Global value chain participation indicators for European regions".

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The finding that regions with a focus on exports weathered the crisis better than those where growth came mainly from internal demand might seem surprising. But regions that have a stronger link with global markets seem to be able buffer adverse shocks in some parts of their economy better than others. This is not only the case for economic output, but also for jobs. Regions with the smallest shifts in employment from tradable to non-tradable sectors before the 2007-08 crisis suffered fewer job losses in the aftermath of the crisis (OECD, 2018[8]).

Trade-related tensions

In many OECD countries, there is a growing scepticism concerning the benefits from trade that has been described by the OECD Secretary-General:

> *[…] there seems to be a growing apprehension about opening up, which, in some cases, is evidenced in a backlash against globalisation. On the political side the response seems to be a wave of populist movements and a call for protectionist measures that threaten to unravel decades of international co-operation that have lifted more than a billion people out of extreme poverty, fostered cultural diversity, and facilitated the fastest convergence of per capita incomes in history.*[5]

Different factors contribute to the backlash and the rise of "trade-related tensions". In some cases, they are tangible, as sectoral change threatens the jobs of people who might not be able to move into new jobs in growing sectors; other aspects are not related to tangible changes, but to the perception that challenges might arise. In some cases, the challenges are not recent, but build on a legacy of poverty, economic decay and lack of opportunities (Rodríguez-Pose, 2018[9]).

A flurry of recent academic studies have highlighted the negative effects of trade shocks on some regions. Local labour markets in the United States where manufacturers competed directly with Chinese imports experienced an increase in unemployment, lower labour force participation and a decline in wages. At the same time, benefits payments for unemployment, disability, retirement and healthcare rose sharply (Autor, Dorn and Hanson, 2013[21]). This impact had lasting effects on the local labour markets. Even a decade after the initial shock, wages and unemployment remain adversely affected (Autor, Dorn and Hanson, 2016[22]). Similar regional effects from import competition occurred also in regions in many other countries. They have been documented in Germany, Norway and Spain, among others.

Even severe geographically confined job losses in one sector would not pose a major problem if workers could easily find jobs in other sectors within the same region or in other regions. Yet, laid-off workers in affected regions struggle to find other jobs because affected regions lack dynamic sectors, which create jobs that offset the job losses from trade. As a consequence, unemployment rates remain persistently high over long time periods in regions that suffered from negative trade shocks (Autor, Dorn and Hanson, 2016[22]). Similar results are found for Spain, where regions affected by import shocks suffered job losses in sectors affected by import competition that were of the same magnitude as in the United States (Donoso, Martín and Minondo, 2015[23]).

Addressing the geography of discontent calls for a place-based approach

In a context of persistent economic stagnation in many regions, a growing discontent with the political and economic status quo has become apparent in recent years. It is reflected, for example, in the 2016 referendum in favour of the United Kingdom leaving the European Union. This amounted to a public rejection of one of the most important political institutions of the United Kingdom. Trust in the EU is also low in many eastern and southern European countries, such as the Czech Republic, Greece and Slovenia (European Commission, 2017[24]). Other indications of discontent include growing political polarisation, for example in the United States (Boxell, Gentzkow and Shapiro, 2017[25]), growing political fragmentation (e.g. in Germany), as well as the collapse of established political parties and the surge of new parties from across the political spectrum (e.g. in France and Italy). Discontent with

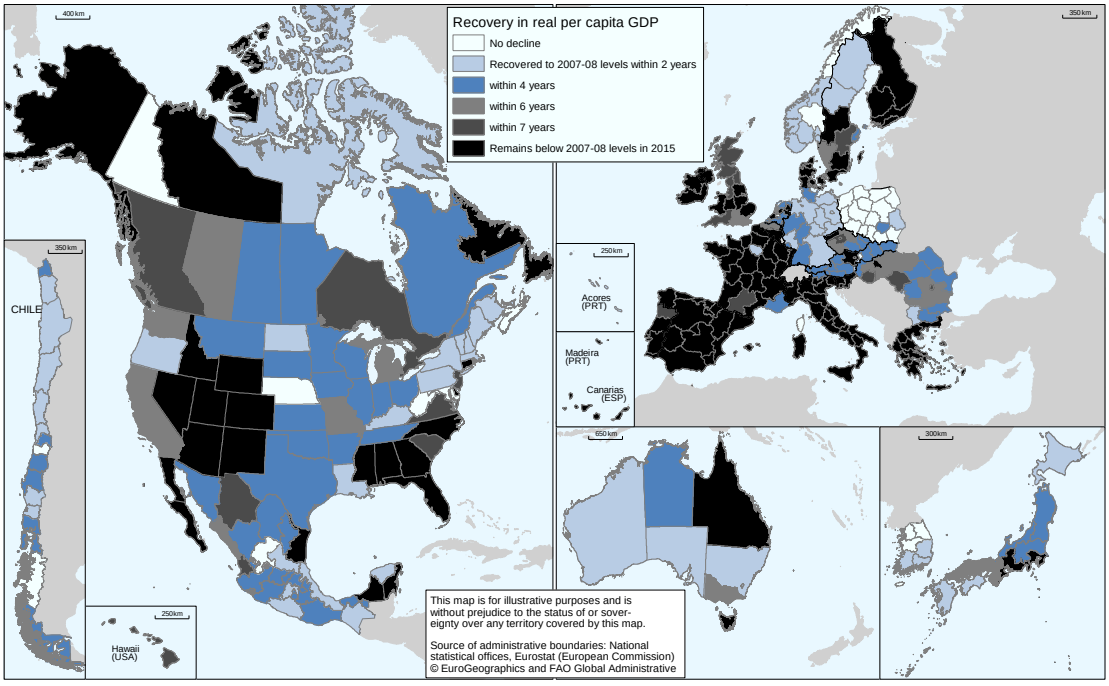
existing institutional arrangements is also reflected in policy decisions, such as threats to upend the global trading system through the introduction of large-scale tariffs.

Many indicators of political discontent show that there is a distinct *Geography of Discontent* – a distinct geographical pattern of unhappiness with the status quo (Los et al., 2017[26]). Discontent is high in regions that have seen long-term economic decline and is particularly strong in former manufacturing regions that struggle unsuccessfully with industrial transitions (Becker, Fetzer and Novy, 2017[27]).

The challenge to respond to public discontent becomes clear when the effects of the financial crisis are considered. Figure 1.9 shows the time it took regional economies to recover from the effects of the financial crisis. In 2015, eight years after the crisis, a large number of regions had still not regained the per capita GDP levels they had before the start of the crisis. Notably, even countries such as the United States, whose aggregate per capita GDP levels recovered quickly from the crisis, had several regions where per capita GDP levels were still below pre-crisis levels after eight years.

Figure 1.9. Economic recovery after the financial crisis

Number of years that regional economies needed to reach their pre-crisis (2007) per capita GDP levels



Source: OECD (2018[8]), *Productivity and Jobs in a Globalised World: (How) Can All Regions Benefit?*, https://dx.doi.org/10.1787/9789264293137-en.

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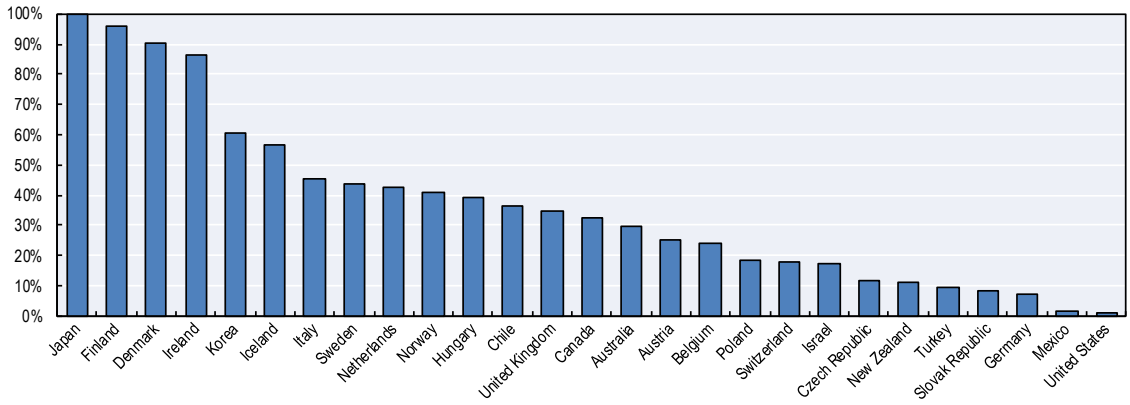
Public discontent in economically stagnating regions is reinforced by the contrast with economically successful, often urban, regions. In several OECD countries, the capital region (which is often home to a country's largest city) created more than 50% of all new net jobs. In most other countries, capital regions were responsible for at least 25% of new net jobs (Figure 1.10). Capital regions were also much less affected by job losses during and after the crisis. Ten OECD countries lost net jobs between 2006 and 2016. However, over the same time period, only three capital regions recorded net job losses.

Figure 1.10. Job creation in capital regions

Share of net job creation in capital regions relative to total job creation, TL2 regions, 2006-16

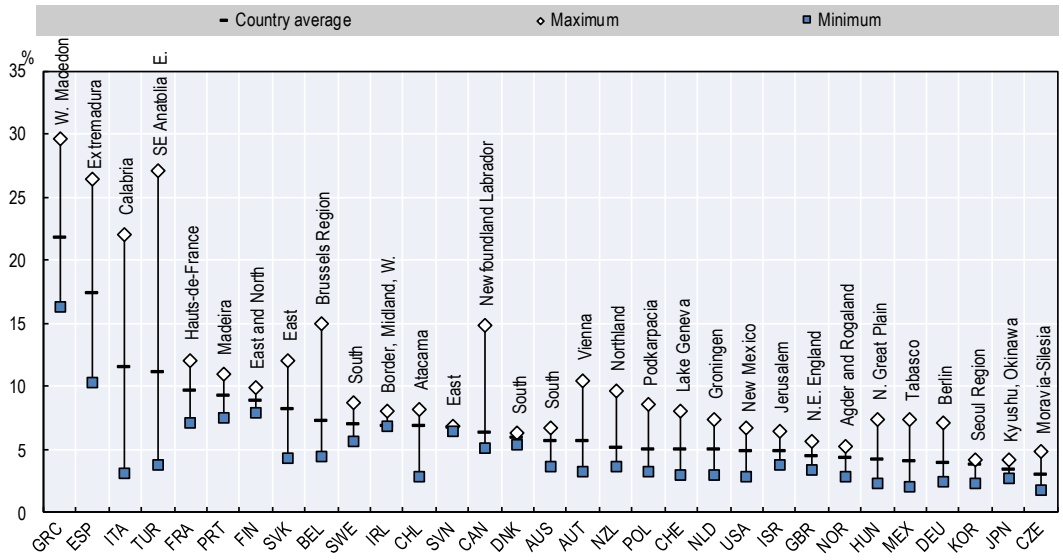


Notes: Capital regions in Portugal, Slovenia and Spain lost jobs over the 2006-16 period. Due to data availability, the values for Chile, Israel and Mexico cover the 2006-14 period.
Source: OECD (2018[28]), *Job Creation and Local Economic Development 2018: Preparing for the Future of Work*, https://dx.doi.org/10.1787/9789264305342-en.

StatLink https://doi.org/10.1787/888933922213

More generally, employment outcomes differ dramatically within countries. In Italy and Turkey, the highest regional unemployment rate is more than seven times higher than the lowest regional unemployment rate. In most other OECD countries, unemployment rates between the top and the bottom regions vary by a factor of at least two to three. Thus, there are sometimes dramatic differences in economic opportunities across regions within a country.

Figure 1.11. Regional unemployment rates, top and bottom region by country, 2017



Notes: The top diamond represents the region with the highest unemployment rate, the bottom square corresponds to the region with the lowest unemployment rate in the country. The horizontal bar shows the national average.
Source: OECD (2018[28]), *Job Creation and Local Economic Development 2018: Preparing for the Future of Work*, https://dx.doi.org/10.1787/9789264305342-en.

StatLink https://doi.org/10.1787/888933922232

Yet, among social scientists, there is a growing debate to what extent economic factors alone can explain the degree of discontent. There is evidence that cultural factors, and in particular a backlash against a changing cultural consensus, also play an important role in explaining the geography of discontent.

The cultural dimension of the geography of discontent is not necessarily identical to the economic dimension. Goodhart (2017[30]) distinguishes two stylised groups of people: those who have built portable identities that allow them to thrive socially and economically in various places and those whose identity is rooted in a particular place. Whereas the former group tends to be comfortable with cultural change, the latter is more resistant to change. In many respects, this divide corresponds to the divide between economically successful cosmopolitan-minded groups in cities and localist-minded population in economically struggling regions.

Gordon (2018[31]) argues that individual attitudinal factors are more important than personal economic conditions in explaining geographical patterns of discontent. He shows that there are pronounced regional patterns in the distribution of attitudinal factors that explain the geography of discontent. Rodriguez-Pose (2018[9]) makes a related point by arguing that inter-regional inequality is much more important in explaining discontent than inter-personal inequality. Where these economic patterns of inter-regional inequality overlap with the above-mentioned cultural and attitudinal factors, feelings of economic neglect and cultural concerns reinforce each other up to the point where large shares of the population reject the dominant political consensus.

Considering the cultural dimension of the geography of discontent together with its economic dimension is important for policy makers. It provides an argument against a

regional development policy based only on persistent cross-regional subsidies to residents. Increasing living standards through transfers can address the material needs in struggling regions, but it will not change the perception of cultural loss in communities where work has been a source of pride and cultural identity (Ulrich-Schad and Duncan, 2018[33]). Furthermore, persistent transfers also threaten to increase the cultural divide within countries by negatively affecting public opinion towards struggling regions in regions that are net contributors.

Cultural and social factors are also a reason why a sole focus on increasing labour mobility will not be sufficient to address the geography of discontent. Many people in economically struggling regions are rooted in their local community and prefer to stay even if this brings economic disadvantages. As highlighted by Cass (2018[34]), historically a majority of the population stays even in severely depressed regions instead of migrating to regions with better opportunities. Moreover, an element of the geography of discontent is the rejection of an urban/cosmopolitan lifestyle that has become a culturally dominant narrative in many OECD countries in recent decades. Social groups that define themselves partly through this rejection will not be enticed to move to economically successful cities by small reductions in barriers to labour mobility.

Policies to address the geography of discontent

The geography of discontent is a symptom of an underlying policy failure. Too many regions are left behind by policies that are not adequate for their situation. Only if policy makers address this fundamental issue will they be able to deal with the cause behind the geography of discontent.

To address geographical patterns of discontent, a place-based policy for economic development is thus indispensable. Residents in all regions must have the possibility to contribute productively to society. While economic change is unavoidable, it is important to manage it in order not to overwhelm the societal capacity for change, nor to create persistent regional disparities that spur resentment. Appropriate public policies need to combine a mix of policies to do so. They need to involve measures to facilitate labour mobility for those who are willing to move, but also include the provision of economic opportunities for those who are not able to move. As discussed in the previous section, this requires complementing structural policies with place-based policies that generate economic development at the regional level.

Many successful place-based policies build on the existing strengths of a region, which are often influenced by its industrial history. Such policies have the dual advantage that they not only provide a strategy for economic development, they are also aligned with a cultural desire for continuity because they follow an evolutionary model of economic development in which the future strengths of a region are built from today's assets. Existing skills within the population are valorised and economic traditions are updated or reinvented instead of disappearing completely.

Without a change towards policies that are more sensitive to regional conditions, regional disparities will most likely only get worse. The subsequent chapters show that global megatrends related to new technologies will increase the importance of knowledge-intensive services that are predominantly located in cities. In contrast, jobs in regions with low productivity levels will be threatened by automation. However, the subsequent chapters show that new technologies also offer opportunities to overcome many of the challenges that regions are currently facing. Yet, the potential benefits of new technologies

will not materialise automatically. It will require policies that link the specific problems within a region with its potential solution.

Thus, inaction is not an option. Without changing course, regional imbalances will grow and public discontent will get worse. The sooner policy makers act, the easier it will be to prevent increasing regional inequality. When a new economic shock, either from automation or from a cyclical downturn, will hit regions, it will be those with the lowest productivity that will fare the worst. By postponing action today, it will be even harder to address the geography of discontent in the future.

Notes

1. Market services are defined as those services produced for sale on the market at a price intended to cover production costs and to provide a profit for the producer.
2. Territorial Level 2 are larger regions that correspond tin most cases to the principal subnational unit of government (states or provinces).
3. A large part of the proliferation of regional trade agreements since the 1990s has been agreements between developing economies rather than between developed or developed and developing economies. Calculations based on World Trade Organization, "RTAs in force and inactive, 1948-2018", *Regional Trade Agreements Information System* (database), https://rtais.wto.org/UI/charts.aspx (accessed 21 November 2018).
4. OECD (2019), "Regional Innovation", *OECD Regional Statistics* (database), https://doi.org/10.1787/1c89e05a-en.
5. Remarks by the OECD Secretary-General Angel Gurría on "Challenges and Solutions for Globalisation" (Beijing, People's Republic of China, 12 September 2017).

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Chapter 2. Adapting regional development policy to future megatrends

This chapter presents an overview of some of the most important megatrends that will affect regional policies over the coming years. It describes how these trends are felt today and how they are likely to evolve in the future. Based on this analysis, the chapter proposes strategies to adapt the policy-making process to future-proof regional policies. It focuses on the question of how to strengthen governance systems to take coming trends into account.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

A rapidly changing world requires constant reforms to keep public policy up-to-date. While change is not a new phenomenon, its pace is accelerating in many important dimensions. Several emerging global megatrends will have substantial implications for economies and societies across the OECD. New technologies are introduced and adopted rapidly and transform how people live and work. Climate change is likely to intensify and population ageing is starting to be felt in many places. All these changes require policy responses to ensure that the opportunities they present are used and their downsides mitigated. Policy makers will need to adjust and reform established policies more and more quickly to keep pace with these emerging megatrends.

Regional imbalances in economic development have received considerable attention. While many factors cause regional economies to diverge, global megatrends of recent decades have been one important factor. Regional economies have been affected by globalisation and the shift from manufacturing to service sector activities. Regions that adapted well to these changes have been economically successful, whereas those that struggle to adapt lag behind. This chapter shows that future megatrends are just as likely to affect regional development, potentially with even more severe effects. They will provide opportunities to regions that adapt well, but present severe threats to those that cannot adjust.

This chapter presents an overview of some of the most important megatrends that will affect regional policies over the coming years. It describes how these trends are felt today and how they are likely to evolve in the future. Based on this analysis, the chapter proposes strategies to adapt the policy-making process to future-proof regional policies. It focuses on the question of how to strengthen governance systems to take coming trends into account. It does not discuss policy responses to individual megatrends, which will be discussed in detail in Chapters 3 and 4 of this report. These chapters also contain a more detailed discussion of the megatrends that are mentioned throughout this chapter.

Different dimensions of global megatrends

Many global megatrends have been discussed extensively in the public debate. Automation, climate change and ageing are all topics that receive considerable attention in the academic literature as well as in policy debates. There is little disagreement that these factors will have significant effects on national economies and the well-being of people.

The 2019 *Regional Outlook* puts a special focus on an aspect that has been much less frequently discussed: the regional dimension of global megatrends. Many global megatrends will not affect countries uniformly. On the contrary, it is rare that any trend has identical effects across all regions of a country, let alone across the globe. Even trends that do not seem to have an intrinsic regional dimension produce regionally differentiated outcomes when they interact with regional circumstances. For example, while many new technologies become available simultaneously throughout a country, the way these technologies are used can vary substantially between rural and urban areas. As a consequence, policy responses need to be adapted to regional circumstances and co-ordinated across all levels of government.

Box 2.1. The objectives and limitations of this report

This report has the objective to help policy makers to prepare for policy challenges that lie ahead and be ready to act when necessary. It discusses likely future megatrends that have a strong subnational dimension and therefore require responses from all levels of government. The report highlights the most important megatrends with regional dimensions that are currently ongoing or emerging. It develops the key implications for regional policy and presents policy recommendations for the scenarios it discusses.

Large parts of Chapters 3, 4 and 5 concern future developments. These chapters, however, are not an attempt to predict the future. It is likely that some megatrends discussed in this report will unfold in a fundamentally different way than expected. Throughout the report, potential future scenarios are mentioned. Policy makers should not take the scenarios as blueprints on which to base policies.

All scenarios presented in this report are based on an assessment of the academic and policy debate. The accuracy of these assessments varies as features of some megatrends are easier to foresee than others. As a consequence, some assessments are likely to remain valid for many years, whereas others will be outdated sooner. For example, it is possible, with relatively high accuracy, to predict demographic trends over one or two decades, but any prediction of the precise nature of technological change over the same time period will be much less accurate. Therefore, the analysis of the effects of technological change will have to be updated within a few years as new information on technological trajectories becomes available.

Even if some of the megatrends discussed in this report will look fundamentally different than expected, it does not invalidate the importance of discussing them today. For all scenarios discussed in this report, there are experts who consider it highly likely that the scenarios will come to pass. Given the potentially drastic consequences of many of the scenarios, policy makers should start preparing for them today despite the uncertainty around them. It is always preferable to plan ahead for a scenario that does not happen than to be unprepared in case it does happen after all.

The regional dimension needs to be at the forefront of policy making when addressing megatrends

The need to develop place-based responses to global megatrends becomes apparent when their region-specific effects are considered. Climate change is an example of a megatrend whose effects vary strongly from region to region (see Chapter 4). In some regions, the most urgent consequences will be increasing hazards for people's health and safety that need to be addressed by policy makers. Many cities can expect more frequent and more severe heatwaves, which increase health risks for vulnerable population groups that do not have access to air conditioning. In other cases, the economic consequences of climate change will play a large role. For instance, regions whose economy is based on winter tourism might experience serious economic disruption from warmer winters with less snow. In other regions, the preservation of fragile habitats and the threat of loss of biodiversity might

be the main concern. Lastly, in some regions, all three elements can be a serious concern. For example, low-lying coastal regions can expect more frequent flooding that puts lives at risk, creates significant economic damage and destroys vulnerable habitats.

Other megatrends will have similarly diverse effects across regions. OECD (2018[28]) shows that the number of jobs that are at high risk of automation varies strongly from region to region. In many countries, more exposed regions have 50% more jobs at high risk of automation than less exposed regions. In a few countries, the difference is even close to 100%. Thus, the economic challenges from automation will have fundamentally different magnitudes across regions and policies need to be adjusted accordingly.

Too often, national or global trends are generalised with little regard for actual trends at the regional level. For example, urbanisation is a major global trend and ongoing population flows into cities are common in most OECD countries. However, this general trend should not obscure the fact that 20% of urban areas in OECD countries shrunk in population size between 2000 and 2014. There is little reason to expect that this pattern will change in the future. National policies that are tailored only to growing cities will be inadequate for shrinking cities and could harm urban areas that are already struggling.

Considering regional differences is even more important when planning ahead. In hindsight, regionally differing trends are often obvious and it is clear that bespoke strategies would have been needed to respond to them. However, this is not the case when looking ahead. Using the above-mentioned example of urbanisation, it might not be obvious in the context of a fast urbanising country such as the People's Republic of China (hereafter "China") that shrinking cities could soon be common. However, it is likely that – once the urban population share in China has plateaued – similar population dynamics as in OECD countries set in and a significant minority of cities will start to loose population. In fact, evidence suggests that this process has already started (Long and Wu, 2016[36]). Understanding this scenario and being able to recognise the first signs of a long-term population decline could help cities to prevent costly policy mistakes, such as investments in unneeded infrastructure.

What changes are likely to come?

Coming megatrends with important implications for regional policy can be divided into three groups. First, technological change will affect regional economies profoundly. Its impact will be felt beyond the economy as many new technologies will be used in daily life. Adapting policies to these new technologies will necessitate reforms in a wide range of policy areas, including tax policies, labour market policies and regulatory policies. Given that many of these policies have an important regional dimension, it is no surprise that regional development policies will also be strongly affected. Second, demographic changes will affect most regions in OECD countries. A major demographic concern in many OECD countries is ageing, but regional demographic patterns are complex due to differences in birth rates as well as domestic and international migration. In almost all OECD countries, there are regions that are ageing and losing population and regions that are gaining new working-age residents. Often, the former regions are rural areas whereas the latter regions are large urban areas. Third, environmental changes are driven by the human impact on the natural environment. Climate change is the biggest concern, but other environmental changes have profound regional impacts, too. For example, the global acidification of oceans will affect coastal economies.

Technological change

The first major type of changes will stem from new and improving technologies. New technologies will not only affect the daily lives of people, but will also transform how regional economies operate. They will create important opportunities to make economies more productive and improve quality of life. However, many benefits of technologies do not emerge automatically, but require complementary policies, to ensure for instance, that people have the right skills to use the technologies. Furthermore, new technologies require adequate regulation to encourage their rapid diffusion and to limit their possible unintended negative consequences.

Compared to demographic and environmental changes, technological change can occur more rapidly and is therefore less predictable. For example, it took only a few years from the introduction of the smartphone to its widespread adoption. Applications based on smartphone technology gain popularity even faster, sometimes becoming widespread within a few months. While not every new technology will be adopted as fast as smartphones or smartphone applications, it is highly likely that digital technologies in particular – which have very low marginal costs of production and distribution – will continue to spread quickly.

Several technologies that have potentially large effects on regional economies and societies are currently in advanced stages of development or in early stages of market introduction. These include virtual and augmented reality techniques, additive manufacturing (3D printing), autonomous vehicles (self-driving cars), and unmanned aerial vehicles (drones) (OECD, 2016[37]). Furthermore, industrial robots will continue to gain importance in manufacturing processes. As the subsequent sections point out, these technologies will have greatly varying impacts across different regions.

Effective regulation of new technologies must address the fact that they will be used differently in different regions and will have different impacts depending on the regional environment. For example, camera-equipped drones to monitor crops on fields do not pose the same risks to safety and privacy as camera-equipped drones in urban areas. More generally, regulation needs to be sufficiently differentiated to be adequate for regional conditions, but needs to be sufficiently harmonised across regions in order not to create barriers to a widespread adoption of new technologies. This requires the devolution of some regulatory competencies to lower levels of government or alternatively, the inclusion of place-dependent provisions in national regulations, while ensuring ongoing co-ordination of regulation and preventing the overlap of regulatory functions across levels of government (Rodrigo, Allio and Andres-Amo, 2009[38]).

Besides regulating new technologies adequately, policy makers at all levels of government have to respond to the economic transformations that new technologies induce. In this context, technologies that allow the automation of tasks which are currently completed by people will be of particular importance. This includes autonomous vehicles and other technologies that have been mentioned above. However, the technology with the largest potential for automation is artificial intelligence (AI). If AI evolves as rapidly as predicted by some experts, it will completely revolutionise the economy by making humans redundant in a wide-range of jobs (Brynjolfsson, Rock and Syverson, 2017[39]). The consequences of this potential wave of automation and their regional implications are discussed in page 57.

Box 2.2. Blockchain technology for smart regional and local governments

Blockchain and distributed ledger technologies (DLTs) have the potential to transform the functioning of a wide range of industries. DLTs are one of the most disruptive innovations currently shaping the global economy, as they allow an immediate and secure digital transfer of value and ownership in total transparency within a network. Information stored on the public ledger is verified through a cryptographic consensus protocol pre-defined among a group of users, decentralising the decision power among all the nodes of the network. The technology has all the characteristics of a general-purpose technology, which means it is pervasive, improvable over time and able to open up the field for complementary innovations.

The advancement of DLTs constitutes an opportunity for regional and local governments. DLTs are still at an early stage of development, but in recent years blockchain projects have been launched or tested in relevant areas of subnational public administrations such as healthcare, education, secure identity management, shared mobility, energy, land and property registration, automated local tax payments, and water distribution (Grech and Camilleri, 2017[40]). The rate at which entrepreneurs and administrations are experimenting with this technology around the world suggests that it could become mainstream in many domains (Benna, 2018[41]).

Dubai's administration launched the Dubai Blockchain Strategy, partnering with IBM and Consensys, which aims at delivering "more seamless, safe, efficient and impactful city experiences" through blockchain-based applications and to transform the city into the first "blockchain powered government". To this end, the government created a USD 275 million start-up investment fund for blockchain proof of concepts and is working on putting government records on distributed ledgers. Blockchain technology implemented to handle visa applications, bill payments and licence renewals is expected to save up to 25.1 million hours of document processing time (Smart Dubai, 2018[42]).

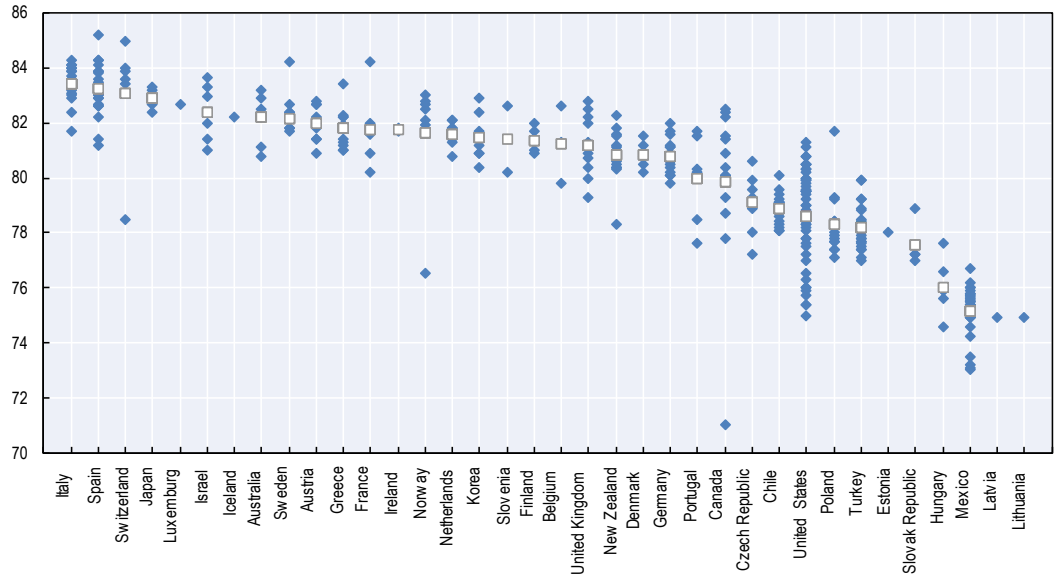
Another example is Singapore, which has been identified as one of the main cities in the world in terms of initial coin offerings and blockchain-related start-ups (Cohen, 2018[43]). Its GovTech office is exploring various blockchain use cases, the government is establishing a blockchain innovation centre, and the Monetary Authority of Singapore and the Singapore Exchange are looking at blockchain technology in order to create a secure platform for selling tokenized securities.

Demographic change

Rising life expectancy is one of the greatest achievements of human civilisation. Since 1970, life expectancy in OECD countries has increased on average by more than ten years and human welfare has improved drastically through longer and healthier lives (OECD, 2017[44]). Moreover, people who stay healthier for longer are able to contribute longer to society. Average life expectancy at birth in some OECD regions exceeds 84 years. Life expectancy at age 65 is even higher, implying that a large part of the population in OECD

countries can expect to live for more than 20 years after retiring. Yet, even though life expectancy has been rising almost everywhere, there is large variability across regions in many countries (Figure 2.1).

Figure 2.1. Life expectancy at birth in TL2 regions, 2016



Note: 2016 or latest available year: data for Australia are for 2015; data for Canada are for 2014, for Japan 2010; for Korea 2014; New Zealand for 2013; and for the United States for 2010.
Source: Calculations based on OECD (2019), *OECD Regional Statistics* (database), https://doi.org/10.1787/region-data-en.

StatLink https://doi.org/10.1787/888933922251

Rising life expectancy also creates new challenges, especially in regions with low birth rates or population outflows. These regions have to develop new models engaging older residents productively in the economy and helping them to age in place. Policy makers have to adjust services to the needs of an ageing and potentially declining population and compensate for declining tax revenues due to a lower share of economically active residents. Population flows create further challenges that need to be addressed. Regions that experience strong population outflows possibly in combination with low birth rates often struggle to ensure the continued provision of services. Furthermore, these regions have to deal with other challenges, such as preventing blight in neighbourhoods with significant population outflows. In contrast, regions with population inflows face the opposite challenges, including how to provide services to newcomers, how to build sufficient new housing and, if population growth is due to international migration, how to integrate new arrivals.

Demographic changes can be disaggregated into natural population changes and population changes due to domestic or international migration. In most OECD countries where natural population changes will play a major role, the main concern is low birth rates and population ageing. However, the trend is far from uniform. Some OECD countries, such as Israel, record high birth rates and natural population growth. Within countries, moreover, there can be significant variation in fertility rates across regions. For example, in the

United States, fertility rates across different states varied between 1.54 in Rhode Island and 2.26 in South Dakota in 2016 (Martin et al., 2018[45]).

Population flows in OECD countries are often driven by economic opportunities (Chapter 4). People will continue to move from regions with weak economic prospects to economically successful regions. Since it is mostly young people that relocate, this trend will have consequences on the age distribution. By 2050, the share of people aged 65 or older is projected to be 8% higher in European regions whose per capita gross domestic product (GDP) is in the bottom 25% of their country than in regions whose per capita GDP is in the top 25% of their country.

Even though demographic change tends to evolve slowly over decades, recent developments are not always good guides for future changes. Some countries that experienced very little population decline in recent years are likely to experience significant population decline over the coming decades. In the Netherlands and Germany, well below 10% of all regions experienced population declines during the period 2014-17.[1] However, population projections show that by 2050, 55% and 79%, respectively, of regions in those two countries are projected to have a lower population than in 2014 (Eurostat, 2016[46]).

Environmental change

Environmental changes will be among the most important trends over the coming decades. The overarching concern in this respect is climate change, but other developments such as a loss of biodiversity or pollution are also highly important in some regional contexts. Environmental changes stand out from other megatrends discussed in this report because they are predominantly threats that have few upsides for humanity. Most other megatrends offer opportunities and challenges at the same time and it is the task of policy makers to ensure that the upsides dominate. In contrast, regional policy related to climate change mostly needs to focus on mitigation and adaptation in order to ensure that the consequences do not become too costly.

Without counteracting policies, global temperatures are likely to increase by more than 4°C by 2100 (IPCC, 2014[47]) (IPCC, 2018[48]). The consequences from such unchecked climate change will be dramatic. They will include extinction of up to 40% of terrestrial species and widespread food insecurity (OECD, 2012[49]). Extreme weather events and natural disasters will increase with corresponding human and monetary losses (IPCC, 2014[47]).

To avoid such catastrophic outcomes, regional and local governments have a series of important levers. Fifty-seven per cent of all public investment in OECD countries is undertaken by subnational levels of government (OECD, 2018[50]). Using this financial capacity to pursue climate-friendly investments is a key condition to limit global warming to 2°C. Investments into energy efficiency, renewable energy and sustainable transport need to be pursued at all levels of government (see also Chapter 4) (OECD, 2017[51]). Beyond dedicated investments in climate change mitigating infrastructure, climate considerations need to be mainstreamed into all investment decisions.

In addition to climate change mitigation at the regional level, regions will have to adapt to climate change. As highlighted in the introduction to this chapter, there is no single strategy for effective adaptation to climate change. The regional effects of climate change vary strongly across regions. Adaptation policies have to respond to the specific combination of threats that climate change poses to each region.

In order to take the right investment decisions for climate change mitigation and adaptation, a number of conditions have to be in place. Most fundamental are appropriate governance

arrangements to co-ordinate policies across levels of government and across neighbouring local governments. Furthermore, appropriate long-term planning processes have to be in place. For example, long-term land-use planning needs to ensure not only that infrastructure will have a low lifetime carbon footprint, but also that it is resilient to expected climate change (Chapter 4).

Automation will have important consequences for regional economies

Automation due to technological progress presents considerable opportunities and considerable challenges at the same time. On the one hand, continued technological progress and the resulting automation of economic activities is highly beneficial in many respects. Automation is a key driver for productivity growth, which is the most important long-term determinant of economic growth, and the most important source of long-term wage growth. Consumers benefit from automation because it reduces the prices of many goods and increases purchasing power. Thus, the benefits of automation can be felt by everybody.

On the other hand, automation has important downsides because it leads to job losses for some workers and can greatly disrupt the business models of firms. In aggregate, the downsides of automation are outweighed by its benefits. However, the negative consequences of automation are not evenly distributed across society: some social groups are more strongly affected than others. For many low-skilled manual workers, the downsides of automation may be felt more strongly than the benefits.

Automation not only affects social groups differently; it also has very different effects on different regions. In some regions, the share of jobs at high risk of automation is as low as 4% whereas in others it is close to 40% (OECD, 2018[28]). In regions where automation occurs gradually and continuously, it is an important source of productivity growth. In these regions, lost jobs are typically replaced with new ones that have been created by firms that become more competitive due to higher productivity. However, in regions where automation occurs rapidly and is unevenly spread across firms, the downsides can outweigh the benefits. In these regions, lost jobs can often not be replaced quickly enough, leading to high unemployment. Likewise, more firms may go out of businesses than are replaced by new start-ups, leading to a deterioration of the overall business environment in the region.

Policies to ensure that automation is beneficial for regions need to be place-based. They have to encourage ongoing innovation within the region to facilitate gradual automation and productivity growth and pre-empt disruptive changes with negative effects. To do so, policies have to be tailored to the specific strengths and weaknesses of a region, for example taking into account its sectoral composition; skill levels in the workforce; relations between public actors, businesses and research institutions; as well as its geographical location.

The effects of automation can be felt today, but they are likely to increase in the future. Furthermore, potentially rapid automation creates two risks. First, if technological progress leads to the rapid automation of many jobs, there is a risk that lost jobs cannot be replaced quickly enough with new jobs. Second, there is often a gap in the skills profile between jobs lost due to automation and newly created jobs. Thus, there is a risk that rapid automation leads to high unemployment during long transition periods. Some estimates suggest that close to 50% of jobs are at a high risk of automation (Frey and Osborne, 2013[52]). Recent OECD work puts the number of jobs at high risk of automation at 14% (Nedelkoska and Quintini, 2018[53]). These aggregate numbers hide significant subnational

variation. As highlighted above, the number of jobs at high risk of automation varies by a factor of ten between the least and most affected regions within OECD countries.

Unemployment is not the only consequence of automation that threatens to increase inequality. There is also a risk that technological progress will supress wages for large parts of the population. Technological progress not only increases the number of tasks that can be completed by machines, it also reduces the costs of these machines. Thus, the substitutability between human labour and machine labour will increase, while the marginal costs of machine labour will decrease. In other words, human workers will compete increasingly with machines for jobs, but machines will become cheaper over time (OECD, 2018[54]). For example, an accountant whose current competitive advantage is that he or she lives within driving distance of a commercial hub, will increasingly have to compete with accounts around the world, who will be able to communicate and interact efficiently from distant locations through telepresence technologies (Baldwin, 2019[55]). Or else, an account whose primary competitive advantage is the ability to detect complex patterns in financial data, will have to compete with machine-learning software that is potentially cheaper (ibid.).

Machines are not only becoming better at doing tasks that only humans could do previously, they are also becoming cheaper. Thus, even if machines could not become better in doing human tasks, they would be used more simply because they become cheaper. This twofold competition from machines will not only put downward pressure on wages in jobs where machine labour is a direct substitute for human labour; it will also put pressure on wages in all sectors where workers have similar skills. This trend is already observable. Median wage growth has been lower than productivity growth since 1995. As a consequence, the labour share (i.e. the share of net national income that is received as labour compensation) has declined by 3.5 percentage points, from 71.5% to 68% (OECD, 2018[54]).

The decline in labour share is partly due to the emergence of new dominant firms at the technological frontier that are highly capital-intensive and have low labour shares. As will be discussed in the following sections, new digital technologies are likely to increase the importance of such firms and put further pressure on the labour share.

The information and communications (ICT) sector stands out from other sectors because markets in it tend to be dominated by a few highly productive firms, which can distribute their products globally at very low marginal costs. Thus, the most productive firms that develop the best product tend to capture a large market share. In addition, network effects and economies of scale can lead to natural monopolies (OECD, 2017[56]). To ensure ongoing competition and prevent a loss of consumer welfare, competition policy needs to prevent the emergence of such monopolies.

In recent years, in particular the importance of owning data has been highlighted as an important reason for the emergence of natural monopolies. Many recent products and algorithms in the ICT sector rely on large volumes of data for their development, and their refinement increases with greater data availability. This creates a self-perpetuating advantage for dominant firms that can collect more data from their users than competitors with a smaller user base (Furman and Seamans, 2018[57]).

Artificial intelligence could be a key technology in the future

In the future, the importance of digitalisation will increase, even though the magnitude and speed of this increase is subject to debate. A decisive factor in determining the importance of the digital economy will be the role of artificial intelligence.

The term artificial intelligence describes a set of technologies that allow machines to mimic cognitive functions. Currently, the technology is used in a wide range of contexts, but mostly for selective applications such as pattern recognition. Nevertheless, many economists and computer scientists predict that it will soon become a general-purpose technology (Klinger, Mateos-Garcia and Stathoulopoulos, 2018[58]) (Brynjolfsson, Rock and Syverson, 2017[39]). If this will be case, AI could have considerable economic consequences.

A general-purpose technology is a technology with a range of characteristics which makes it particularly well-placed to generate longer term productivity increases and economic growth across a range of industries (OECD, 2010, p. 7[59]). In other words, a general-purpose technology is a technology, such as the wheel or electricity generation, that in itself forms the basis for new technologies. By enabling a large number of subsequent innovations in diverse areas, general-purpose technologies are highly disruptive for the entire economy.

Some of the technologies that artificial intelligence will enable have already emerged. For example, image recognition is well advanced. Error rates are approximately at human levels and improving fast. While image recognition does not necessarily appear to be a key technology, it has important implications. Among them are self-driving cars that can identify images of their surroundings from cameras, radar and LIDAR,[2] and respond appropriately (Brynjolfsson, Rock and Syverson, 2017[39]). Self-driving cars technology will trigger large productivity gains in the transport sector and will affect many important aspects related to the functioning of cities (Chapter 3). However, if AI becomes a general-purpose technology, self-driving cars would be just one of many future innovations that are based on the technology. A wide range of further technologies, many of which are not yet imagined, could also be based on it.

If artificial intelligence becomes a general-purpose technology, it will change the economy profoundly. It would lead to an increased risk of unemployment because of automation and would put downward pressure on wages for a broad share of the population. Moreover, a large share of the value added would be derived from the algorithms behind the technology. Since these are likely to be owned by a limited number of companies for the above-mentioned reasons, economic concentration could increase unless counteracting policies are implemented.

At this point, there is no consensus that AI will become a general-purpose technology. While many experts expect AI to have dramatic effects, others doubt that the technology in its current form has the potential to be used beyond specific applications. Sceptical economists, for instance, raise the question of why AI has not led to measurable productivity growth despite its enormous progress in recent years (Furman and Seamans, 2018[57]). A growing number of computer scientists and engineers directly involved in developing AI argue that the current technology faces inherent limitations that restrict its applications. They predict that such limitations cannot be overcome by an evolution of current technologies. Instead, continued progress would require a fundamental redesign of basic methods. As of today, it is unclear if and how fast these methods can be developed (Marcus, 2018[60]).

Rapid, widespread adoption of artificial intelligence would pose severe challenges for many regions

For individual regions, the consequences of the emergence of AI as a general-purpose technology could be even more dramatic than for countries. Under a scenario of a rapid adoption of AI, a number of compounding factors would affect regional economies and the capacity of many regions to respond to it.

First, regions would be affected by job losses of varying magnitudes. OECD (2018[28]) shows that there are significant differences in the share of jobs at risk of automation across regions. If AI is rapidly adopted in many economic sectors over the coming years, it is likely that most of the jobs currently considered at risk of automation would be lost quickly. Given that today's projections of jobs at risk of automation are based on the most likely evolution of artificial intelligence, a more rapid spread of the technology would probably lead to even greater job losses. Thus, it is particularly important for regions with a high share of jobs at risk of automation to track the evolution of AI to be aware of the potential risks from it.

Second, the creation and provision of AI algorithms would most likely capture a significant share of value added. This would come at the expense of more traditional economic activities such as manufacturing, but could also affect other activities such as the provision of intellectual services. For example, already today, some back office legal services are being replaced by artificial intelligence algorithms (Barton, 2016[61]). This will harm regions that have a strong base in these activities without corresponding strengths in ICT development related to them. It would also affect the tax revenues of regional and local governments that rely on business taxes by affecting the profits of firms in those sectors.

Third, the shift in value-added creation could severely disrupt the business models of many firms to the point that they go out of business. This would lead to increased unemployment even among workers whose jobs are not directly affected by automation. Furthermore, it would have important feedback effects for suppliers of those firms. Since these are frequently based in the same region, the disruptive effects on regional economies would go beyond the firms directly affected by the emergence of AI.

Fourth, AI that disrupts existing modes of production will reshape global value chains. At this point in time, any detailed prediction of how global value chains will evolve if artificial intelligence becomes a general-purpose technology is impossible. However, it is likely that regions relying on the provision of cheap labour for their position within global value chains will be most profoundly affected. One of the consequences of AI is that human labour will decline in relative importance in the production process. Any competitive advantage due to cheap labour costs will be less important if automation becomes more relevant. Thus, it seems likely that firms will base their location decisions less on the availability of cheap labour and more on other factors, such as market access. This could have profound consequences, for example, for regions in Latin America that currently rely on cheap labour as their comparative advantage.

Without counteracting policy measures, the consequences of a rapid, widespread adoption of AI could be a further polarisation between few regions that dominate the technological frontier in the field and a large number of regions that would struggle to keep pace economically. Klinger, Mateos-Garcia and Stathoulopoulos (2018[58]) find that already today research activity on AI is clustered in a few locations. Furthermore, the regional distribution of activity has become more stable since 2012. Thus, AI seems to follow a trajectory that is similar to other ICT technologies, which are also heavily concentrated in a few regions.

For regional development policy, a rapid transition to AI will create significant challenges even in regions where the benefits dominate. Regions would have to respond to the above-mentioned consequences of the (potentially disruptive) economic transition that a shift to artificial intelligence entails. This will require a variety of measures, including retraining programmes for laid-off workers and capacity-building programmes for firms to adjust to the new market environment (OECD, 2018[8]). These programmes need to be tailored to

regional and local conditions instead of following national blueprints. For example, a region in Latin America that relies on its integration in a global value chain of a car manufacturer needs other policies than a region in East Asia that has an absolute advantage in manufacturing consumer electronics.

Global megatrends will be felt differently in urban and rural areas

The most important characteristic that determines how megatrends will affect a region is the region's degree of urbanisation. Economic trends, new technologies as well as demographic and environmental changes will affect urban and rural regions in fundamentally different ways. Partly, this is because some trends will have very different characteristics in urban and rural areas. For example, most urban areas are likely to experience population inflows, whereas many rural areas are losing residents. Partly, it is because the same trend will have very different consequences in the two types of regions. A new technology such as autonomous vehicles will lead to very different outcomes in urban and rural areas even though the underlying technology will be identical. For example, urban areas face a much more severe threat from increasing congestion due to autonomous vehicles than rural areas.

The subsequent sections discuss how coming megatrends will be felt differently in urban and rural regions. However, it is important to keep in mind that there are few regions in OECD countries that are entirely urban or entirely rural. Most regions contain a mix of urban and rural areas in varying proportions. Thus, most regions will face some of the challenges and opportunities that global megatrends will pose to urban areas, just as they will face some of the challenges and opportunities that global megatrends will pose to rural areas. Furthermore, urban and rural regions do not form uniform categories. Within each class of regions, there are large variations in important dimensions, such as human capital levels, geographic location, and importantly the quality of its administration and leadership. These factors will have important influences on how regions will be affected by future developments.

How coming megatrends will affect urban areas

Cities are well-placed to benefit from future trends. They are likely to reap the largest economic benefits from new technologies that will further increase the importance of the knowledge-based service economy. Cities could also see significant improvements in quality of life due to new technologies that improve public service delivery and mitigate the negative externalities from high population densities. Last, but not least, many cities will continue to have economically favourable demographic profiles because they will continue to attract young and well-educated residents.

Yet, none of the potential benefits will accrue automatically and not all cities will benefit from them. The high density of people and economic activity in cities provides a comparative advantage in knowledge-intensive activities. Cities offer the frequent face-to-face interactions and create the knowledge spillovers that are indispensable for these activities (OECD, 2015[62]). Consequently, the concentration of knowledge-intensive services in cities is a universal pattern across OECD countries (OECD, 2018[8]). If the importance of these activities increases, cities will be the main beneficiary. However, it is unclear if newly emerging knowledge-intensive activities will be located in all cities or clustered in a few cities. As discussed above, already today there is a strong clustering of firms working on artificial intelligence in a few cities. The more strongly value creation in the future will rely on this technology (or any other single technology), the more likely it is that the economic benefits will be clustered in a few places.

Even cities that will benefit economically the most from coming megatrends will face serious challenges. A key task for them will be to avoid becoming a victim of their own success and ensure that all residents benefit from their prosperity. Unequal income distributions combined with high costs of living can make it more and more difficult for low- and middle-income households to live in economically successful cities. (OECD, 2016[63]). For example, median house prices in San Francisco exceeded USD 1.6 million in 2018 (Paragon Real Estate, 2018[64]). At these levels, adequate housing is becoming increasingly unaffordable even for upper middle-class households and is far out of reach for low-income households.

A related risk for successful cities is income segregation. Wealthier cities tend to be more segregated by income than less wealthy cities. Cities in the highest income quartile have an approximately 25% higher degree of segregation than cities in the lowest income quartile (OECD, 2018[65]). Recent seminal work by Chetty and Hendren (2018[66]) shows that such segregation has dramatic effects on the subsequent economic and social life outcomes of children growing up in disadvantaged neighbourhoods. As discussed above, technological change is likely to lead to increased labour market polarisation between a small group of highly qualified workers whose jobs cannot be automated and a larger group of less-skilled workers whose wages are suppressed due to competition from machines. In such a world, successful cities will have to increase their efforts to prevent social segregation from growing worse.

Beyond segregation, affordability, and in particular housing affordability, will continue to be a major challenge in many successful cities. Across the OECD, large urban areas have attracted population at a rate of approximately 0.9% per year since 2000 (OECD, 2018[67]). This population growth will likely continue for two reasons. First, job opportunities are likely to continue to shift towards knowledge-intensive services that are based in cities. Second, cities also host many low-skilled service jobs that provide alternative employment for workers who have been made redundant due to automation.

Currently, many cities build fewer housing units than needed for the new arrivals. To reduce market prices for housing, construction has to increase in economically successful cities. To allow low-skilled workers in the service sector to live in cities, it is furthermore important to provide sufficient affordable housing at below-market prices. Given that the urban core is largely built-up, such new housing construction has to occur through densification or – where further densification is not possible – in newly built neighbourhoods that offer good access to jobs.

Continued population growth in cities will lead to a further increase in the already high share of population in urban areas across the globe (see Chapter 4). This trend is most pronounced non-OECD countries. New OECD research indicates that in 2015, 54% of the world's population lived in functional urban areas with more than 50 000 inhabitants. The largest of those urban areas is Greater Tokyo in Japan with a population of 36 million, followed by Greater Jakarta with 29 million inhabitants and Kolkata in India with 27 million inhabitants. However, the country where urbanisation had arguably the most transformative impact is China. For example, within a 200-kilometre radius around Shanghai, there are 62 more functional urban areas with a total population of 48 million. Together with the inhabitants of Shanghai, they form an urban megaregion with a total of more than 72 million city dwellers. If these people made up a country within the OECD, it would be the sixth-largest OECD country by population.

However, it is important to emphasise that despite overall continuing urbanisation, not all cities will grow in the future. Demographic trends in cities tend to follow economic trends. Thus, cities that will struggle economically are likely to have stagnating or even declining population levels. These cities will face a fundamentally different set of challenges. They need to scale back public services to match lower population levels and tax revenues without sacrificing quality. Cities that are affected by significant population loss have to reconvert developed land into undeveloped land to reduce costs for infrastructure maintenance and ensure the attractiveness of the urban fabric. These challenges are not a new phenomenon. Between 2000 and 2014, 38 out of 290 metropolitan areas in the OECD lost population (OECD, 2018[67]). Among urban areas of all sizes, the share of cities with shrinking population reaches 20%. To develop adequate policy responses, it is important that these population declines are anticipated through realistic population projections.

It is not only economic and demographic trends that will shape cities over the coming years. Cities will also be affected by new technologies that will profoundly alter the day-to-day lives of their residents. Many technologies have the potential to improve quality of life for residents and make cities more efficient. However, few technologies will have this effect in the absence of any government intervention. Effective regulations are key to ensuring that new technologies improve well-being in cities.

The most impactful technological development for day-to-day life in cities in the intermediate future will arguably be the emergence of self-driving vehicles (see Chapter 3). This technology will transform urban mobility patterns and will reshape how cities look. It will make commuting much more convenient than today, drastically increase mobility for residents who cannot use cars today and free up large amounts of public space that is currently used for parking. However, without guiding policy interventions, it is likely that the technology will have important downsides that could outweigh its benefits. Among the primary risks is an increase in congestion due to growing traffic as well as increasing suburban sprawl. Furthermore, many benefits will require accompanying government interventions to materialise. For example, autonomous vehicles will reduce the need for parking spaces. However, freed-up parking spaces will only be a benefit to cities if the space is put to uses that are socially beneficial.

From a public policy perspective, new technologies offer city governments the opportunity to become more efficient, more sustainable, more resilient and more responsive (see Chapter 3). The Internet of Things can help monitor natural resources consumption and improve management of resources within a systemic circular economy approach (see Chapter 4). New ICT systems make it possible to analyse information in real time. For example, cleaning agents can be deployed where the general public signals the need for it through dedicated smartphone apps. This enables the administration to respond more quickly to problems and at the same time use scarce resources where they are needed most. Smartphone technology can also be used to increase the resilience of cities. Early warning and information applications help cities to increase their disaster preparedness and can reduce the loss of lives in case of catastrophic events.

How new technologies will affect rural areas

Technological change presents a threat and an opportunity in equal measure to rural areas. On the one hand, rural areas will be threatened by an ongoing or even accelerating shift to the knowledge-based service economy described above. Rural areas rely to a much larger degree on extractive and manufacturing activities than more densely populated areas do (OECD, 2018[8]). Thus, any decline in the share of value-added obtained from these

activities will harm them disproportionally. On the other hand, many new technologies can help rural regions to overcome the economic challenges that they currently face. Thereby, they can mitigate the disadvantages from an accelerating shift towards economic activities that have traditionally been based in cities. If used well, these technologies have the potential to create new economic growth in rural areas and to improve quality of life for their residents.

The primary economic challenge of rural regions is low density. Within a given area, there are fewer customers, investors, competitors, potential employees, potential employers, experts, service providers and so on. As a consequence, people and goods in rural areas have to travel longer distances, which leads to several disadvantages for firms located there. First, transport costs are high and market potential is low. This makes it difficult to compete against firms that can produce higher volumes at more strategic locations located closer to customers. Second, it is more difficult for firms to find specialised expertise, either by hiring new staff or by employing external experts. Third, the spread of new ideas and innovation that leads to agglomeration economies in cities typically takes place at a lower rate in rural areas.

Many new technologies that may emerge in the near future can help to alleviate these disadvantages. Two technologies in particular are likely to alleviate the disadvantage from long distances that are related to shipping goods. Autonomous vehicles will reduce transport costs and shipping times. Driverless trucks can run 24 hours a day and cover much larger distances than drivers who have to respect rest periods (see Chapter 3). They will not only be faster, but also cheaper than traditional trucks because of lower labour costs. Likewise, drones may soon ship small, but important, items such as spare parts or crucial components for just-in-time production (see Chapter 3). Just as driverless vehicles, this technology would increase delivery speeds and lower costs.

New communication technology is likely to overcome some of the challenges of rural areas. One of the earliest and most influential works of the Internet age was *Death of Distance* (Cairncross, 1997[68]). The key prediction of the book is the idea that the Internet and new communication technologies will lead to an economy in which location does not matter anymore. As is well-known by now, this prediction did not materialise. Even though better communication technology helped to overcome some of the effects of distance, it also increased the importance of knowledge-based clusters (Porter, 2000[69]). Arguably, the latter effect outweighed the distance-mitigating effects of new communication technology and led to an increased importance of location. However, further progress in communication technology offers the prospect to mitigate some of the effects of distance even if it is unlikely to completely reverse this picture. Emerging virtual reality technology could eventually be a close substitute for face-to-face business meetings (see Chapter 3). It also has the potential to further improve online education and distance learning.

3D printing can help small and medium-sized firms in rural areas that serve small markets. The technology has the potential to reduce economies of scale by making small-scale production more cost effective (see Chapter 3). Many mass production techniques require equipment such as moulds that can only be used to produce one specific type of good. Producing a different good in the same factory requires retooling, which can be slow and expensive. Thus, these production methods are only cheap if large volumes are produced. In contrast, 3D printers can produce many varieties of goods without the need for reconfiguration. They are especially beneficial to firms that produce small volumes, for example because they cater to small regional markets and are poorly placed to expand because of their geographic location.

Lastly, technology can make rural areas better places to live by improving service delivery (see Chapter 3). For example, autonomous school buses will make it easier for children to access schools. Telemedicine will improve the quality of medical service. Drone-based mail delivery might improve postal services. These developments will improve quality of life and can help to mitigate the population decline that many rural areas are facing (see Chapter 4)

Using opportunities will be crucial for the success of rural areas

The resulting picture for rural areas is mixed. The overarching trend to a knowledge-based service economy is likely to continue in the future. This will represent a challenge since knowledge-intensive services are predominantly located in urban areas. However, many emerging technologies have characteristics that make them especially valuable in rural contexts because they mitigate some of the disadvantages inherent to low densities and long distances.

Despite the advantages that new technologies offer, many regions are slow to take them up. This can be seen by the use of existing technologies. For example, ICT is used very effectively to provide remote schooling and telemedicine in some rural regions in the OECD (OECD, 2017[70]). Yet, although the underlying technologies are well-established, these methods are not used in many other regions where they could be highly beneficial. Thus, the constraining factor is not technological availability, but institutional factors such as awareness, administrative capacity and political will. For policy makers, the challenge is to ensure that the distance-mitigating possibilities of technology will be used. This will require large investments in technological infrastructure, but also in complementary policies such as education and skills training. Chapter 5 discusses how to finance these investments needs.

Megatrends will be shaped by policy

The discussion above has shown that few megatrends are unequivocally good or bad. Most offer opportunities, but also present risks. For example, automation has the potential to raise productivity and can make many jobs more pleasant by removing the need to do physically strenuous or repetitive tasks. At the same time, there is a risk that jobs will be destroyed more quickly through automation than can be replaced in other parts of the economy. As of today, it is unclear which effects will dominate and if new technologies will lead to widespread increases in prosperity or growing inequality. The broad range of possible scenarios for future trends is also reflected in polarised public opinion about many megatrends. A significant share of the public is anxious or very anxious about technological progress related to automation and artificial intelligence (McClure, 2018[71]). This contrasts with other population segments who eagerly await new technological developments.

It is not just the public that is split about the consequences of a megatrend. Expert opinions are often likewise polarised and tend to focus on either the positive or the negative dimension of a future megatrend. Some scholars expect automation to lead to jobless societies and high unemployment. Ford (2015[72]) is a prominent proponent of this theory. In contrast, others assume that technological progress and automation can drastically improve human welfare. A notable early example of such an optimistic view is Keynes (1930[73]), who argues that technological progress and automation would lead to 15-hour work weeks and a life free of material needs.

The one thing proponents of monochrome optimistic or pessimistic visions of coming megatrends often have in common is that they see them as deterministic developments that are guided by forces akin to laws of nature. According to this view, public policy can only intervene to mitigate the outcomes at the margins, but is unable to affect developments at a more fundamental level. However, this perspective tends to underestimate how external trends interact with institutions and how they can be shaped by public policies. Instead of operating in isolation, the functioning of markets fundamentally depends on the institutions and social norms that shape them (Polanyi, 1944[74]). How megatrends will play out will depend on how these institutions and social norms evolve and on the policies that are shaped by them.

In order to illustrate the practical implications of this theoretical argument, it is useful to analyse why Keynes (1930[73]) and Ford (2015[72]) come to fundamentally different conclusions about the likely effect of automation. Despite writing 85 years apart from each other, they do not differ much in their assessment of technological progress. Both authors expect that automation will drastically increase the output of an economy. At the same time, both authors also expect that automation will lead to a decrease in labour demand because jobs lost to automation will outweigh the newly created jobs. As a consequence, they expect labour supply to exceed labour demand permanently.

Keynes' (1930[73]) and Ford's (2015[72]) disagreement stems from their assessment of how labour market institutions will respond to this mismatch between labour demand and labour supply. While Keynes assumes that the remaining work will be distributed across workers, Ford argues that a lucky few will remain in full-time employment while the majority of workers will be unemployed. Yet, nothing in the nature of technological progress inherently predicts one or the other outcome. Ford admits that it is not a lack of skills that prevents a larger number of workers to participate in the labour market in his scenario. Instead, he argues that even if everybody was highly educated, only a few workers would have jobs.

The reasons for the presumed labour market responses are only briefly discussed by both authors even though they are a critical element in their predictions. Keynes (1930[73]) argues that automation will lead to a world in which all material needs will be satisfied and "we shall endeavour to spread the […] work there is still to be done among" all workers.[3] In contrast, (Ford, 2015, p. 252[72]) claims as justification for his winner-takes-all argument that "historically, the job market has always looked like a pyramid".

Despite being considered a direct consequence of future automation, neither of the two contrasting outcomes is inevitable. Whether a world with shrinking labour demand due to automation will lead to a 15-hour work week or to a permanently unemployed underclass or to a completely different outcome depends on the collective choices made by a society. Policy choices, institutions and individual preferences are all important factors that determine the consequences of automation.

Policy makers play a central role shaping the responses to automation and other megatrends. Doing so will not always be easy. Some of the changes to the way that regional economies and societies operate will be enormous. Ensuring that technological progress will enhance overall well-being and does not lead to rising inequality will require policy responses that can seem radical. Today's tax policies, regulatory policies and also governance arrangements have been designed with respect to how economies and societies have operated in the past. Some of them will need to be fundamentally overhauled to make them fit for the future.

For regional policy, this implies that many of its current pillars have to be reconsidered. This ranges from the economic development policy of countries to their system of multi-level governance. In some instances, unprecedented decentralisation could be required to empower regions to respond adequately to the challenges that they are facing. In others, greater centralisation may be needed, for example to develop more effective fiscal equalisation mechanisms. Both types of decisions tend to be politically difficult and have far-reaching implications. Yet, policy makers should not shy away from them if they seek to ensure future prosperity in all regions.

Innovative governance to address megatrends

Long-term planning, projections and other foresight methods are important tools to future-proofing regional policy making. However, they will fall short if the insights generated through them are not translated into policies. Adequate governance mechanisms are therefore important in order to design and implement policies in response to challenges that have been identified in foresight exercises. Such governance mechanisms have to evolve together with the challenges that they seek to address. This section presents pathways to adapt the governance of regional development policy to future megatrends.

As argued above, governments can play a leading role in addressing challenges associated with globalisation, climate change or disruptive technologies, rather than being side-lined by them. This requires the public sector to become more agile, experimental and innovative, especially at the regional and local levels. In this rapidly changing world, fixed rules of governance written by a hierarchical authority (e.g. "command and control" regulation) are quickly rendered obsolete on the ground. Policy makers need to act as front-line actors to find joint solutions to common problems through experimental trial and error processes (Morgan, 2018, forthcoming[76]). Several tools can strengthen governance frameworks and make them fit to deal with future megatrends. They are discussed in more detail in Chapter 5.

Governance arrangements across countries, but also within countries, differ greatly from each other. Within many countries, subnational governments have varying degrees of autonomy, attributed responsibilities and administrative capacity. Many of the megatrends discussed above will further increase the need for differentiated governance arrangements. Yet, it is often not clear *a priori* which governance models are appropriate for local or regional circumstances.

Experimental governance can help to develop better models of governance through trial-and-error processes. By giving local and regional governments space to experiment, new solutions can be tested in a limited environment. If they turn out to be successful, they can be adopted more broadly. Ideally, such trials are accompanied by monitoring and evaluation processes that make it possible to identify the underlying causes for success or failure in order to maximise the learning potential from experiments.

Governance mechanisms that take behavioural insights into account are an important specific class of experimental governance. The use of behavioural insights for policy design is becoming more and more common in many OECD countries. Such policies integrate insights into how citizens behave in real-world settings, rather than relying solely on the predictions of traditional economic models based on assumptions of rational behaviour. Considering behavioural responses in policy design can help to bridge the gap between policy objectives and ultimate outcomes.

Behavioural insights can also be applied to the design of governance mechanisms and to the structure of organisations. For example, in the design of regional development policy frameworks, it is important to consider that many factors influence the actions of policy makers and policy implementers beyond what traditional models of rational behaviour can predict. Anticipating this and adjusting the framework accordingly can increase its effectiveness.

Innovative governance makes use of new technologies. New technologies provide the opportunity for governments to become more responsive, to use resources more efficiently and to streamline administrative processes. For example, the growing use of Geographical Information Systems (GIS) at the local level can help municipal governments to better allocate resources across their territory. By mapping maintenance needs or the incidence of crime, maintenance crews and police officers can be more effectively distributed throughout the territory.

A greater use of digital technology can also improve interactions between governments and citizens. Providing administrative services on line increases the convenience for citizens and can improve the efficiency of administrative processes. Furthermore, online tools allow citizens to provide immediate feedback to governments. For example, many cities have started to introduce smartphone applications that allow citizens to notify the local administration about irregularities in the public space, such as uncollected rubbish, broken street lighting or other defects in public infrastructure.

Digital technology can also enhance public participation in the decision-making process. For example, public consultations in the planning process can reach a broader audience if the possibility exists to provide feedback online instead of in hearings only. Governments also use online voting procedures to obtain feedback on proposals or prioritise spending through citizen budgeting processes.

New technologies will present further opportunities. Big data analysis will allow governments to use the vast amount of data that is constantly generated in cities. Currently, much of the data produced by cities are not analysed because the amounts of data are too vast to handle and often owned by private companies. While some of the required technology for real-time big data analysis already exists today, many applications still have to be developed.

New technologies will require reforms to subnational finance

The emergence of new technologies will affect the tax base of regional and local governments. The effects discussed above would change the distribution of labour income and affect the valuation of capital. If automation leads to growing wage inequality, income taxation will have to be adjusted to mitigate inequality and ensure sufficient revenue collection. Influential actors, such as Bill Gates, have even called for the introduction of a robot tax to slow down automation (Delaney, 2017[77]). Furthermore, many other taxes will be affected by technological change. For example, once electric vehicles become widespread, receipts from petrol taxes will decline. However, new sources of regional and local transport taxes may emerge due to the introduction of autonomous vehicles and the associated need to control traffic flows through new taxes.

If value creation becomes more concentrated in a few regions, tax revenues from business taxes and income taxes will likely undergo a similar concentration. Several steps can be taken to counteract this effect. Taxation can be shifted to tax bases that have less regional variation. Furthermore, vertical and horizontal equalisation mechanisms across regions will become increasingly important. These mechanisms can ensure that total per capita revenues

of regional governments within the same country do not diverge too much from each other. They are discussed in more detail in Chapter 5.

In addition to reforms in tax policy, the financing of investment at all levels of government will have to be adopted. Enabling regions to benefit from new technologies will require large investments not only in infrastructure, but also in human capital. Further investments are needed to address other global megatrends. Combatting global warming will require investments to reduce new carbon emissions. It will also necessitate additional spending in infrastructure that is resilient to the effects of climate change.

Addressing the investment needs will require a reversal of the long-term trend of declining public investments in advanced economies that can be observed since the 1970s. Overall, public investment has fallen, from approximately 5% of GDP to approximately 3% of GDP in 2017 (OECD, 2018[50]) (IMF, 2015[78]). Since approximately 57% of all public investment within the OECD is undertaken by subnational governments, a large part of the financial burden of additional investment needs will fall on their shoulders. Financing this investment will require a better utilisation of existing funds combined with tapping new, potentially external, sources of funding, and developing new forms of financing, such as bond financing and pooled financing (see Chapter 5).

However, additional investment spending is only part of the solution. It is equally important to raise the quality of public investment. This requires improvements to the governance of public investments. For example, *ex ante* assessments of the benefits of an investment should be used even more routinely than they are now. Likewise, multi-year forecasting and scenario analyses should be integrated in the budgeting process for investment decisions.

How to future-proof regional policy making?

To anticipate these changes, governments have developed a variety of mechanisms to ensure that today's policies are aligned with future developments. They include various instruments and are often, but not always, integrated in the regional planning system. Among the most important tools are forecasting and strategic foresight processes that identify trends, analyse scenarios and develop policy responses to them.

Forecasting is a data-driven activity that uses and extrapolates existing data to anticipate the future. Forecasting usually assumes that the future will follow a pattern similar to that observed in recent data. Potential breaks in the factors that drive trends are not considered. Forecasting processes, therefore, produce one main scenario about the future (with possible lower- and higher-bound estimates), where the emphasis is on the predictability, accuracy, reliability and precision of outcomes (Wilkinson, 2017[79]). However, forecasting cannot be relied on for long-term decision making under unpredictable and uncertain conditions. Given that forecasting is essentially an extrapolation of current trends, it cannot take fundamentally new trends into account. In contexts where new trends are likely to emerge, strategic foresight can help policy makers to better anticipate and prepare for different futures that are all possible and plausible, as will be discussed below (Van Duijne and Bishop, 2018[80]).

Strategic foresight to better prepare for an uncertain future

Strategic foresight is a thought-driven, planning-oriented process for looking beyond the expected future to inform decision making. It aims at redirecting attention from knowing about the past to exercising prospective judgement about events that have not yet happened (Wilkinson, 2017[79]). For example, strategic foresight does not claim predictive power but

maintains that the future is open to human influence and creativity, with an emphasis – during the thinking and preparation process – on the existence of different alternative possible futures (Wilkinson, 2017[79]). This generates an explicit, contestable and flexible sense of the future, where insight about different possible futures allows the identification of new policy challenges and opportunities, and the development of strategies that are robust in face of change (Cass-Beggs, 2018[81]).

In a strategic foresight process, a manageable and memorable number of plausible stories about the future are developed, shared and contrasted in different forms – narratives, numbers and images (Wilkinson, 2017[79]). The "users" engage in regular or ongoing strategic group conversations, iterating between different ways of envisioning the future. Strategic foresight starts with defining the domain of what is being studied, the time horizon, the key issues, the stakeholders involved and the current conditions through quantitative and qualitative information (Van Duijne and Bishop, 2018[80]). As uncertainties associated with these driving forces of change come up, alternative scenarios about the future are formulated, according to three main types: 1) possible scenarios; 2) plausible scenarios; and 3) preferable or normative scenarios.

The first type of scenarios, possible scenarios, seeks to determine what is constant, what may change and what is constantly changing during the analysed time period (Wilkinson, 2017[79]). Collecting information from different sources, such scenarios are based on a systematic "horizon scan" of emerging trends, early signs of new or different possible futures, and disruptive developments that might affect their external environment. This can take the form of an open search, an expert-led scan or a data-mining meta-scan, where outputs can be presented as quantitative trends, visual maps of qualitative themes or discourse analyses. Possible scenarios, thus, help to anticipate, detect and prepare for early signals of transformations (ibid.).

Box 2.3. Horizon scanning in Canada

A possible-scenarios assessment (*MetaScan 3: Emerging Technologies*) was used by the Canadian government in 2013 to explore how emerging technologies will shape the economy and society, and the challenges and opportunities they will create (Padbury and Christensen, 2013[82]). The study was conducted through wide research, consultations and interviews with more than 90 experts. The key findings include some of the following policy challenges (ibid.), i.e. if the assumed possible futures materialise:

- The next decade could be a period of jobless growth, as new technologies increase productivity with fewer workers.
- All economic sectors will be under pressure to adapt or exploit new technologies, where the main characteristics of change include greater customisation, localisation and intelligence built into production and delivery. Having workers with the right skills, therefore, will be essential.
- New technologies are likely to significantly alter infrastructures for health, transportation, security and energy systems. Governments will have to decide whether to maintain old infrastructures or switch and invest in new, more efficient ones.

The second type of scenarios, plausible scenarios, construct a set of two to three plausible futures that cannot be influenced by policy makers (Wilkinson, 2017[79]). Such scenarios reflect the possible causal logics and behaviour of the wider, underlying sociological, technological and ecological megatrends, relevant to a new situation of concern. The scenarios are created via an iterative process of strategic conversation about plausibility as the guide to attention to the future (ibid.). Hence, plausible scenarios are about engaging in different perspectives, reframing and re-perceiving the policy maker's assumptions about the future, so to consider more and better strategies that are robust in the face of change.

The third type of scenarios, preferable or normative scenarios, construct a preferred future state to determine pathways for progress (Wilkinson, 2017[79]). Transforming a vision into concrete policies is then achieved through a process of backcasting from future to present to identify the strategic priorities, goals and indicators that are relevant to attain the preferred future. Normative scenarios, thus, create a shared understanding and explicit description of the preferred future and a medium-term guideline detailing the specific policies for making progress towards the initial vision (ibid.). Within such scenarios, goal-oriented scenarios can be used to imagine and describe the role of an organisation in a changed future world (Van Duijne and Bishop, 2018[80]).

Box 2.4. Megatrends analysis and scenario planning in the United Kingdom

A plausible scenarios-led foresight assessment (*Futures of Cities*) was launched by the UK Government Office for Science in 2013 to develop an evidence base on the future of UK cities (challenges and opportunities towards 2065), to inform national- and city-level policy makers (UK Government Office for Science, 2016[83]). The study was conducted through the commissioning of working papers and essays, and interactive workshops, with over 25 UK cities participating (ibid.). By combining megatrends analysis and scenarios planning, for instance, the study "produced" a plausible future consisting of considerable climate shocks presenting key urban challenges by 2065 – e.g. drier summers and heatwaves affecting the United Kingdom's southern cities, and high levels of precipitations affecting western cities during the winter. The study, thus, suggested the importance to adapt, and develop localised ecosystem services such as green infrastructure to mitigate flood risk or have greater resilience on local energy production (UK Government Office for Science, 2016[83]).

Across the OECD, governments use several of the above forecasting and strategic foresight instruments to future-proof regional policy. The following section provides a descriptive analysis of how national and regional OECD governments prepare for future economic, technological, demographic and environmental megatrends. It is based on responses to an OECD survey provided by delegates from national governments to the OECD Regional Development Policy Committee.[4]

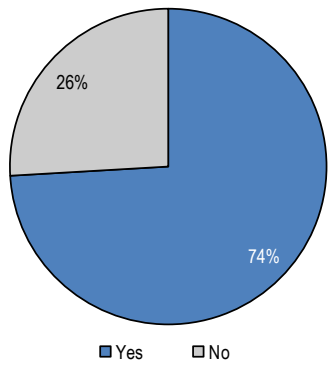
How countries use forecast and foresight

As of 2018, more than two-thirds of countries had a national long-term planning or strategic foresight unit at the centre of government (Figure 2.2). In most cases, such units provide a long-term framework, vision or strategic development plan for the country; conduct foresight activities; and co-ordinate the government's long-term plans across different levels of government. Moreover, although they are devoted to planning at the national level, more

than 90% of such units also consider regional elements and dimensions, such as divergent policy impacts across regions and different regional competitive advantages.

Figure 2.2. National long-term planning or strategic foresight unit at the centre of government

Percentage of countries having a national long-term planning or strategic foresight unit at the centre of government



Note: Centre of government refers to a body that provides support and advice to the head of government and Council of Ministers, for example: head of the prime minister's office, cabinet secretaries and/or secretary general of government.
Source: Calculations based on 35 country responses to the OECD Regional Outlook Survey.

StatLink https://doi.org/10.1787/888933922270

Table 2.1 shows the main tools used in forecast and strategic foresight processes. Monitoring and evaluation and SWOT (strengths, weaknesses, opportunities and threats) analysis are included, although they are not primarily forward-looking tools. They are used to obtain a better understanding of the current state of the world and to learn about the effectiveness of policies. Given that accurate forecasts require a good understanding of the present, monitoring and evaluation and SWOT analyses are essential also for forward-looking activities as they establish links between past, present and future actions.

Nearly two-thirds of the countries in the sample use both forecasting and strategic foresight in regional planning processes (Figure 2.3, left panel). The remaining third only uses forecasting. Strategic foresight is almost never used as a stand-alone planning process.[5] Correspondingly, data-driven tools are more frequently used than thought-driven tools in planning processes (Figure 2.3, right panel). Trend analysis, for instance, was applied at least once in 28 of the total 35 countries. In contrast, the use of strategic foresight planning-oriented activities – due to their less clearly defined nature – varies strongly across countries. In particular, some countries have implemented large-scale strategic foresight exercises while others only use them as preparatory processes for data-driven forecasts or not at all.

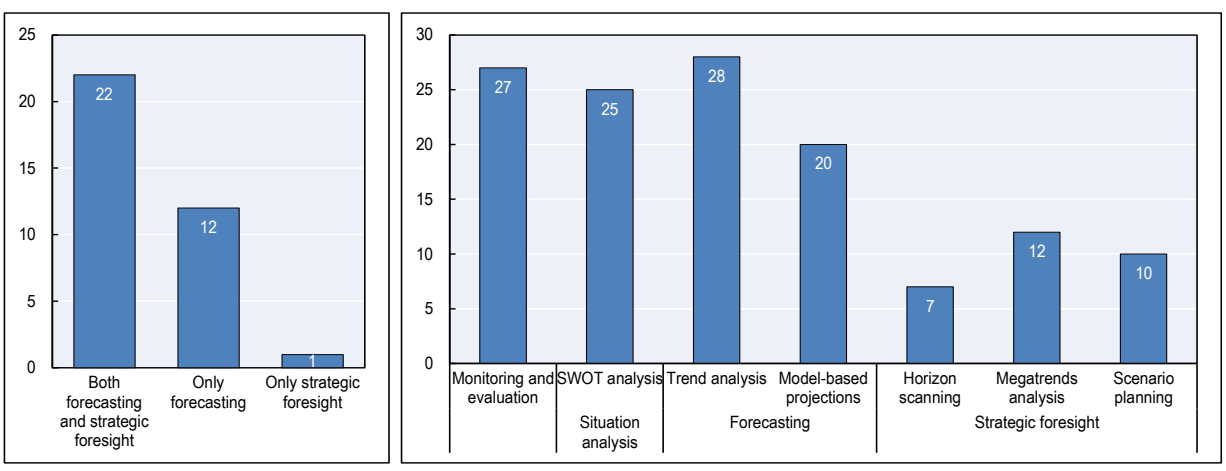
Examples of countries having comprehensively applied strategic foresight processes include Canada (Box 2.3), the United Kingdom (Box 2.4) and Switzerland, which developed its report "Perspectives 2030" combining megatrends analysis and scenario planning (Box 2.5).

Table 2.1. Forecasting and strategic foresight tools

Type of planning-oriented process	Planning-oriented process tool	Definition
Monitoring and evaluation	Monitoring	Monitoring is a continuous assessment that aims primarily to provide the management and main stakeholders with indications of progress, or lack thereof, in the achievement of results (UNDP Evaluation Office, 2002[84]).
	Evaluation	Evaluation is the systematic and objective assessment of the design, implementation process and results of an ongoing or completed project, programme or policy. The aim is to determine the relevance and fulfilment of objectives, efficiency, effectiveness, impact and sustainability (UNDP Evaluation Office, 2002[84]).
Situation analysis	SWOT analysis	SWOT analysis is a framework used to evaluate a body's internal and external environment to identify its present and future strengths, weaknesses, opportunities and threats (SWOT), before taking action (American Marketing Association, 2017[85]).
Forecasting	Trend analysis	Trend analysis is a method for understanding how and why specific things have changed, or will change, over time. To do that, it collates past and recently observed data to discover patterns or trends (Rae, 2014[86]).
	Model-based projections	Model-based projections use available historical data as inputs in statistical models to make informed estimates that are predictive in determining a future state.
Strategic foresight	Horizon scanning	Horizon scanning is an ongoing systematic process aimed at detecting early signs of new and different futures and disruptive developments (Wilkinson, 2017, pp. 15-17[79]).
	Megatrends analysis	Megatrends analysis provides a conceptual framework to think and prepare for inevitable pattern shifts that will occur in a decadal time frame, where causal logics are complex and cannot be fully known ahead of time (Wilkinson, 2017, pp. 17-19[79]).
	Scenario planning	Scenario planning involves building and using a set of plausible, alternative stories that can be used to reframe the present situation (Wilkinson, 2017, pp. 20-24[79]).

Figure 2.3. Type and tools of planning-oriented processes

Number of countries using each type (left panel) and tool (right panel) of planning-oriented processes



Notes: Countries can use several forecasting and strategic foresight tools, for example in different reports, development plans or planning activities. Each tool was only counted once for each country if it figured in several documents.
Source: Calculations based on 35 country responses to the OECD Regional Outlook Survey.

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Box 2.5. Megatrends analysis and scenario planning in Switzerland

The first step of the "Perspective 2030" report sought to identify influencing factors, changing trends and megatrends that will impact Switzerland in the next 15 years, through online questionnaires submitted to experts and think tanks. During the second step, the surveyed experts assessed the influencing factors and trends by assigning them a value between 1 (low impact/low degree of uncertainty) and 10 (high impact/high degree of uncertainty). These assessments, therefore, identified influencing factors with a high degree of uncertainty or impact, i.e. which might require attention from policy makers. Thirdly, the assessed influencing factors and trends for Switzerland were integrated into four different plausible world scenarios, where the interaction between the Swiss and international influencing factors as well as the resulting potential "winners" and "losers" were analysed for each scenario (Swiss Federal Chancellery, 2014[87]).

For example, the "*Pleins gaz*" scenario supposes a world characterised by multilateralism, globalisation and economic interdependence where the world economy, under the stimulus of free trade, continues to grow. As a result of the removal of trade barriers, under the World Trade Organization's authority, Switzerland is highly economically interconnected and stands out as a world-class research and production hub. The overall economic and technological dynamism, however, requires great efforts of adaptation by state institutions, the Swiss export economy and the population. A strong agreement clarifies Switzerland's relations with the European Union. Differently, the "*Attention, bouchon*" scenario assumes a world characterised by dazzling technological progress, against the backdrop of rivalry between the United States and the People's Republic of China (hereafter "China"). The struggle for raw materials leads to a technological competition. Transatlantic links between the United States and the EU are strengthening; at the same time, China and the Russian Federation are getting closer. Switzerland is struggling to assert its political and economic position in the world. New technologies, however, partly offset the negative effects of the decline in foreign trade, and energy consumption can be largely reduced thanks to technical progress and effective regulation (Swiss Federal Chancellery, 2014[87]).

Furthermore, in Switzerland, the Council for the Territorial Organisation (COTER), which was set up in 1997, and brings together experts, evaluates territorial developments with a view to contributing to the design and the development of policies with territorial impacts. COTER performs as a think tank for policy-makers. It relies on the Swiss Territory Project to perform the following tasks: early detection of significant changes from the territorial point of view and their influencing factors; identification of 'blind spots'; co-ordination between public authorities and the scientific community; consideration of appropriate options for action; development of new strategies for territorial organisation; and formulation of recommendations for the implementation of the strategies. In the third year of each legislature, COTER submits a report on global megatrends to the Federal Council. The 2018 version of this report, to be published mid-2019, was entitled "What influence do megatrends have on the Spatial Development Switzerland?"

In their forecast and foresight exercises, countries frequently adopt short- to medium-term time horizons – where shorter time horizons usually correspond to forecasts, while longer ones correspond to strategic foresight exercises. In fact, more than two-thirds of countries adopted a time horizon of 1-5 years, less than half a time horizon of 11-15 years, which further declines to less than one-fifth of countries for a time horizon of 30 years or more.

Using and combining a variety of data-driven and thought-driven approaches is useful to look beyond the expected future in a more comprehensive way, to plan and prepare for different possible scenarios, and to build strategies that are robust in the face of change. Such planning-oriented forecasts and strategic foresight processes, in fact, have two core objectives. First, they help to avoid costly policy mistakes today, such as investment in infrastructure that will soon become obsolete. Second, they improve the preparedness for future challenges and help policy makers to respond when these challenges arise.

Preparing for future megatrends can have various implications. In some cases, it requires to start acting today. For example, it is still uncertain by how many degrees temperatures will rise due to climate change and how this will affect regional climate and weather conditions. However, it is a fact that climate change is occurring. As Chapter 4 points out, regions are facing the consequences of it already today and the severity of the challenge will only get worse over the coming decades. Thus, regions need to analyse the dangers that climate change poses for them and implement policies to adapt to it as soon as possible.

In other instances, preparedness means being ready to act when necessary. For example, Chapter 3 points out that many experts expect autonomous vehicles to emerge before the end of the next decade, but it is still uncertain when the technology will be ready, how quickly it will be adopted by a majority of the population and how it will change mobility patterns. Thus, it is too early to implement major changes to spatial planning policies today. Nevertheless, there is a non-negligible possibility that autonomous vehicles will become available within a few years and will quickly replace traditional cars on the road. In such a scenario, policy makers would have to respond quickly to avoid negative consequences. To be able to do so, governments should have strategies prepared that outline the most important policy responses.

And, preparedness can also mean to be aware of the latest developments without taking action today. Some of the technologies discussed in this report are still speculative at this point in time. It is difficult to predict their impact on regional economies and societies let alone the time by when they will be widespread. For example, it is unclear if and to what extent virtual reality will be able to replace face-to-face contact in daily business life as discussed in Chapter 3. However, it is clear that the technology – should it become reality – would offer profound opportunities for rural regions to attract businesses that currently locate in cities. Given the significant uncertainty around virtual reality, it is too early for rural regions to prepare regional development strategies that are based on the technology. However, policy makers should follow the developments closely to start the preparation of concrete strategies once a timeline for the introduction of it becomes clear.

Lastly, as this chapter has shown, most megatrends will have strong region-specific implications. Routinely taking into account regional elements and dimensions in the above planning-oriented processes, thus, will be critical for policy makers to develop place-based and effective responses.

Notes

1. This was partly due to the increase in migration over the time period.

2. LIDAR is an imaging method that uses laser to create a three-dimensional image of its surroundings.

3. In this statement and the related discussion, Keynes acknowledges that the emergence of the 15-hour work week is not guaranteed. However, he assumes that it will emerge because of changing human preferences once material needs are satisfied.

4. The analysis is based on the information directly provided by delegates from national governments, and on the information collected from the documents and websites mentioned in the surveys. Any information beyond the provided text and the documents and websites mentioned by delegates in the surveys was not taken into account so to minimise any "ease of access to information" country differences or language-related biases. To describe countries' general approach to prepare for global megatrends, such as the level of government undertaking regional long-term planning and strategic foresight, or the type, tools and time horizon adopted in planning-oriented processes, all items of information of surveys were quantified and categorised *ad hoc*. Such items of information were collected systematically when they were explicitly named in the surveys and related documents and websites, or when the description of a certain process allowed their precise identification and categorisation. Reports written in languages other than English, German, Italian or French were fully translated using Google Translator.

   The analysis considers the following 35 countries: Australia, Belgium, Canada, Colombia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

5. Each country in the sample was categorised as using forecasting, strategic foresight or both, according to the tools applied in their planning processes as described in the surveys and related documents and websites – in line with endnote 4 above.

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Chapter 3. Regional policy is facing disruptive technologies

This chapter discusses some of the most important consequences of expected technological change for regional policy. First, it focuses on economic outcomes. In particular, the chapter discusses the consequences of automation on regional labour markets. Second, the chapter analyses the implications of selected technologies for regional policy. This part of the chapter will look beyond economic policies and will discuss the consequences of new technologies on many other important dimensions of regional policy. It looks at the effects of new technologies for public service delivery and discusses how to deal with the emergence of autonomous vehicles.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Regions face a continuous challenge to adapt to technological change. This challenge might become more difficult in the future, because the speed of technological change is accelerating. This chapter discusses some of the most important consequences of expected technological change for regional policy. First, it focuses on economic outcomes. In particular, the chapter discusses the consequences of automation on regional labour markets. Second, the chapter analyses the implications of selected technologies for regional policy. This part of the chapter will look beyond economic policies and will discuss the consequences of new technologies on many other important dimensions of regional policy. For example, it looks at the effects of new technologies for public service delivery and discusses how to deal with the emergence of autonomous vehicles.

None of the technological changes discussed in this chapter will have only positive or only negative implications. Unmanaged or poorly managed, they can create more harm than good, but with the right policy responses, they have the potential to improve economic outcomes and quality of life in all regions.

Job automation will have asymmetric impacts on regions

From an economic perspective, automation is likely to be the most important implication of technological progress in the coming years. If automation proceeds as many experts expect, it will have two opposing consequences. On the upside, automation offers a path to revive productivity growth that has been lacklustre in many OECD countries in recent years. Productivity growth raises aggregate incomes and reduces the prices of goods and services. In the long term, it is the only source for sustainable growth in living standards. On the downside, automation also creates the potential of large-scale job losses. This is especially a concern in the short and medium term, as the economy might shed jobs faster in rapidly automating sectors than it can create them in other sectors. This section provides an overview of the regional dimension of automation based on OECD (2018[28]).

The use of manufacturing robots is increasing rapidly

In 2009, the estimated world production of industrial robots was 60 000. In 2017, more than six times as many units (381 000) were sold (IFR, 2018[88]). Most of these are used in industries that manufacture mechanically complex goods, such as cars or electrical equipment. Countries leading in industrial production in these sectors are also the ones that invest the most heavily. Among the five countries with the largest investment, four are OECD countries; Germany, Japan, Korea and the United States. However, since 2015, investment has been the highest in the People's Republic of China (hereafter "China"). Automation by robots affects sectors beyond manufacturing. Logistics and distribution centres are seeing a rapid increase in automation with, for example, automated carry robots moving goods between fixed workstations and whole automated assembly lines sorting and distributing goods for shipping. The market for these tools remains smaller than for industrial robots, but is expanding rapidly (IFR, 2018[89]).

Both supply and demand contribute to the rise of robots in manufacturing and services. Technologies are constantly improving and, crucially, become cheaper as the industry matures. Especially in fast-growing emerging economies, rising wages make it more attractive to substitute robots for human labour. This is the case for OECD countries where the use of robots is already very much prevalent, but also for countries, such as China, that are still catching up. In Korea, estimates suggest that for each 1 000 manufacturing workers 71 robots are in use; for Germany and Japan the estimates are 32 and 31 robots, respectively; while in China less than 10 robots are in use (IFR, 2018[88]). The absolute

price of robots has decreased significantly (De Backer et al., 2018[90]) and is likely to decline even more in the future. As wages tend to rise, the relative decrease in the price of robots compared to wages is even higher. This relative decline means that even in low-wage sectors, such as logistics, automated solutions based on robots become cheaper than human labour.

Job automation will have asymmetric impacts on regions

Automation due to greater use of robots is bound to proceed. However, the most important factor determining the magnitude of job losses due to automation is arguably the evolution of artificial intelligence (AI). Two scenarios provide the plausible range of future developments in this respect. On the one hand, it is possible that the development of AI stalls at the current level (Marcus, 2018[60]). In this scenario, minor progress could be made due to increasing computing power as well as by optimising current applications of AI. However, no new technologies based on AI could be developed in the near future. Productivity growth at the regional and national level could still be achieved, but would rely on innovation related to other technologies and processes.

On the other hand, there is a possibility that the development of AI accelerates drastically. Such a scenario could occur, for example, if AI becomes able to develop new algorithms to solve fundamentally different problems than those for which it was created. In its most dramatic form, the process could culminate in AI being able to simulate all human cognitive processes, an event with unpredictable consequences for human civilisation. According to a survey of 550 researchers on artificial intelligence, a majority estimates that there is a 90% chance that this crucial point will be reached before the end of the current century (Müller and Bostrom, 2016[91]). In such a scenario, the substitutability of human and machine labour would increase significantly over the coming years and decades. AI could reach a point where it could replace workers in most jobs well before it can fully simulate human cognitive processes.

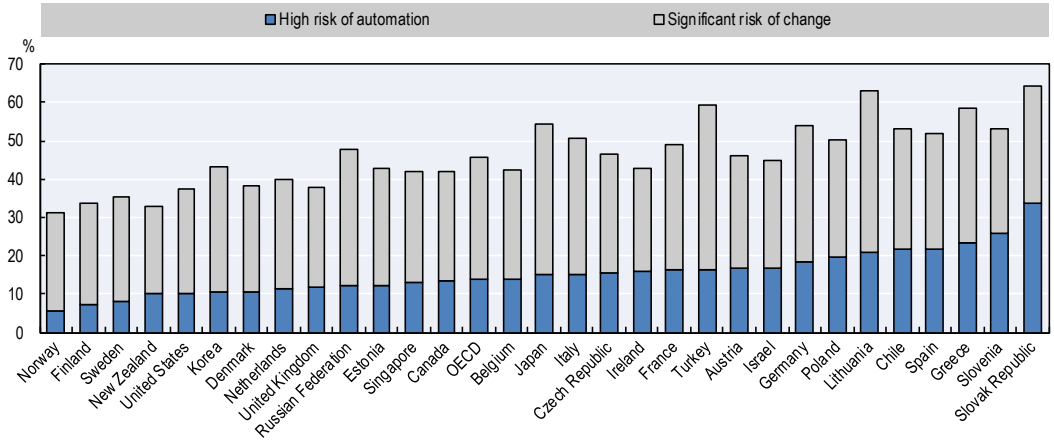
From today's perspective, neither of the two scenarios can be ruled out in the medium term, but neither is there a consensus that one of them is particularly likely. In response to this uncertainty, this section discusses a middle-ground scenario of the evolution of AI. It is based on expert judgements on the most likely evolution of AI in Frey and Osborne (2013[52]) and presents regional estimates for the number of jobs at risk of automation from OECD (2018[28]).

Figure 3.1 shows the number of jobs that are at risk of automation at the national level if the development of artificial intelligence follows the expected path. Across the OECD, 14% of all jobs are estimated to consist of more than 70% of tasks that are likely to be automated, whereas another 32% of all jobs consist of 50-70% of tasks that are likely to be automated (Nedelkoska and Quintini, 2018[53]).

Previous waves of technological breakthroughs have shown that automation does not spread evenly across space. This is due to the fact that automatable tasks are more prevalent in certain occupations and sectors, and neither occupations nor sectors are evenly distributed within national borders. Thus, areas with a higher proportion of jobs relying on easily automatable routine tasks are likely to experience more disruption, whereas places where jobs involve more complex tasks are less at risk.

Figure 3.1. Jobs at risk of automation by country

Percentage of jobs at significant and high risk of automation, by country, 2013



Notes: "High risk of automation" refers to the share of workers whose jobs contain at least 70% tasks that are likely to be automated. "Significant risk of change" reflects the share of workers whose jobs contain to 50-70% tasks that are likely to be automated.
Source: OECD (2018[28]), *Job Creation and Local Economic Development 2018: Preparing for the Future of Work*, https://dx.doi.org/10.1787/9789264305342-en based on Nedelkoska, L. and G. Quintini (2018[53]), "Automation, skills use and training", http://dx.doi.org/10.1787/2e2f4eea-en.

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Regional labour shocks caused by automation will be concentrated in some regions (Figure 3.2). Regions that rely largely on basic manufacturing will be particularly affected. In contrast, many urban economies that have a high share of service sector jobs are less likely to be affected by automation. In addition, while the jobs lost may be concentrated in a few regions, new jobs may well emerge in entirely different regions. Inter-regional migration is one way in which these regional labour market imbalances can be resolved within national borders. However, there are several factors limiting the effectiveness of inter-regional migration as an adjustment mechanism. First, while mobility can be an important structural adjustment mechanism in the long term, it is rarely a short-term solution. People may find themselves out of a job and struggle to find a new one; but they also have family obligations, friends, financial responsibilities, etc. that are tied to where they currently live.

Second, geographical mobility is more restricted for low-skilled workers. This is due to the monetary and non-monetary fixed costs of moving that are proportionally higher relative to income gains from moving for workers with low incomes (Kennan and Walker, 2011[92]). The costs of moving are relatively similar for workers at all income levels. They include monetary costs, for example related to transporting furniture, as well as non-monetary costs, such as the effort required to find new friends. For high-income workers, these costs are often outweighed by the financial gains of finding a new job rather than staying unemployed. However, for low-income workers, the financial gains from moving are frequently not enough to make up for the costs. This is especially a problem in countries where house prices and rents are elevated in economically successful areas and much of the financial gains from higher wages would be absorbed by higher housing costs.

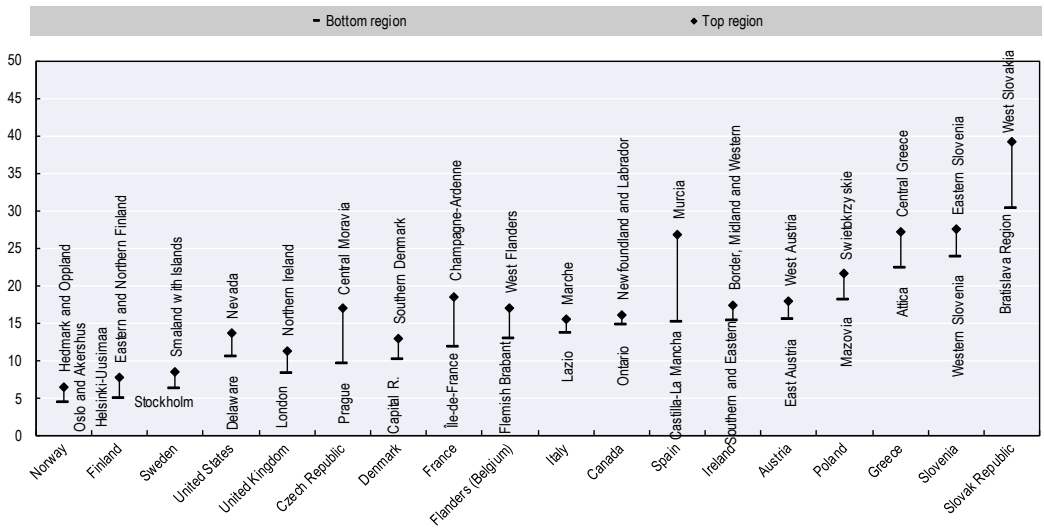
Thus, even under the most optimistic assumptions, it is unlikely that labour market mobility can make up for the uneven impact of automation across local labour markets. Thus, public policy needs to respond to shocks at the local and regional level with targeted measures that take the concrete local impact from automation into account.

How high is the risk of automation at the regional level?

There are large within-country differences in the number of jobs at risk of automation, but it is not straightforward to quantify them. This section presents estimates of the share of jobs at risk of automation at the regional level that are based on OECD (2018[28]). The methodology to produce subnational estimates of the share of jobs at risk of automation builds on several previous pieces of work. The general approach is based on Frey and Osborne (2013[52]), who estimate the risk of automation by occupation based on expert judgements on the expected future capabilities of artificial intelligence. Nedelkoska and Quintini (2018[53]) refine this approach by drawing on information from the OECD's PIAAC survey on the tasks and required skills within occupations. To derive regional estimates, these numbers are disaggregated by OECD (2018[28]) using the data on the sectoral composition of regional economies to calculate the share of occupations by region. Interested readers are referred to these studies for further information on the underlying methodology.

Figure 3.2. Some countries have wide disparities in terms of risk of automation across regions

Percentage of jobs at high risk of automation, highest and lowest performing TL2 regions, by country, 2016



Notes: High risk of automation refers to the share of workers whose jobs face a risk of automation of 70% or above. Data from Germany correspond to 2013. For Flanders (Belgium), sub-regions are considered (corresponding to NUTS2 level of the European Classification).
Source: OECD (2018[28]), *Job Creation and Local Economic Development 2018: Preparing for the Future of Work*, https://dx.doi.org/10.1787/9789264305342-en based on Nedelkoska, L. and G. Quintini (2018[53]), "Automation, skills use and training", http://dx.doi.org/10.1787/2e2f4eea-en.

StatLink https://doi.org/10.1787/888933922327

Figure 3.2 shows the regional disparities in the share of jobs at risk of automation based on OECD (2018[28]). Several countries, including the Czech Republic, France, the Slovak Republic and Spain, display considerable differences in the share of jobs at high risk of automation. In Spain, the country with the largest regional disparity, the difference

between the region with the most and least risky job profile is roughly 12 percentage points. In contrast, other countries such as Austria, Canada and Italy show much smaller disparities in the risk of automation. Furthermore, Figure 3.2 reveals an important pattern. Many of the regions with the lowest risk of automation are home to a large urban area. This pattern is due to the concentration of service sector jobs in the urban economy, which are generally less exposed to automation than other occupations.

Figure 3.2 refers to the share of jobs at high risk of automation and all further estimates relate to this measure. However, the share of jobs at risk of automation, or at least at risk of significant change, is much higher. Instead of varying between 4.3% and 39.3% across OECD regions, it varies between 28.8% and 70.0% across OECD regions.

Some occupations have a particularly high risk of automation. Table 3.1 provides an overview of the occupations with the highest risk of automation and shows the total share of jobs in these occupations. Jobs in these occupations are more likely to be automated on a large scale than any other occupations. About 10% of workers across all regions are employed in the five "riskiest" occupations. Food preparation assistants; drivers and mobile plant operators; labourers in mining, construction, manufacturing and transport; machine operators; and refuse collectors face a particularly high risk of automation. As technology develops, their jobs are likely to be the first to suffer significant alterations. Targeted reskilling efforts should therefore be focused on these individuals in regions where a large share of workers are active in the occupations.

Table 3.1. Top 5 occupations in terms of jobs at risk of automation

ISCO occupation group	ISCO occupation name	Share of jobs at high risk of automation, average across TL2 regions
94	Food preparation assistants	0.6%
83	Drivers and mobile plant operators	3.5%
93	Labourers in mining, construction, manufacturing and transport	2.2%
81	Stationary plant and machine operators	2.6%
96	Refuse workers and other elementary workers	0.8%
	Total	**9.7%**

Note: The table shows the five occupations that have the highest risk of automation (in descending order) as well as their share of total employment, average across TL2 regions in the sample.
Source: OECD (2018[28]), *Job Creation and Local Economic Development 2018: Preparing for the Future of Work*, https://dx.doi.org/10.1787/9789264305342-en based on Nedelkoska, L. and G. Quintini (2018[53]), "Automation, skills use and training", http://dx.doi.org/10.1787/2e2f4eea-en.

The evolution of regional employment and risk of automation over time

Regions can be classified into four categories depending on whether they gain or lose jobs and whether the gains or losses occur in sectors with high or low risk of automation. Table 3.2 shows a classification based on OECD (2018[28]) that divides regions according to whether or not they created jobs between 2011 and 2016 and according to whether job creation occurred predominantly in occupations with high or low risk of automation.

Regions that create jobs in occupations with a low risk of automation (Column A) improve their job situation in the short term and also reduce their long-term risk of unemployment from automation. In contrast, regions that create jobs in occupations at high risk of automation (Column B) improve their short-term job situation, but do so at the expense of moving towards a riskier job profile in the future. Regions that are losing jobs primarily in

areas that are at high risk of automation (Column C) have the typical profile of regions in the process of undergoing a structural change caused by automation. While jobs are being lost to automation today, the risk of further job losses due to automation decreases. Lastly, regions that are losing jobs predominantly in occupations that are at low risk of automation (Column D) face the greatest challenge. They suffer current job losses combined with an increasing risk of further job losses in the future due to automation.

Several regions managed to transition towards low-risk jobs in the period 2011-16. Generally, a majority of regions in Europe have been creating new jobs in the aftermath of the financial crisis. Exceptions to this rule include some of the areas which were hit harder by the economic downturn: those in southern European countries along with Slovenia and parts of France. In addition, in most countries, more than half of the regions have been shifting towards employment that is at lower risk of automation (Table 3.2).

Table 3.2. Most regions have been creating jobs in lower risk occupations

Number of TL2 regions per country (% of all regions within the country), 2011-16

	A. Creating jobs, predominantly in less risky occupations	B. Creating jobs, predominantly in riskier occupations	C. Losing jobs, predominantly in riskier occupations	D. Losing jobs, predominantly in less risky occupations
Austria	2 (66.7%)	-	1 (33.3%)	-
Canada	6 (60.0%)	1 (10.0%)	3 (30.0%)	-
Czech Republic	8 (100.0%)	-	-	-
Denmark	4 (80.0%)	1 (20.0%)	-	-
Estonia	1 (100.0%)	-	-	-
Finland	2 (40.0%)	-	3 (60.0%)	-
Flanders (Belgium)	2 (40.0%)	2 (40.0%)	1 (20.0%)	-
France	9 (40.9%)	3 (13.6%)	4 (18.2%)	6 (27.3%)
Germany	4 (25%)	5 (31%)	2 (13%)	5 (31%)
Greece	1 (7.7%)	-	11 (84.6%)	1 (7.7%)
Ireland	2 (100.0%)	-	-	-
Italy	6 (28.6%)	3 (14.3%)	6 (28.6%)	6 (28.6%)
Lithuania	-	1 (100.0%)	-	-
Norway	7 (100.0%)	-	-	-
Poland	12 (75.0%)	-	4 (25.0%)	-
Slovak Republic	1 (25.0%)	3 (75.0%)	-	-
Slovenia	-	-	2 (100.0%)	-
Spain	4 (21.1%)	3 (15.8%)	9 (47.4%)	3 (15.8%)
Sweden	7 (87.5%)	-	1 (12.5%)	-
United Kingdom	11 (91.7%)	1 (8.3%)	-	-
United States	49 (96.1%)	1 (1.2%)	1 (1.2%)	-

Notes: Each cell reflects the number of regions of a country in the corresponding category. The percentage among all regions within the country is indicated in parenthesis. For Flanders (Belgium), sub-regions are considered (corresponding to NUTS2 level of the European Classification).
Source: OECD (2018[28]), *Job Creation and Local Economic Development 2018: Preparing for the Future of Work*, https://dx.doi.org/10.1787/9789264305342-en based on EU Labour Force Survey and Nedelkoska, L. and G. Quintini (2018[53]), "Automation, skills use and training", http://dx.doi.org/10.1787/2e2f4eea-en.

A few countries, such as the Czech Republic and Norway, managed to generate overall employment growth and shift towards less risky occupations in all regions. However, most countries experienced either a decline in employment or a move towards more risky jobs

in some regions. Five countries had regions where both trends occurred in parallel, i.e. overall employment declined while the share of risky jobs increased.

Without action, automation is likely to result in stronger economic gains in more prosperous regions (and in particular for the highly educated) while creating losses for workers with low and intermediate levels of education in less prosperous regions (see Box 3.1 for a model-based simulation of results for EU regions). While the aggregate gains from automation are positive, the change in the way firms produce will hence have strong adverse consequences for inequality, both across and within regions. Labour demand will shift towards the high skilled, with associated increases in their wages relative to workers with low or intermediate skill levels.[1]

Box 3.1. Projecting the impact of automation on regional development in Europe

Building on an economic model of European TL2 regions developed by the Joint Research Centre of the European Commission (JRC), the JRC and the OECD have projected the impact of automation on the regional economy in the European Union.

The efficiency of capital is assumed to rise with technological progress in automation, i.e. the increase in the number of tasks that robots can perform and the quality with which they handle these tasks. This is modelled by an increase in the productivity of capital, i.e. as robots become "smarter", the amount of output that can be produced for a given investment in capital will increase. This positive productivity shock will lead to an increase in output. The improvement in capital efficiency not only translates into direct output gains as the same amount of capital can now produce more output, but it also creates additional gains from increased capital investment. On average, households benefit from this development. Increased efficiency of the capital stock that workers use to produce output increases their productivity and therefore the wages for those in employment. Households also benefit from lower prices given that productive efficiency increases.

However, not all workers and regions will benefit the same. How much they benefit depends on the assumptions of the underlying model. For the simulation exercise, the working assumption is that technological change will be complementary to the skills that highly educated workers possess, while workers with low and intermediate levels of education are both (imperfect) substitutes for a combination of capital and high-skilled labour, i.e. workers with low or intermediate levels of education can be replaced by both more capital and more high-skilled workers. Consequently, automation creates stronger benefits in regions with a more educated workforce (typically more developed regions) and those with higher capital intensity, which tends to favour less developed regions (the capital share is 45% in less developed regions as opposed to 39% in more developed regions and 38% in transition regions). Overall, the positive effect of having a larger percentage of skilled workers dominates. The total labour income generated in more developed regions increases by about 0.12% for a 5% shock in capital productivity, while less developed and transition regions lose a labour income share by about 0.8% and 0.11%, respectively. Highly educated workers increase their labour share in all three types of regions, by 1% in less developed and transition regions and by more than double that

percentage in more developed regions. Workers with low and intermediate levels of education lose income shares in all types of regions, but most in less developed regions where their income shares drop by 1.5% and more.

Simulating the impact of automation on European regions

The RHOMOLO model is a spatial general equilibrium model that is used for policy impact assessment and provides sector-, region- and time-specific simulations to support EU policy on investments as well as reforms covering a wide array of objectives (Lecca et al., 2018[93]). The standard model is combined with tailored estimates on the risk of automation for workers in different industries with different levels of education in European NUTS2 regions by combining results from OECD (2018[28]) with the European Labour Force Survey. The estimated risk of automation augments the elasticity of substitution between capital and labour. To estimate the impact of automation on the economic equilibrium, the simulation considers the deviation from the initial steady-state baseline driven by a gradual and permanent increase of capital productivity by 5%.

Source: Lecca, P. et al. (2018[93]), *RHOMOLO V3: A Spatial Modelling Framework*, https://ec.europa.eu/jrc/en/publication/rhomolo-v3-spatial-modelling-framework.

More developed regions will benefit more than less developed or transition regions (less developed regions defined by having per capita GDP below 75% of the EU average, and transition regions between 75% and 90%). More prosperous regions where a larger percentage of workers has high levels of education will see the strongest gains from automation as their economy is already well-prepared to reap the benefits through the combination of capital investment and increased use of workers with complementary high skills. In contrast, automation undermines the price competitiveness of less developed regions that often hinges on the low cost of labour. As capital becomes more efficient (and therefore relatively cheaper compared to workers' wages), production is projected to "reshore" to locations with higher wages and skills. The type of jobs created will, of course, be very different than the ones that will be lost.

Factors that explain the risk of automation at the regional level

The uneven distribution of risks linked to automation raises the question of which kinds of regions will be most affected by it. Identifying the characteristics of these regions will help policy makers concerned with inclusive growth to target policy interventions to the most disadvantaged areas.

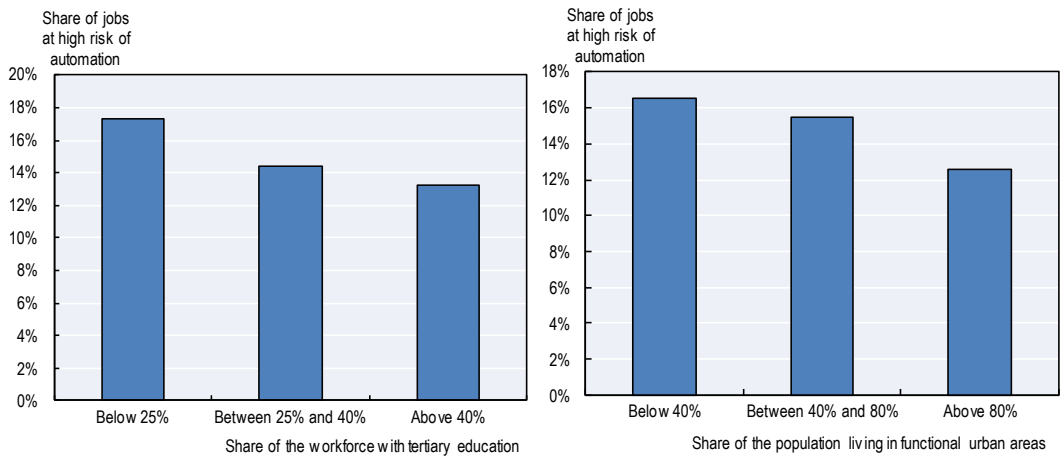
Highly automatable jobs are more likely to be concentrated in regions where productivity is low. At least partially, this is because regions with low productivity make less use of advanced machines. Since automation tends to increase labour productivity, regions with low levels of productivity also tend to have low levels of automation. This implies that these regions have more potential for further automation and hence a higher risk of future job losses.

Places with highly educated workforces are less affected by automation. With some exceptions, the risk of automation decreases as educational attainment required for the job increases. Thus, it is no surprise that regions that have a highly educated workforce have a low share of jobs at risk of automation. Figure 3.3 (left panel) shows the share of jobs at risk

of automation for three types of regions: those with less than 25% of the workforce with a tertiary education, those with between 25% and 40% of the workforce with a tertiary education, and those with more than 40% of the workforce with a tertiary education. There is a negative relationship between the risk of automation and the share of workers with a tertiary education. Regions that have the highest share of jobs at risk of automation also have the lowest share of workers with a tertiary education. Reducing the risk of automation in those regions will therefore require efforts in training and education.

Figure 3.3. Urban regions with a highly educated workforce have a lower risk of automation

Average share of jobs at high risk of automation, by TL2 region, 2016



Note: Data reported in the education chart correspond to regions (TL2) in the Czech Republic, Denmark, Estonia, Germany, Greece, Ireland, Italy, Lithuania, Poland, the Slovak Republic, Slovenia, Spain and the United Kingdom.

Source: OECD (2018[28]), *Job Creation and Local Economic Development 2018: Preparing for the Future of Work*, https://dx.doi.org/10.1787/9789264305342-en based on Nedelkoska, L. and G. Quintini (2018[53]), "Automation, skills use and training", http://dx.doi.org/10.1787/2e2f4eea-en and national Labour Force Surveys.

StatLink https://doi.org/10.1787/888933922346

Rural economies are especially at risk of automation. Figure 3.3 (right panel) shows that regions which have a low share of the population living in urban areas have a higher share of jobs at risk of automation. Rural economies have a lower share of service sector jobs, which are better protected from automation. Smaller towns and rural areas are also more likely to be highly reliant on a handful of employers or on a single industry. While this does not necessarily increase the risk of automation in and of itself, it makes it more difficult to absorb displaced workers if one of the employers automates on a large scale.

Automation creates a policy dilemma for economically struggling regions

Automation creates a dilemma for policy makers. On the one hand, economically struggling regions are often in particular need of productivity growth to restore their external competitiveness. In such cases, greater automation by firms is a key measure to increase the required productivity growth. On the other hand, automation threatens to raise unemployment in the short and medium term. This is a threat especially in those regions that are already facing high levels of unemployment combined with a large number of jobs

at risk of automation. In those regions, any steps that increase unemployment have particularly severe social consequences and are politically challenging.

The challenge for low-productivity regions is especially daunting because they often have high levels of unemployment in parallel with low productivity levels. These regions have to provide jobs in the short term, but also have to encourage efforts to increase labour productivity to ensure high employment levels and prosperity in the long term.

This dilemma can only be solved by taking two considerations into account. First, policy makers need to embrace automation insofar as it is an important mechanism to increase labour productivity and thus, an important source of wage growth and long-term prosperity. Attempts to prevent automation today only lead to increased risks of job losses in the future. Such job losses could either occur if regional firms rapidly embrace new automation methods that have been pioneered elsewhere or they could occur if regional firms are pushed out of business by more productive competitors from other regions that have embraced automation.

Second, policy makers have to help their local workforce and businesses to deal with the potential downsides of automation. They should consider both worker skills and firm upgrading. Training and reskilling programmes can target people in jobs at high risk of automation. Engaging employers in skills development is important in identifying the set of skills required for the local labour market. Policies that facilitate the transition to new economic activities with higher value added, particularly in regions relying on high automation risk sectors, are also essential. In particular, small and medium-sized enterprises (SMEs) can benefit from training programmes targeted at the management level that inform about the possibilities of digital technologies and provide advice on how to transition to a greater use of digital technology.

Digital innovation in cities

The emergence of artificial intelligence in particular and increasing digitalisation more generally have important consequences for urban and rural areas that go beyond labour market effects. At city level – which is the focus of this section – digitalisation has been at the centre of attention in discussions about “smart cities”. While the definition of smart cities has evolved over time, a smart city can be characterised as using digital innovation as a tool to help local governments boost economic growth, foster well-being and facilitate civic engagement.

Much of the literature on smart cities has focused on the opportunities that digital innovation can create for cities. Local governments are, for instance, at various stages of adopting smart metres to better manage water and energy consumption, or smart sensors to improve traffic flow. Yet digital innovation can also present challenges and risks for cities that need to be better understood and addressed. New technologies disrupt the existing regulatory and policy environment: for example, Uber and Airbnb have transformed the traditional landscape for mobility and short-term rental housing in cities. New technologies can pose challenges to legal and regulatory frameworks, consumer protection, taxation, labour contracts, or fair competition.

Digital technologies, if implemented, would therefore profoundly reshape urban development and management. To analyse their possible implications for cities, this section is organised in two parts. The first sub-section identifies the main opportunities (i.e. objectives) of key smart technologies in cities. The second identifies the main risks, challenges and trade-offs of smart urban technologies.

Smart city objectives: The opportunities of digital innovation in cities

Among the numerous emerging new technologies, several are predicted to have particularly strong implications for urban development and management. These include additive manufacturing (3D printing), AI, big data analytics, Blockchain, civic technology, the Internet of Things (IoT) and unmanned aerial vehicles (drones) (see Table 1.1). In the intermediate future, autonomous vehicles (AV) are also primed to have a strong impact on cities, as will be discussed in the subsequent section.

Table 3.3. New technologies with disruptive potential

New technology	Definition
Additive manufacturing (3D printing)	Manufacturing technique that builds a product by adding material in layers, often using computer-aided design software (OECD, 2016[37]).
Artificial intelligence (AI)	The ability of machines and systems to acquire and apply knowledge, and to perform intelligent tasks such as cognitive tasks, sensing, processing oral language, reasoning, learning or taking decisions (OECD, 2016[37]).
Autonomous vehicles (AV)[1]	Vehicle capable of driving itself without human intervention; also called driverless car, robot car or self-driving car.
Big data analytics	Set of techniques and tools used to process and interpret large volumes of data generated by the increasing digitisation of content, greater monitoring of human activities and diffusion of the Internet of Things (OECD, 2015[94]). Big data can be collected through sensors (incorporated in cars, buildings, streets or infrastructure), social media, large administrative data sets or large-scale scientific experiments (Kleinman, 2016[95]).
Blockchain	Shared ledger of transactions that allows the transfer of value between parties in a network, by facilitating trustworthy transactions without a third party (OECD, 2018[96]).
Civil technology	Technology that facilitates civic engagement and participation, and strengthens the link between citizens and governments by improving citizen communication, public decisions, and government delivery of services and infrastructure.
Internet of Things (IoT)	Devices and objects (computers, smartphones, sensors in the public space, homes, workplaces) whose state can be altered via the Internet, with or without the active involvement of individuals.
Unmanned aerial vehicles (drones)	Remote-controlled pilotless aircraft.

1. Autonomous vehicles and their implications will be discussed in the next section.
Sources: OECD (2016[37]), *OECD Science, Technology and Innovation Outlook 2016*, http://dx.doi.org/10.1787/sti_in_outlook-2016-en; Mohammed, F. et al. (2014[97]), *UAVs for Smart Cities: Opportunities and Challenges*, https://doi.org/10.1109/ICUAS.2014.6842265.

From a public policy perspective, digital technologies can enable municipal administrations to be more efficient, more responsive and more sustainable. In terms of efficiency, digital technologies can enable public sector interventions to have a larger impact by using fewer resources, including through greater integration of public services. For example, big data availability on transport flows, energy, water and waste systems allows unprecedented depth of analysis and facilitates targeted real-time interventions for a better management of urban systems. The electricity grid is a good example of an increasingly integrated system through information and communication technology (ICT) and real-time data. A key aspect of such "smart grids" is demand- and supply-side management, enabled by smart metres that contribute to energy savings.

Likewise, IoT technologies can support the efficiency of public service delivery. It enables street objects (street lamps, parking metres) to communicate, which allows a continuous monitoring of their performance and scheduling maintenance only when it is needed – or predict when there is danger of a breakdown. McKinsey & Company estimates that the application of this technology could reduce maintenance costs by up to 25%. And, by 2025,

the IoT could have a total economic impact of USD 3.9 trillion to USD 11 trillion per year (Manyika and Chui, 2015[98]).

As to responsiveness and transparency, digital technologies can improve cities' communication with citizens through virtual platforms. The expansion of digital government (e-government) services and civic technology enables a broader range of the population to access public information and services, take better and informed decisions, and express their opinions through online platforms, online petitions or online voting. Civic technology, therefore, could allow greater participatory and democratic engagement around urban issues. In addition, governments increasingly use crowdsourced data to gain real-time detailed information on public service delivery and infrastructure needs, and facilitate appropriate real-time responses. For instance, citizens can report and inform city employees about the location of potholes, broken traffic lights, stray garbage or any other urban challenge they face on a daily basis through smartphone applications. Governments could also better identify individuals in disadvantaged conditions and determine target groups for policy instruments through the completion of online surveys, primary data collections and IoT technologies. For example, wearable devices, telemedicine or e-health could send early warnings of citizens' health conditions, which would improve the responsiveness of the healthcare system and reduce medical expenses by avoiding emergency care and unplanned hospitalisation. Crowdsourced data, moreover, could assist disaster management in cities.

Digital technologies can also bring opportunities for sustainability and resilience in cities. Unmanned aerial vehicles, for instance, could allow geospatial surveying, and more accurate and cost-efficient air and water pollution monitoring, where information can be shared with citizens in real time. Similarly, early warning systems for floods and other types of natural disasters could improve preparedness and immediate responses. Smart metres and dynamic pricing on electricity have the potential to drastically change the energy consumption patterns of firms and households. They can provide incentives to adapt energy consumption to energy demand. Thereby, they facilitate the use of renewable energy, which tends to have greater supply fluctuations than traditional sources of energy Moreover, electrically powered cars, bicycles and scooters could considerably reduce air and noise pollution. Such a shift towards electric transport modes should be incentivised by a favourable policy environment (tax breaks and exemptions, waivers on road tolls, or subsidy programmes), improvements in the scale and power of the charging infrastructure, as well as uniform standards for charging stations and plugs for all vehicle manufacturers.

Risks, challenges and trade-offs of digital innovation in cities

There are important risks associated with citizen privacy. In an era of open data, big data analytics and the Internet of Things, personal information could be shared with undesirable parties or for unwanted purposes. Such privacy concerns are particularly relevant for health and medical data. In addition, there are risks that open data and big data analytics, which enable information to be tailored to specific groups according to their personal characteristics, could be manipulated by third parties (see (Glancy, 2012[99]), (Helbing, 2015[100]), (European Research Cluster on the Internet of Things, 2015[101]), (Piniewski, Codagnone and Osimo, 2011[102])). Hence, from a public policy perspective, crucial challenges need to be addressed as to the type of data cities should collect and publish as well as for how long it will be stored. In this respect, political considerations, regulatory frameworks, interests and values will be useful to influence, guide and implement citizen privacy-related policies. The OECD has published specific privacy guidelines to advise/inform policy making (OECD, 2013[103]). Meanwhile, the University of Rotterdam (Netherlands) has developed a decision

model to help urban policy makers to determine whether and how a data set should be published for reuse (Gemeente Rotterdam,(n.d.)[104]).

In addition to citizen privacy, security breaches that put data and safety at risk are also a challenge and should be a priority for public policy makers. In fact, as digitalisation is increasingly mainstreamed into urban infrastructure, services and activities, public administrations and the private sector are at higher risk of cyberattacks. For example, the 2018 cyberattack on several critical systems in Atlanta in the United States affected the police department, the judicial system, water management and other citizen services. Similarly, in 2017 a number of European hospitals, telecoms and railways were damaged by a co-ordinated cyberattack (Greenemeier, 2018[105]).

As a response, the current regulatory frameworks must be adapted. Along these lines, the European Union proposed a new data protection reform through the 2016 General Data Protection Regulation (European Parliament, 2016[106]) that strengthens privacy and improves the control of citizens over personal data. This will: 1) oblige privacy policies to be written in a clear and straightforward language; 2) require users to give an affirmative consent before their data can be used by businesses; 3) increase transparency regarding data transfers and the purpose of business data collection; 4) give stronger rights to users to access copies of their data held by businesses; move their data to other platforms; have their data deleted (right to erasure); sue companies who process, collect or own private data; and 5) strengthen the enforcement of data privacy laws through higher fines and greater co-operation between data protection authorities.

Current regulatory frameworks must also be adapted to new ways of doing business. In particular, technology companies often control a very large share of their markets, which raises the question to what degree they are monopolies with the potential to harm consumers. Furthermore, regulation is often uneven in areas where digital business models compete with traditional business models. On the one side, newcomers complain that rules and regulations designed for traditional market practices are being applied to newly evolved business models in inappropriate ways. On the other side, there is a gap of rules and regulations for new business models for traditional market players, giving them an unfair advantage.

Not all cities have the human, technological and governance capacity (within local governments) to adapt to new business models in technologically driven environments. In many cases, municipal governments lack the necessary human and infrastructure capacity to develop and adopt comprehensive smart city initiatives, in particular when attempting to incorporate integrated, systems-approaches to urban services within municipal administrations that are often strongly divided by policy area (Kleinman, 2016[95]). For instance, many local governments lack the requisite capacity and skills for collecting, storing and analysing data given the depth and scale required, nor the infrastructure and computing power needed to store and process the data. Building in-house capacity with data scientists is not easy for many cities, given that similar skills are of great value in the private sector as well. Regarding infrastructure and computing power, many cities will not have the financial means or know-how to build and maintain local servers.

Lastly, although smart cities would increasingly rely on data for policy design and implementation, more data do not necessarily translate into better policy making. As Kleinmann (2016[95]) points out, “data are not information”, and reliance on big data may still only provide a piece of the bigger puzzle. Examples of data-driven policy inefficiencies are smartphone applications inviting citizens to report problems on city streets: one study found that the map of potholes reported by citizens systemically corresponded to areas with

younger, wealthy residents who owned smartphones rather than an accurate portrayal of the broader street network's problems. Another study found that social media alerts generated in the aftermath of Hurricane Sandy overrepresented the challenges experienced in Manhattan (given the high density of smartphone users who reported storm-related problems), compared to the challenges in coastal communities that were in reality harder hit (Kleinman, 2016[95]).

Further research is needed to understand the trade-offs between competing policy objectives of efficiency, transparency and environmental sustainability. Big data and smart city technologies depend on sizeable infrastructures (servers, data centres, cabling and power supplies) that consume significant amounts of energy and leave a sizable carbon footprint. Thus, further research should measure the environmental, social and economic impacts of digital innovation in cities. By extension, there is concern that digital innovation might exacerbate existing disparities among social groups that use digital technologies regularly and those that do not.

Autonomous vehicles will transform mobility in cities and beyond

Autonomous vehicles will become available in the intermediate future. Such self-driving cars will drastically increase comfort and safety of road travel. They will also improve the mobility of people who cannot drive today, for example because of disabilities or age. While self-driving cars have the potential to improve many aspects of daily life, they could also create a series of undesired consequences if they are inadequately regulated.

Almost all major car manufacturers as well as several tech companies are working on the development of autonomous vehicles. Advanced prototypes exist that can autonomously drive in most traffic situations. As of mid-2018, Waymo, a leading developer of self-driving cars, announced that its test-fleet drives more than 40 000 vehicle kilometres per day autonomously on public roads (Lebeau, 2018[107]).

In a few cities, pilot programmes allow private customers to use self-driving cars already today. For example, selected customers in Phoenix (United States) can hail rides in self-driving cars through a conventional ride-hailing app (Randall and Bergen, 2018[108]). However, as of the time of writing, the technology is not ready for a universal adoption. This was shown by an accident in which a self-driving car driven in autonomous mode struck and killed a pedestrian in early 2018 during a test drive.

Today's prototypes of self-driving cars still struggle to handle complex traffic conditions and adverse weather conditions that blind their sensors. Predictions on when the first fully autonomous vehicles go on sale to the general public vary. On the one hand, the most optimistic experts and car manufacturers predict that fully autonomous vehicles will be on sale by 2021 (Walker, 2018[109]). On the other hand, a few experts argue that fully autonomous vehicles will not be available in any foreseeable future (Wolmar and Sutherland, 2017[110]). However, such extreme predictions seem to be outliers. Most experts expect autonomous vehicles to become available at some point during the next decade.

As of late 2018, cars are on the market that can drive autonomously in some circumstances. On the most common definition of vehicle automation, these cars have reached Level 3 (see Table 3.4). In comparison, the cars used in the large field test in Phoenix mentioned above are probably at or close to Level 4. However, the most transformative effects of self-driving cars are likely to emerge once cars reach Level 5, i.e. when cars will be able to drive in all traffic conditions autonomously. Only once this technology is available will cars be able to drive while the occupant is asleep or even drive without any occupant. Such

cars will not require a steering wheel and other control instruments of today's cars. The subsequent section will discuss the implications of such fully autonomous vehicles that are able to drive in all traffic conditions on public roads without a driver.

Table 3.4. Levels of vehicle automation

Level of driving automation	Name	Definition
0	No automation	All dynamic driving tasks are performed by the human driver.
1	Driver assistance	The vehicle is controlled by the human driver but some features such as the active cruise control system can assist the driver to maintain a predefined speed.
2	Partial automation	The vehicle can control both the steering and accelerating and braking functions, but the human driver must monitor the driving environment at all times and perform all other driving tasks (i.e. the driver is responsible for safety-critical functions).
3	Conditional automation	The driver is a necessity but is not required to monitor the environment in all circumstances; that is, the driver can disengage from safety-critical functions but must be ready to take control upon the vehicle's notice (e.g. many current Level 3 vehicles require no human attention to the road on highways at speeds below 60 kilometres per hour).
4	High automation	The vehicle is capable of performing all driving tasks in most circumstances. In highly dynamic driving situations such as merging onto highways, which cannot be autonomously handled, the vehicle should nonetheless be able to safely abort the operation if the driver does not retake control.
5	Full automation	The vehicle requires no pedals or steering wheel: it is able to perform all driving tasks under all circumstances. The vehicle is able to drive without anybody on board.

Source: Society of Automotive Engineers (2014[111]), *Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems*, https://doi.org/10.4271/J3016_201806.

Fully automated cars will probably not become available in all places at the same time. Most likely, cities or countries with advantageous climate conditions (e.g. no snow and little rain), orderly traffic and a favourable regulatory environment will see an earlier introduction than other places. Such a staggered introduction offers policy makers two advantages. First, the timeline for the introduction of self-driving cars becomes more predictable once a large-scale rollout begins in some places. Second, policy makers in most places will be able to learn from the experience of the early adopters and can adjust their policies accordingly to deal with any undesired consequences.

It is uncertain how quickly self-driving cars will become widespread once they are available. First, it is not yet foreseeable for how long manually operated cars will be sold once self-driving cars become available. Second, the lifespan of today's cars is well over a decade. Depending on whether these cars are driven until the end of their economic lifespan, the widespread adoption of self-driving cars may take more or less time. In any case, even if the transition to self-driving cars happens quickly, it will take several years from the time the first self-driving vehicles become available to their widespread use. Given these constraints, it appears unlikely that self-driving cars will make up a majority of all cars before the early 2030s.

Autonomous vehicles will change where people live and how they use cars

Once cars can operate without driver, vehicle occupants will be able to use their time during a trip for various activities. For example, occupants might work, sleep or read during a commute to and from work. Thus, commuting by car could become much less of a hassle than it is today. This effect might be amplified by a fundamentally revised design of cars.

Once the need for a traditional car cockpit disappears, cars could be redesigned to resemble small living rooms, offices or other spaces designed to maximise work productivity or comfort (Litman, 2018[112]).

If commuting becomes more pleasant, people may decide to live much further away from cities than they do nowadays in order to live in larger homes or be surrounded by more green space (Metz, 2018[113]). A commute of 90 minutes might not be so daunting if the time can be used to answer emails in the morning and to read or watch TV in the evening. As a consequence, self-driving cars are likely to lead to a renewed suburbanisation process in the absence of policy interventions to prevent this. Most likely, this suburbanisation process would be felt most strongly in ex-urban areas around cities that are beyond today's commuter belt of cities. These areas would experience price increases and could see significant new construction. In contrast, house prices in suburbs close to city centres might decline in relative terms because the advantage of living close to a city centre becomes smaller relative to more remote locations. Even the higher costs of longer commutes would not necessarily provide a deterrent from living further away from places of work in city centres. At least in cities with expensive housing prices, the savings from lower housing costs further away from cities could compensate for the higher costs of longer commutes.

Better planning at the metropolitan level is necessary to prevent uncontrolled suburbanisation. Where metropolitan planning or other co-ordination mechanisms at the metropolitan or regional level exist, their geographic boundaries might have to be adjusted to account for the fact that people will commute longer distances into core cities. Where planning is not co-ordinated within metropolitan areas, the need to do so will increase because of self-driving cars.

Box 3.2. The employment effects of autonomous vehicles

Autonomous vehicles are likely to have strong effects on employment. In the United States alone, there are an estimated 3.8 million professional drivers who transport goods or people (Beede, Powers and Ingram, 2017[114]). As soon as self-driving cars become widespread, many of these jobs could become redundant. At the same time, new jobs are likely to emerge related to the servicing of autonomous vehicles, but also in professions that do not yet exist.

Given that the employment effects of autonomous vehicles are likely to be similar to those of other technologies that lead to automation, they are not discussed in this section. Interested readers are referred to Section 0 of this chapter, which discusses the labour market effects of automation more broadly.

Car sharing will become widespread

Self-driving cars are likely to lead to a widespread adoption of car-sharing services (ITF, 2015[115]). Shared self-driving cars would operate similarly to current ride-hailing services. Instead of picking up a car at a designated location, a shared self-driving car could drive to the user on demand. Once it is possible to order a car on demand at any time, the need to own a private car will decline drastically. For many people, using shared cars would also offer a financial advantage, as it would be much cheaper to rent a shared car occasionally than to own a private car. Car sharing will be especially attractive for people who use cars

only infrequently or drive short distances. For those who drive long distances regularly, savings will be smaller because the costs of owning and sharing a car converge, the more a car is used. Furthermore, cost savings of shared cars would probably be lower for commuters who have to rent a shared car during rush hour. It is likely that car-sharing companies will charge higher prices during these times to account for increased demand.

Car-sharing services have the potential to drastically reduce the number of cars that are needed to transport a given number of people. By increasing the time that a car is in use, the same number of cars can serve a much larger number of trips than individually owned cars. However, at least initially, the widespread introduction of car-sharing services could lead to some frictions. For example, car-sharing companies need to ensure that there is a near-constant availability of cars to be attractive to customers. If many car-sharing companies enter the market at the same time, this could lead to an oversupply of cars on the road.

Self-driving cars will threaten established public transport models

Ride-hailing schemes based on shared self-driving cars could pose a significant threat to existing public transport systems. Currently, it is prohibitively expensive to use taxis and other ride-hailing schemes on a daily basis for most of the population in OECD countries. However, a large share of the costs of a taxi is due to labour costs of the driver. In comparison, the costs of operating a private vehicle per kilometre tend to be much lower than the costs of a taxi. For example, the German Automotive Club estimates the total operating costs for a typical middle class car to be approximately EUR 0.45 per kilometre (ADAC, 2018[116]). This figure includes capital costs, depreciation, fuel, maintenance, taxes and other costs.

Once self-driving cars are widespread, it is unlikely that the kilometre costs of a self-driving taxi that is ordered on demand will be much higher than the costs of operating a private vehicle today. Competition between operators will push prices towards their marginal costs and operating costs of autonomous cars will not be much different than operating costs of cars today. Bösch et al. (2018[117]) estimate that the costs of a vehicle kilometre in an individual autonomous taxi would be CHF 0.41 in Switzerland (approximately USD 0.42). Other estimates fluctuate between USD 0.2 and USD 0.6 per kilometre (Litman, 2018[112]). If autonomous taxis operate in a car-pooling mode with several passengers on board, the kilometre costs per passenger would be even lower. As a consequence, the price for a trip of a few kilometres in a self-driving taxi would be approximately as high as the price of a single public transport ticket in many cities in OECD countries.

Given the low costs, it is likely that many public transport users would switch to self-driving taxis that are ordered on demand. Such a shift would threaten the financial viability of many public transport systems and could lead to increased road traffic and congestion. To prevent a major shift away from public transport, two sets of policy measures should be introduced.

First, self-driving cars should be integrated with public transport systems. In areas that are well-served by public transport, self-driving cars are direct competitors for the public transport system. However, in less densely populated areas that have an insufficient public transport coverage, self-driving cars could complement public transport by helping to cover the last “mile” that is not covered by public transport. To make this attractive for users, the interchange between self-driving car and public transport should be made as seamless as possible. At a suburban train station, this can, for example, mean providing infrastructure for a large number of self-driving cars that will wait for passengers arriving on a train during evening rush hour.

Second, congestion pricing and other tax and regulatory instruments should be used to limit congestion and prevent large shifts away from public transport to individual transport (see the following section). Taxes on trips in self-driving cars may be adjusted to encourage multi-modal trips. For example, taxes per kilometre on trips in which self-driving cars are used to cover the last mile to and from a train station could be lower than taxes for trips that take place entirely in self-driving cars.

Self-driving cars need to be regulated and taxed to avoid congestion

Given the convenience of self-driving cars that are ordered on demand and their low cost, it appears likely that the number of trips would increase considerably. To counteract the expected increase in demand for trips, congestion pricing and other taxes on the externalities of self-driving cars should be introduced. They could take into account the time and route of a trip in the calculation of the tax. Such pricing schemes should encourage the use of carpooling and the above-mentioned integration of self-driving cars with public transport services.

In densely populated city centres, strongly increasing demand for trips in self-driving cars can only be accommodated without increasing congestion if carpooling becomes widespread. In such a scenario, passengers with similar itineraries share a vehicle and are picked up and dropped off on the way. With a sufficiently large number of users, passengers can be selected automatically by an algorithm so that their itineraries largely overlap. This works better the greater the number of people using a carpooling service, because it becomes easier to find users with matching itineraries for a vehicle. In an ideal scenario, carpooling services would take only slightly more time than using a single-occupancy vehicle. In order to incentivise carpooling, public authorities should tax it at lower rates than single-occupancy use of cars.

A further cause of congestion could be self-driving cars that circulate empty in wait for passengers. While this helps to assure prompt availability of a car in an on-demand service, it also adds to congestion and pollution. In cities where costs of parking are high, it could even be cheaper to have a car circulate permanently on the road instead of parking it for a fee. To prevent excessive circulation of empty vehicles, it should be monitored and, if necessary, limited. Authorities could impose special charges on cars that circulate empty or prohibit extensive empty circulation entirely.

The increase in car usage due to self-driving cars and the available road capacity will vary strongly from city to city. Taxes, fees and other regulatory instruments need to be adapted to the local and regional circumstances. Thus, legal frameworks at the national level should allow for regionally and locally variated taxation and regulation.

Eventually, self-driving cars could increase road capacity because shorter reaction times of the computers guiding the vehicles could mean that a much lower safety distance between vehicles is needed. Using so-called platooning, a group of vehicles could circulate in a close formation similar to wagons of a train. This requires autonomous vehicles to communicate with each other. To facilitate the development of this technology, policy makers should implement suitable regulations and standards (Fagnant and Kockelman, 2015[118]).

However, platooning works best on roads where only autonomous vehicles operate. It is unclear if platooning will be a viable option to increase road capacity during a transition period in which self-driving and manually driven cars operate. In cities, the technique is unlikely to be widely applicable anytime soon because roads are shared with pedestrians, cyclists and other users. Thus, unless proven otherwise, policy makers should assume that

gains in road capacity from automated vehicles will not be sufficient to compensate for an increased use of cars and prepare measures to limit congestion.

Self-driving cars could free up much of the existing parking space in cities

Once self-driving cars constitute a majority of cars, the need for parking space would decline substantially. Partly, fewer parking spaces would be needed because of the above-mentioned shift towards car-sharing models. Widespread car sharing implies that fewer cars are needed to serve a population than today. Estimates show that the number of cars could decrease by up to 80% (ITF, 2015[115]). Furthermore, those cars would be in use for a much higher percentage of their time than today's cars. Thus, they will spend less time being parked.

A second factor reducing the need for parking within cities is the fact that self-driving cars can drive autonomously to a parking space. Instead of having to park close to the destination of the vehicle occupant, cars could park where they create the fewest nuisances. For example, cars could park in empty parking lots around stadiums, on brownfield sites outside of cities or in purpose-built parking garages at strategic locations.

The combination of those two factors could make parking space within cities almost obsolete. While there would still be space required to drop-off people, no space for parking would be needed along roads. If self-driving cars do not lead to a widespread adoption of car sharing, parking space in cities could still be reduced, but to a lesser degree. The limiting factor for removing inner-city parking would be the time it takes for an autonomous vehicle to reach its parking destination and the negative effects that the additional traffic creates. Without a shift away from private car ownership, eliminating on-street parking in large cities would probably require the construction of large-scale parking garages at strategic locations.

As Shoup (2017[119]) documents in much detail, parking creates significant monetary and non-monetary costs for society. Thus, a reduction in parking space in valuable locations could provide social benefits, provided the freed up space is put to good use. This would primarily benefit dense city centres, where space is most valuable. Freed-up on-street parking space could be used for other purposes. It would be possible to enlarge sidewalks, build cycle lanes, create green space, or install outdoor seating for cafés and restaurants. Likely, there are other, yet undiscovered, uses for the space, too.

In addition to on-street parking, large parking lots within the urban fabric are common in some OECD countries, such as the United States (OECD, 2018[120]). Often, this parking space is owned by businesses and provided to customers or employees. In some instances, its provision is required by land-use regulations. Most of the parking space would become obsolete under a scenario of widespread adoption of self-driving cars. If it becomes available for development, this space would have significant economic value. Furthermore, developing the space would bring important co-benefits, for example related to the environmentally beneficial impacts of densification.

To use this potential, parking space within cities should be progressively reduced as self-driving cars become available. As a first step, minimum parking requirements for new developments should be abolished. Their downsides outweigh their benefits even without self-driving cars. Once self-driving cars become widespread, they will have even less justification. Thus, these requirements should be reduced or abolished entirely as soon as possible (OECD, 2017[121]). In parallel, the public provision of parking space should

gradually be reduced. Given that parking space in many cities already exceeds the socially optimal amount, this process should be started today (Shoup, 2017[119]).

In parallel, alternative uses for the freed-up space should be explored. City-wide plans should be developed that show how the space is allocated across neighbourhoods and across competing uses. Since it is impossible to predict at this point how much and how quickly parking space can be freed up, the plans should include prioritisations and stages that allow a step-by-step reduction in on-street parking. Furthermore, new planning policies should be developed to allow the conversion of inner-city parking lots. Often, these parking lots are in prime locations and offer great economic potential for development as well as the possibility to increase the attractiveness of the urban fabric.

In parallel, planning should begin for how to provide parking for self-driving cars. Given that one shared self-driving car can replace several privately owned cars, the number of new parking spaces needed is likely not as high as the number of parking spaces that will be abolished in city centres. Nevertheless, large cities will eventually have to provide space to park hundreds of thousands of cars outside of rush hour and especially at night. Currently underused spaces such as the parking lots around sport stadiums outside of cities could be suitable sites for such parking. Given that the shift towards autonomous vehicles is likely to coincide with a shift towards electric vehicles, such parking spaces would need to be equipped with large-scale charging infrastructure.

Self-driving cars will increase the attractiveness of rural areas

While the use of cars has declined in urban areas, it remains high in rural areas, where few alternative solutions exist (van Dender and Clever, 2013[122])]; (ITF, 2017[123]). Public transport tends to be costly and inefficient in low-density areas, with long waiting times for passengers and an underutilisation of the system. Under such conditions, self-driving cars will be an important complement to public transport in rural areas. A fleet of self-driving vehicles operating in ride-sharing mode could eliminate the need for traditional public transport in small towns and villages (ITF, 2015[115]).

Self-driving cars will increase the attractiveness of rural areas. As mentioned above, rural areas close to cities will become more attractive as places to live for workers who commute into cities. Greater ease of travelling and improved mobility will also improve quality of life in places further away from cities. Nevertheless, the technology has potential downsides also in rural areas. Important amenities for local communities, such as small shops and restaurants, will face increased competition from competitors in larger cities that will become more accessible. This could contribute to a further decline of activity in the centres of small towns and villages.

Autonomous vehicles will also decrease the costs of freight transport and reduce delivery times. The most immediate savings will come from saving the labour costs of drivers. Autonomous freight trucks will also be able to run around the clock, without the need to respect rest times. This will reduce costs because it allows better capital utilisation. Shorter delivery times will also be a major benefit to producers of perishable goods as well as to companies that rely on just-in-time delivery. For example, producers of quickly perishable food that are located in remote areas will be able to access much larger markets than today or to forego costly air transport.

Good regulation is essential for the successful introduction of self-driving cars

Well-regulated self-driving cars offer the potential of making cities more liveable, greener and more inclusive. They will also improve mobility in rural areas. However, these advantages will not materialise automatically. It will require adequate regulation to prevent unintended consequences. In this respect, self-driving cars are similar to traditional cars that also provided huge benefits, but had severe undesired effects. Regulations need to minimise these side effects, while still encouraging the adaption of the technology.

Once the technology for fully self-driving cars becomes available, there is the possibility that urban mobility will change drastically within a few years. As of today, it is still unclear how and when the transformation towards self-driving cars will occur. As a consequence, it is yet too early to determine the exact policy framework for self-driving cars at the local level. However, it is almost guaranteed that certain steps need to be taken to prevent undesired effects and use opportunities. Policy makers need to be prepared for this change and need to have the right tools to steer this transformation. This includes, in particular, congestion charges and other measures to limit an increase in car use. Since many of these measures will eventually have to be introduced at the local level, national governments should already provide the legal basis to allow local governments to introduce them when necessary.

Last, but not least, it should be mentioned that the successful introduction of autonomous vehicles requires further measures, such as harmonised regulatory frameworks at national and international level. They need to cover aspects such as safety standards and liability regulations. Since these frameworks do not have an explicit regional dimension, they go beyond the scope of this report and are not further discussed.

New technologies for regional development in rural regions

A number of technological changes are likely to shape how rural areas can succeed in a more complex, dynamic and challenging environment. Digitalisation will open up wider possibilities to engage in regional, national and international markets. Along with the spread of high-speed broadband, innovation can create new educational opportunities in rural areas (e.g. e-education), increase social connections, boost productivity (e.g. 3D printing), and change the ways in which land is managed and services delivered (e.g. automated farms or e-health). Other technologies that are likely to have large effects on rural areas are self-driving cars (as discussed above) and better communication techniques.

Better communications techniques

Technologies to work remotely have facilitated the delocalisation of jobs and created organisational changes in many industries (Moriset, 2011[124]). Teleworking, co-working spaces, virtual teams, freelancing and online talent platforms are all on the rise. For instance, in the United States, the share of workers who primarily work from home has more than tripled over the past 30 years, representing currently 2.4% of the workforce (Bloom et al., 2015[125]). Home-based workers have a wide spectrum of jobs ranging from academics and software engineers to managers and sales assistants.

Some OECD countries have considered teleworking as a policy strategy to revitalise rural areas. Gers, for instance, is an organisation that promotes teleworking in 47 towns in the south-west of France. The organisation maintains a network of entrepreneur teleworkers. Together with participating local governments, it provides support for their installation and helps them to integrate into communities (Moriset, 2011[124]).

In the future, the emergence of augmented reality (AR) and virtual reality (VR) technologies could further increase the possibilities for working remotely. AR projects virtual elements into actual surroundings, whereas VR projects an entirely virtual reality. Both technologies have been advancing and are getting closer to the point where virtual imagery becomes indistinguishable from real surroundings. Furthermore, improvements are being made concerning the inclusion of auditory and tactile elements. The technologies could, for example, serve as a much closer substitute for face-to-face meetings than current teleconferencing technologies. Businesses in rural communities, therefore, could particularly benefit from AR and VR as virtual face-to-face meetings could be used to improve connections with customers and suppliers.

Beyond the possibility to improve teleworking experiences, AR and VR will have other economic implications. Estimates suggest that the market for AR and VR has grown fourfold between 2015 and 2018 (Hall and Ryo, 2017[126]). Distinct enterprise applications are now emerging across a variety of tasks. For example, within professional education, the technology is used to simulate workplace environments in various professions, such as quality control, healthcare and driving. In other professions, such as surgery and mechanical maintenance, AR is already used to provide guidance to workers in the workplace by superimposing directions into their field of vision. In the future, AR and VR could also enter mass markets, for example to improve online shopping experiences by providing more realistic impressions of goods (Glazer et al., 2017[127]).

Using AR and VR in rural areas requires access to fast broadband at affordable prices. Thus, policy frameworks should reflect the need for a wider diffusion of digital networks. Ensuring competition in broadband provision, promoting private investments and setting minimum broadband speed are strategies that have been tremendously effective in extending broadband coverage in OECD countries (OECD, 2018[128]). Implementing universal service frameworks to provide telecommunication access when the costs exceed commercial returns has also been widely used to provide services for low-density areas.

Smart service provision in rural areas: Future of health and education

Better ICT and digital connectivity also facilitates a wider provision of public services in rural areas by allowing remote delivery of services. Education is more costly in rural areas and in many cases of lower quality than in urban areas. For example, students in small towns score 31 points lower on average in science than their peers in large cities in the OECD's Programme for International Student Assessment (PISA) tests (OECD, 2017[129]). While many factors influence learning outcomes of students, long travel distance to schools, limited curriculum options, as well as difficulties in attracting and retaining teachers make education provision more difficult in rural areas.

Policies to integrate digital technologies in schools are common in most OECD countries, but they can be further expanded. Beyond helping students learn crucial ICT skills, they can also improve and expand the educational profile of schools. For example, schools in rural Finland provide elective classes through teleconferencing technologies. Lessons in one school are streamed to classrooms in other schools, where students interact remotely with the teacher. This allows the schools to offer elective classes, such as foreign language classes, which do not have a sufficiently large number of students in a single school (OECD, 2017[70]).

Importantly, many of the challenges related to the introduction of new technologies into online education and other online public services are not related to the technologies themselves, but to organisational processes. For example, integrating video conferencing

equipment into classrooms is technologically simple. However, in order to use it to provide lessons remotely in multiple schools, it is necessary to synchronise each school's timetable. Likewise, teachers need to know how to use the equipment and have to adjust their teaching styles and methods to the new teaching environment. This requires the provision of adequate teacher training (OECD, 2017[129]).

Beyond public service delivery, new technologies also allow new private providers of education to service rural areas. Long-distance education (or online courses), e-learning, podcasting, interactive television teaching tablets, modular coursework and self-directed learning can enrich curriculum opportunities in remote areas (OECD, 2017[129]). For example, online courses can be effective in terms of peer-to-peer interactions and free up teachers' time. Massive open online courses (MOOCs) are nowadays more common and have created large online communities. The online platform Coursera, for example, has more than 22 million course enrolments across 190 countries.

The second area of service delivery that can be particularly improved in rural areas through new technologies is healthcare. So-called e-health (i.e. the use of information and communications technologies for healthcare provision) is about improving the flow of information through digital means. As of 2016, 43 out of 73 analysed countries had developed a national e-health strategy (World Health Organization, 2016[130]). E-health services can be especially beneficial in remote areas where doctors and other health service providers can be difficult to access. For example, remote consultations of specialists are becoming more and more common across the OECD.

Beyond specialist care, new technologies can also improve day-to-day healthcare provision in areas that are underserved by healthcare providers. Smartphone-based health apps, for instance, is one of the ways in which this trend has progressed the most. Between 2013 and 2015, mobile health apps doubled, reaching 165 000 available apps in 2015 (OECD, 2017[131]). They can perform various healthcare functions, such as the continuous monitoring of patients, interactions between patients and health professionals beyond traditional settings, and communications with systems that can provide real-time feedback from prevention to diagnosis, treatment and monitoring (OECD, 2017[131]).

New health technologies not only create new treatment options, they also modify the procedures for healthcare delivery (OECD, 2017[131]). As in the case of education, using them is not only a question of mastering the technology; it is equally important to adjust organisational structures to integrate them into existing processes. For example, medical specialists need to be available to interact remotely with patients when needed and solutions have to be found to provide urgent intensive care to emergency patients. Furthermore, new technologies are also changing how individuals and communities engage with healthcare providers. Thus, it is important to involve the general public in the development of these technologies and their implementation into existing healthcare systems. Otherwise there is a risk that they will not be accepted by the population.

3D printing: Decreasing reliance on supply chains

Additive manufacturing (often called 3D printing) is a process of making three-dimensional solid objects by adding layers of material on top of each other. It has the potential to transform traditional manufacturing processes based on large centralised factories into a decentralised manufacturing process that integrates large parts of the value-added chain. Decentralised manufacturing technologies have the potential to make small-volume production much cheaper relative to mass production. This could allow some goods to be produced in small volumes directly in regions, rather than be shipped from large factories

to rural areas. Eventually, it could allow small businesses and even consumers to design and assemble final products.

The technology is already available today and the 3D printing market is growing rapidly. 3D printers are already capable of producing products from a variety of materials and 3D-printed goods are sold in various sectors including aerospace, jewellery and medical devices (Beyer, 2014[132]). While mass production using 3D printing is still less common, the technology is already significantly altering the market for some machined plastic and metal parts. For instance, Boeing has already replaced machining with 3D printing for over 20 000 pieces (OECD, 2017[133]).

Mainstreaming 3D printing will largely depend on the evolution of the cost of switching from mass-manufacturing methods to 3D printing. The small size of current printers and quality requirements of input materials (plastics, resin, ceramic and metals) still pose barriers to the widespread production of some goods. However, the technology is maturing quickly and is likely to become more common for the production of various goods at competitive prices (OECD, 2017[134]).

3D printing creates new opportunities for economic development in peripheral regions

From a regional development policy perspective, 3D printing offers two major opportunities. First, it reduces the dependence of businesses on established supply chains. Such supply chains are often clustered geographically and businesses located far away from them face more challenging logistics. By integrating the production process, 3D printing reduces the logistical complexity of production, which could potentially benefit businesses in remote regions the most. 3D printing can also bridge supply gaps for the delivery of time-critical parts in the production process. Thus, companies could become less reliant on just-in-time delivery. Likewise, urgent medical goods can be produced and delivered much faster through 3D printing than through centralised production processes. For example, hospitals in rural areas can use 3D printing to prepare tailor-made casts or implants without the need to send specifications to specialised centres and wait for the final prosthesis to be delivered. All these benefits are most valuable in remote regions, where distances are greater.

Second, 3D printing reduces the costs of prototyping and small-scale production (Conner et al., 2014[135]). This is a particular advantage for start-ups and SMEs, which could increase innovation and firm creation. For example, in Colombia, 3D printing has been applied in innovative ways in fashion design (Ishengoma and Mtaho, 2014[136]). By reducing the advantages from economies of scale, this effect also encourages production tailored to local needs. As a consequence, production could become more decentralised. Smaller firms that are located within regions would often be best placed to produce for local markets because they know the demand best.

Although 3D printing is a technology that provides opportunities especially for rural areas, some challenges to use these opportunities remain. There is a lack of professionals qualified to operate and maintain 3D printers. Since these professionals are in high demand across most national economies, rural areas struggle to attract and retain experienced workers (OECD, 2018[137]). Unless this skills gap is overcome, there is a risk that 3D printing will benefit primarily regions with highly educated workforces. Enhancing the knowledge about the technology's possibilities is critical to allow rural business to prepare and plan production processes. In some cases, government agencies and research institutes provide 3D printing services directly to businesses. For example, regional public agencies such as the Institute for Entrepreneurial Competitiveness in Hidalgo (Mexico) are already offering

3D-printed prototypes to local entrepreneurs, mainly from the textile industry (OECD, forthcoming[138]).

Unmanned aerial vehicles: Improving productivity

Drones or unmanned aerial vehicles are unmanned aircrafts that are remote-controlled or operate autonomously. Drones are already undertaking complex, time-consuming or dangerous tasks in industries such as agriculture, construction, retail, insurance and entertainment. For example, drones are used to check remote infrastructure, such as oil pipelines, count wildlife and monitor forest fires (Rao, Gopi and Maione, 2016[139]). In farming, drones are used to monitor livestock and crops, allowing farmers to survey large areas more quickly. This process can be further automated through intelligent systems that do not require farmers to monitor video feeds but rather flag anomalies that need to be investigated. Beyond monitoring, drones are also used to intervene directly in the agricultural production process, for example by spraying pesticides (OECD, 2018[137]).

Automated drone-based deliveries are still in their infancy, but could transform postal services, especially in sparsely populated areas. Amazon Prime Air, DHL and Google have already conducted tests of deliveries with drones, and in 2015, the US Federal Aviation Administration approved the first commercial drone delivery (Xu, 2017[140]). Amazon has projected that once the service is fully deployed it will be able to deliver more than 80% of its goods through air (Rao, Gopi and Maione, 2016[139]). Drone-based deliveries may become commercially available within five to ten years. They are likely to be firstly deployed in rural areas since it is far more difficult for drones to navigate buildings and infrastructure in more densely populated cities (Xu, 2017[140]). Once widespread, drone-based deliveries would not only improve the supply of goods in rural areas, they could also make it easier for rural producers to reach new markets with their products.

Rural areas can also further benefit from economic activities around the development and testing of drones, which cannot be done in urban areas. As most of the regulatory framework in OECD countries prevents the use of drones in dense urban settings (OECD, 2018[137]), the technology can only be tested in sparsely populated areas. This could make rural areas attractive for technology and R&D companies, which, if well managed, could generate knowledge spillovers in local communities.

However, regulation around the use of drones is often not adapted to conditions in rural areas. At the moment, there are mostly national guidelines on the use of drones, which do not always take regional conditions into account. Sometimes, guidelines are also imprecise about the areas where certain kinds of drone use are permitted. As a consequence, drone users and developers operate in legal grey zones (Levush, 2016[141]). Providing more clarity about the areas and conditions in which certain types of uses are permitted could help the development of an industry built around drones.

Drones also have several potential downsides that need to be addressed. Beyond obvious safety and privacy concerns requiring appropriate regulations, drone deliveries create competition for the local retail sector. This is a concern primarily in rural areas, where the local retail infrastructure is sparse and even the closure of a single shop can be a serious loss for a community.

New approaches to agricultural practices

In the agricultural sector, there is a wide range of innovations with the potential of substantially changing the way food, fibre and biofuel is grown and distributed. All of these developments hold the promise of achieving more resilient, productive, and sustainable agriculture and food systems and enabling comprehensive farm-to-fork traceability. At the core of such innovation lies the increasing capacity to capture, analyse and exchange agricultural data. So far, four key trends have been identified as part of the digitalisation and automation of farms: 1) the ratification of production processes; 2) data-driven decision making; 3) innovation from traditional suppliers as well as new actors entering the market; and 4) the reduction of information asymmetries between different actors (OECD, 2018[142]).

The data-driven technologies that are enabling the surge of "smart farming" or "e-farming" leverage ICT, sensors, the Internet of Things (IoT), robots, drones, big data, cloud computing, artificial intelligence and blockchain (OECD, 2018[142]). The integrated use of these technologies supports farming innovations such as satellite data to monitor crop growth and water resources, automated agricultural production, and ICTs to connect farmers in new ways (OECD, 2018[142]).

For example, precision farming is a pioneer technique that provides farmers with near real-time analysis of key data about their fields, which is paving the way for full automation of farms (OECD, 2017[143]). This technique uses big data analytics to provide productivity gains through an optimised use of agriculture-related resources including savings on seeds, fertiliser, irrigation and even a farmer's time. The development began with yield mapping and later developed into technology that provides precision-guidance throughout the entire agricultural production cycle (OECD, 2017[143]).

These early products have since been enhanced by using a combination of sensors and GPS on tractors that not only drive themselves, but also use analytic systems that permit the vehicles to plant, water, harvest and communicate among themselves. It is estimated that autonomous tractors can plant or harvest 200-250 hectares per day (in comparison to the 40-60 acres that a single farmer can manage without automated technology) (OECD, 2017[143]). In 2017, the project "Hands Free Hectare" led by Harper Adams University in Shropshire (England) and the firm Precision Decisions, resulted in the first farm in the world to successfully plant, tend and harvest a crop in a completely automated way (Feingold, 2017[144]).

Automation of farms and the large-scale use of ICT systems require fast and reliable mobile Internet connections throughout rural areas. In order to seize the benefits of the deployment of data-collection technologies, policy making should address persisting issues regarding connectivity, particularly in remote regions (OECD, 2018[142]).

Agricultural data governance and regulation will be central to ensure that rural communities benefit from the automation of agriculture. The control of agricultural data by major agriculture technology providers has led to controversial discussions on the potential harm to farmers. The benefits of data-intensive equipment for farmers can be uncertain unless ownership of data is well-defined (OECD, 2017[143]). Local and regional governments should push for data governance regulation that empowers and involves local communities in the automation process, and takes into account local specificities. Some countries have already made step forwards on this. In the United States, the American Farm Bureau Federation met with major providers of precision farming technologies to produce the *Privacy and Security Principles for Farm Data* in 2016.

Long-term perspectives on the future of food

Several global trends are influencing food security and the overall sustainability of food and agricultural systems. In addition to a higher food demand from a larger world population, income growth in low- and middle-income countries adds pressure on the dietary transition towards higher consumption of meat, fruits and vegetables, relative to that of cereals, which would require shifts in output and pressure on natural resources (FAO, 2017[145]).

Innovative systems that protect and enhance the natural base while increasing productivity are hence needed. Synthetic meat production, insects or land-based fish farming are some examples of how innovative technologies can participate in the future of food. Synthetic meat is a niche technology that can attain the dual goal of coping with an increasing demand for food and protein while reducing the environmental impact of regular livestock (i.e. less land and water consumption). In the immediate future, progress will come from better technologies to use plant protein as a meat substitute. In the long term, meat grown from animal cells *in vitro* could replace meat from livestock (Alexander et al., 2017[146]). However, it is unclear when the technology will be ready for large-scale adoption: although it is possible to grow *in vitro* meat in small quantities, several important technological obstacles remain for commercialisation (Hocquette, 2016[147]).

Insects are another alternative source of protein that can be produced with lower levels of greenhouse gas emissions and water consumption. They are high in fat, protein and micronutrients. They have the advantage of having high production efficiency due to their rapid growth rates and maturity. Moreover, 100% of the production is edible – opposed to 40% for cattle (Alexander et al., 2017[146]). Products made from cricket flour are already on the market and several companies are actively researching the potential for the use of insects in protein production. However, while the technological challenges to the use of insects are manageable, cultural challenges concerning the acceptance of this food source are likely to be more severe.

Further technological developments in the field of aquaculture (or aquafarming), more specifically in land-based fish farming, are already changing aquaculture practices. Aquaculture is mostly responsible for the rapid growth of fish for human consumption. In 1974, it provided only for 7% of fish for human consumption and by 2004 it had increased to 34% (China represents more than 60% of global aquaculture production) (FAO, 2016[148]). However, current aquaculture practices are often inefficient, volatile, susceptible to disease and damaging to the environment (Hodgkins, 2017[149]). For instance, conventional aquaculture systems depend on flow-through of clean water from freshwater sources or coastal currents, thus depending on an ample supply of high-quality water. On the other hand, in recycling aquaculture systems, effluent water leaving the tanks is treated and refreshed before being returned, thus reducing water consumption (Kvernevik, 2017[150]). Other benefits include more flexibility for choosing location and species for farming as well as a high yield potential. While research is still ongoing, especially to implement land-based fish farming at an industrial scale, some firms such as Niri in Norway and Marvesta in the United States have begun using it for commercial purposes.

If any of the above-mentioned technologies become widespread, it would have large implications for agriculture. It would create an opportunity for rural regions to diversify their production of food and unlock new business opportunities that are more sustainable, but it would also threaten established modes of production and could harm established producers unless they adapt their business models.

Note

1. Education in the context of the underlying economic model is taken as a proxy for the more abstract notion of "skills".

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Chapter 4. Preparing regions for demographic and environmental transformations

This chapter focuses on global demographic and environmental megatrends. It first looks at the social and economic effects of natural population decline and ageing. It then discusses the regional effects of three different kinds of population flows: 1) the movement of people from rural areas to cities; 2) the regional and local impacts of international migration in OECD countries; 3) global tourism, which is an increasingly important factor for many regional economies. The chapter then analyses the implications of environmental megatrends by focusing on climate change. The chapter concludes with a discussion of the future of natural resources, by focusing on the sustainability of natural resource extraction and implications for regional policy and by analysing the design of new approaches to strengthen the circular economy at the local level as a tool to reduce the need for new resources.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

This chapter discusses global demographic and environmental megatrends. These megatrends have broad implications for regional policy that go beyond economic concerns. Social policy, environmental policy and education policy, among others, will all be affected by the demographic and environmental transformations discussed in this chapter. Yet, this does not imply that economic consequences of demographic and environmental megatrends are less important. By transforming the economic framework conditions in all regions, they will have profound effects on regional economies. For example, declining working-age populations are already creating shortages of workers in some OECD regions. In the future, such shortages could increase unless they are counter-balanced by other factors, such as increasing automation.

This chapter examines three factors that drive demographic change in regions: ageing, internal mobility and international migration. It analyses the consequences of longer life expectancies and low birth rates and shows how these factors differ across regions. Subsequently, the chapter focuses on population flows, starting with internal mobility. Within countries, people tend to move from rural to urban regions, thereby causing population decline in many rural areas, while causing population growth in urban areas. In fact, large cities are frequently growing even in countries that have shrinking populations in aggregate. As most people move to a large city when they are young, internal mobility also contributes to the growing ageing gap between rural and urban regions.

Moving beyond internal mobility, this chapter discusses the regional and local impacts of international migration. This second type of population flow is a global phenomenon with strong local implications. Migration can increase economic vibrancy and diversity. As migrants tend to be younger than native populations, international migration can also compensate natural decline in local working-age population. Yet, migration can also create challenges related to service delivery and the labour market integration of immigrants. Largely, these challenges are borne by local governments that provide services such as language classes.

Subsequently, the chapter discusses the consequences of tourism for regional development. While tourism is not a demographic trend itself, it is closely linked to demographic developments. Its importance is likely to increase in the future due to the rapid growth of urban middle classes in emerging economies. Furthermore, tourism contributes to the mobility of workers across countries by increasing the openness towards other cultures. To some degree, tourism and international migration are also conceptually linked, as both phenomena are cross-border population movements due to an increasingly globalised world.

After discussing demographic megatrends, the chapter focuses on environmental megatrends, the third group of megatrends presented in this report. In this context, a particular emphasis is placed on climate change. In contrast to all other megatrends discussed in this report, climate change is a threat that offers no upsides for most regions. Thus, policy responses have to focus on mitigation measures to limit the increase in global temperatures, and on adaptation measures to reduce its negative impacts. One of the main implications of climate change is the need for ever-stricter standards for greenhouse gas (GHG) emissions. Only firms that manage to adapt to these new requirements will be successful in the long term.

Yet, environmental megatrends go beyond climate change. In particular, resource availability is an environmental factor that will be of increasing importance for regional economies in the coming decades. The chapter addresses natural resource from two angles. First, it focuses on the sustainability of resource extraction and its implications for regional policy. While resource extraction is an economic opportunity especially for rural regions,

its environmental impact is a growing concern. Second, the chapter discusses strategies to reduce future resource needs in order to become more sustainable. In this context, the chapter presents new approaches to the circular economy that yield not only environmental benefits, but also economically beneficial efficiency gains.

Population decline and ageing across regions

Demographic change is less prevalent in the public debate than many other global megatrends. Nevertheless, the effects of population decline and ageing on cities and rural areas will be significant. While growing life expectancies are one of the greatest human achievements, the transition to an ageing society also creates challenges. In particular, demographic change will strain social security systems, as a shrinking workforce will have to cover benefits for an increasing number of retirees. Moreover, healthcare and other public services will have to be adapted while tax revenues are declining due to a shrinking working population.

The impacts of population decline on regions and cities

The large decline in fertility rates between the 1960s and 1980s is starting to be felt as baby boomers and the following generations are reaching retirement age. In many regions, population decline is already a reality: 29 out of 36 OECD member countries had regions with shrinking populations. Across the OECD, 691 of 6 460 Territorial Level 3 regions (i.e. 11%) lost population between 2014 and 2017 (Figure 4.1). In ten countries, more than one in five regions declined. These include southern European countries (Greece, Italy, Portugal, Spain), eastern European countries (Estonia, Hungary, Latvia, Lithuania and Poland) and Japan. These countries generally have fertility rates well below the replacement rate, which leads to ageing societies.

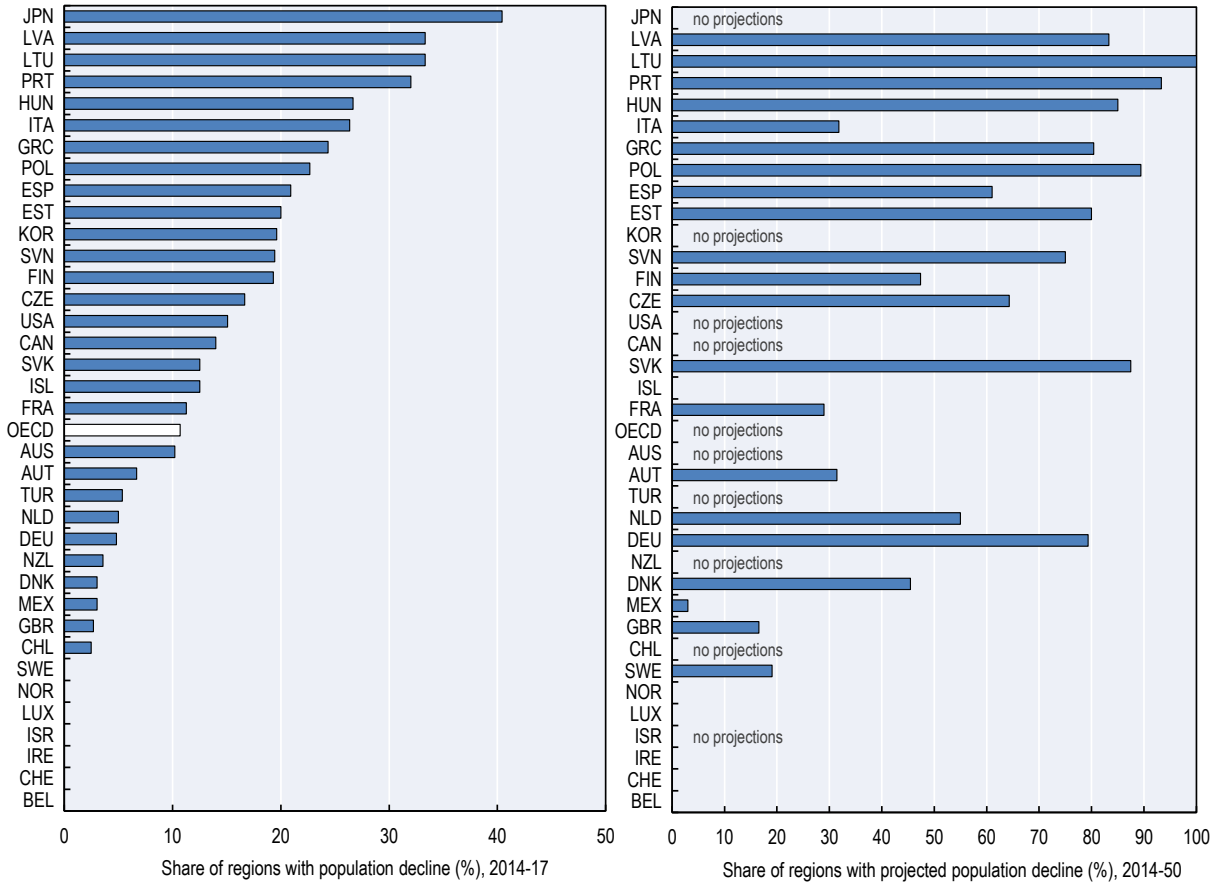
Regions will have to address the challenges associated with overall population decline. Projections until 2050 show that the population in nearly all regions is expected to shrink (Figure 4.1). For countries with available data, between 2014 and 2050, 56.8% of 1 363 OECD TL3 regions are projected to lose population. A shrinking labour force and loss of tax base will pose challenges to efficient service delivery, as fewer places will have the necessary critical mass to sustain health, public transport and other types of public services. A smaller local market and decrease in consumption will create fewer employment opportunities. Planning is likely to become more difficult as properties will become vacant or abandoned and public services will have to be closed down.

The impacts of ageing on regions and cities

Ageing is a second major factor in addition to decreasing birth rates that drives demographic change. Longevity has been continuously increasing in most OECD countries as healthcare technologies and availability have improved. The share of elderly people (i.e. 65 years old or older) is projected to increase in almost all regions over the coming decades. By 2050, nearly 30% of the population in European regions outside of metropolitan areas is expected to be 65 years old or older (Figure 4.2). The pressure is slightly lower in regions that are close to large metropolitan areas (28%). Regions that are part of cities with at least 250 000 inhabitants are expected to face a similar age profile (i.e. 27.5% of elderly people). Only regions that are part of large metropolitan areas, i.e. those with at least 1.5 million inhabitants, remain close to one-fourth (25%) of their population being 65 or older.

Figure 4.1. Population decline is affecting many regions and more in the next 30 years

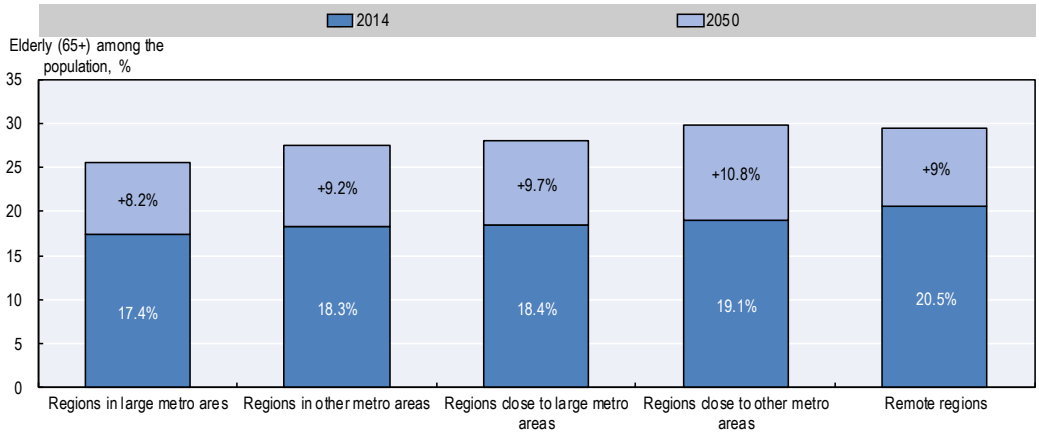
Percentage of TL3 regions where population declined 2014-17
and projections of the percentage of declining TL3 regions, 2014-50



Note: Population projections are for the main scenario developed by Eurostat in its "Europop2013" model for which regional projections were developed to complement the national-level projections.
Sources: OECD (2018), *OECD Regional Statistics* (database), http://dx.doi.org/10.1787/region-data-en and Eurostat "Europop2013" demographic projections.

StatLink https://doi.org/10.1787/888933922365

Figure 4.2. Projection of the percentage of elderly (65+) population in European TL3 regions



Notes: Population projections based on Eurostat's "Europop 2013 scenario". Administrative boundaries correspond to the NUTS 2010 classification.
Source: Calculations based on Eurostat statistics on regional population projections.

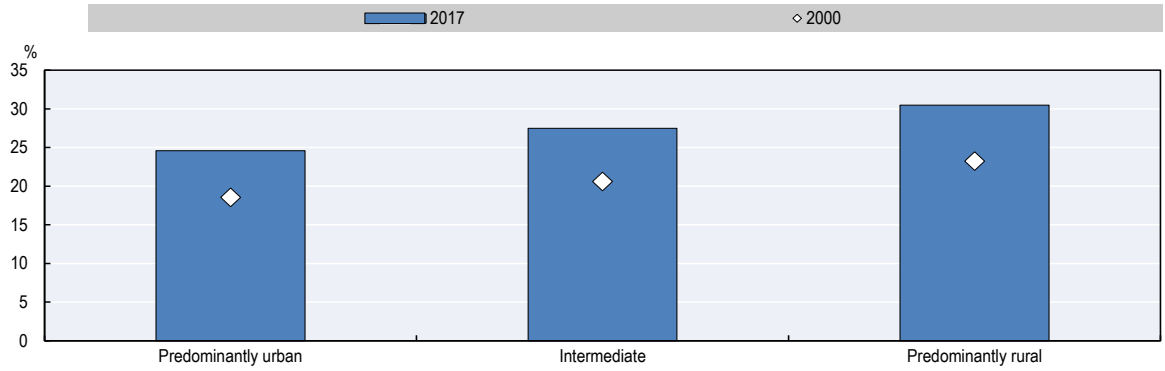
StatLink https://doi.org/10.1787/888933922384

Demographic trends in large cities tend to follow different patterns than in other places. Capital cities, which are usually among the largest cities of a country, tend to have some of the lowest shares of population over 65 and some of the lowest increases in that share over the next decade (EC, 2017[151]).[1]

Ageing is affecting most severely rural regions (Figure 4.3). The shift towards an older society strains economic development of regions and countries. The first immediate consequence of ageing is an increase in the dependency ratio, i.e., the ratio of retired people to those involved in productive activities, thus implying a reduction in the growth rate of GDP per capita. Yet, the need for additional productivity growth to compensate for this negative impact of ageing is moderate. The 20 TL3 regions where per capita GDP is most adversely affected by demographic shifts lost about 0.7 to 0.8 percentage points per year in per capita GDP growth over the 2006-14 period. An increase in productivity growth by the same margin, i.e. 0.7 to 0.8 percentage points, could have compensated and ensured that living standards remained constant. But even this modest annual increase can be difficult to achieve. In half of the 20 TL3 regions, the actual annual average labour productivity growth was below the required rate to compensate for the impact of ageing. Three out of the ten regions managed to avoid declining per capita GDP by raising employment rates, but in seven per capita GDP declined (Daniele, Honiden and Lembcke, forthcoming[152]).

Figure 4.3. Dependency ratio, elderly (% 65+) over population aged 15-64, OECD countries

Small (TL3) regions



Source: OECD (2018), *OECD Regional Statistics* (database), http://dx.doi.org/10.1787/region-data-en.

StatLink https://doi.org/10.1787/888933922403

Economic models predict that workers in ageing societies will save more as transfers from the next generations will not be able to sustain their pensions. This increase in savings is predicted to translate into an increased availability of capital, which should be invested in places where the returns are highest. This, in turn, implies capital flows from faster to slower ageing economies (Börsch-Supan, 2008[153]). However, in contrast to economic models, capital flows are actually moving in the opposite direction from slowly ageing to fast ageing countries (Acemoglu and Restrepo, 2017[154]).

One reason is that technological change creates opportunities for capital investments that raise productivity more in developed and rapidly ageing countries than in those with slower demographic change. There is evidence that the adoption of robots in industrial production is more prevalent in countries that are ageing faster. The same pattern can be found at the local level in US commuting zones (Acemoglu and Restrepo, 2018[155]). In those areas, the increased use of capital compensates for the decline in labour by raising productivity.

All regions will have to address the challenge of an ageing society (see Figure 4.2). A shrinking labour force relative to population will increase the burden of pensions and age-related services. Demand for "non-silver" (i.e. non-senior) goods and services will decline, and entrepreneurship and innovation are likely to contract as well. As such, the need to sustainably plan the available fiscal space and prepare public infrastructure and services are key challenges. It is important to note, however, that neither the potential negative economic and social impacts of ageing are inevitable, nor are the potential benefits of directed technological change and productivity growth mentioned above guaranteed. For example, in several countries, growth prospects will depend on the private savings rate and labour force participation of older workers. Both depend on policy choices that need to correspond to circumstances. In fact, labour market regulations and pensions systems that encourage early exits from the labour market are more harmful to growth the faster the ageing process (Oliveira Martins et al., 2005[156]). Addressing such incentives can often require significant intervention in core policy areas, such as labour market regulations (OECD, 2016[157]).

Global urbanisation

Domestic population flows are an important factor behind the uneven demographic development of regions. As discussed, the lower old-age dependency ratio in cities is primarily due to the domestic migration of young people into cities. However, rural-urban migration does not just affect the age profiles of cities and rural areas; the growth of cities is a global megatrend in itself that affects countries both inside and outside of the OECD.

As rapid population growth in many countries continues, understanding the process of urbanisation is essential to the design of policies to make "cities and human settlements inclusive, safe, resilient, and sustainable" in support of Sustainable Development Goal 11. Innovative policies and solutions are required to address the needs of urban populations, including housing, energy, environmental quality, healthcare and transportation. Further, smart investments in infrastructure and education are essential to promote inclusive growth, access to employment, and a safe and healthy environment.

This section previews the forthcoming analyses of a new, representative data set of all cities globally that will allow an unprecedented description of the dynamics of global urbanisation.[2] It shows that recent decades have seen a strong increase in the number of people living in megacities with more than 10 million inhabitants. However, driven by overall global population growth, also the number of smaller cities with between 100 000 and 1 million inhabitants grew rapidly. Yet, the section highlights that, despite an overall trend towards urbanisation, a significant number of cities have shrinking population due to emigration and low fertility rates.

Table 4.1 shows that 40% of the world's population lived in cities with more than 100 000 inhabitants in 2015. The vast majority of these cities (97%) have fewer than 1 million people. However, cities with more than 1 million inhabitants have a larger population share. Close to 1.62 billion people live in cities with more than 1 million inhabitants. Among them, a third (530 million people) live in cities with more than 10 million inhabitants. In contrast, only 1.33 billion people live in cities with 100 000 to 1 million inhabitants. Nevertheless, this impressive number shows the importance of mid-sized cities.

Table 4.1. Population and built-up statistics by city size

	2015				1990			
Size	Population	Cities	Average built up	% world	Population	Cities	Average built up	% world
>10 million	530	28	77	7%	274	18	97	5%
5-10 million	295	43	96	4%	150	23	100	3%
1-5 million	796	394	104	11%	551	285	114	10%
500k-1 million	363	523	92	5%	271	396	106	5%
100k-500k	964	4811	82	13%	764	3926	78	14%
Total	2951	5799		40%	2010	4648		38%
Else	4398			60%	3299			62%
World population	7349				5309			

Note: Built-up per capita is reported in square metres per inhabitant. Population is reported in millions.
Source: Calculations based on the Global Human Settlement Layer (Pesaresi and Freire, 2016[158]).

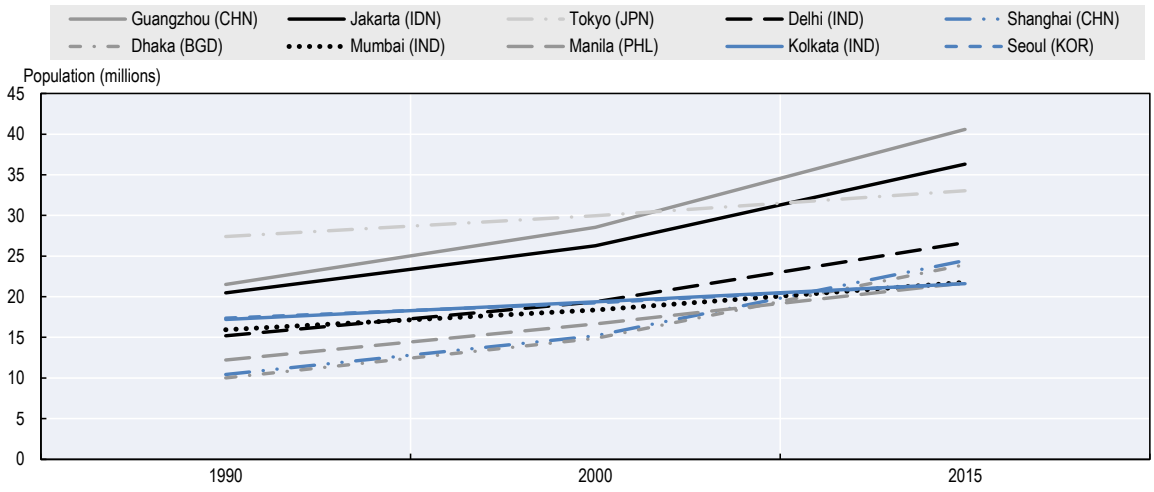
Drivers of growth: Megacities and urbanisation in the hinterlands

As the world population grows at a rapid pace, the world's largest cities grew fastest as a share of the urban population. In 1990, only 18 of the world's cities had a population of over 10 million inhabitants. The number of these cities, often referred to as "megacities", increased to 28 by 2015. Over the same time, population living in megacities more than doubled, from 274 million to 530 million, a rise from 5% to 7% of the world population. Of the cities that grew into megacities between 1990 and 2015, the majority are located in Asia (7) with the exceptions of Teheran, Lagos and Istanbul.

East Asia has the highest share of its population living in cities with over 10 million inhabitants – nearly 11% – followed by South Asia and North America, and Latin America. Sub-Saharan Africa and Europe and Central Asia are the regions with the lowest concentration of population in megacities, 1.2% and 3.1% respectively. Yet, population growth in the two largest African cities, Lagos and Johannesburg, has been rapid and population has doubled since 1990. In contrast, population growth in megacities in Europe (Istanbul, Moscow and Paris) has been substantially slower.

While the growth of megacities drives popular views of the process of urbanisation in Africa and Asia, an important source of urbanisation is the dramatic increase in smaller urban centres. In Africa, cities with between 100 000 and 1 million inhabitants account for 191 million people. In contrast, African cities with more than 10 million are home to just 11 million people, and cities with between 5 million and 10 million inhabitants have a total of 30 million inhabitants. Similarly, there are 345 million inhabitants in South Asian cities with 100 000 to 1 million inhabitants, while cities with more than 10 million inhabitants are home to 255 million people. Furthermore, 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. Of these, 70% are located in Africa and Asia.

Figure 4.4. Population growth of ten largest cities in the world



Source: Calculations based on the Global Human Settlement Layer (Pesaresi and Freire, 2016[158]).

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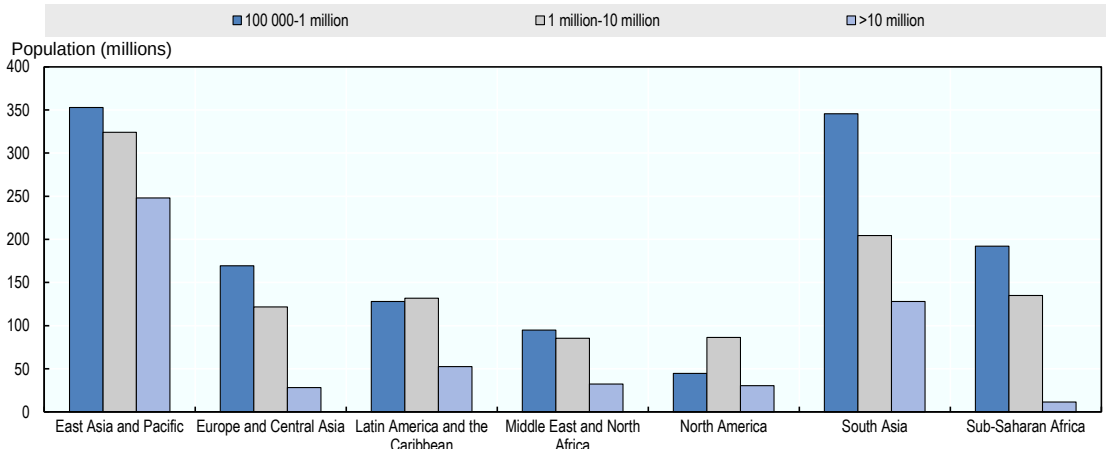
Figure 4.5. Distribution of urban population by city size, region, 2015



Notes: The figure shows the distribution of population in each region by city size. Sub-Saharan Africa includes Central Asia.
Source: Calculations based on the Global Human Settlement Layer (Pesaresi and Freire, 2016[158]).

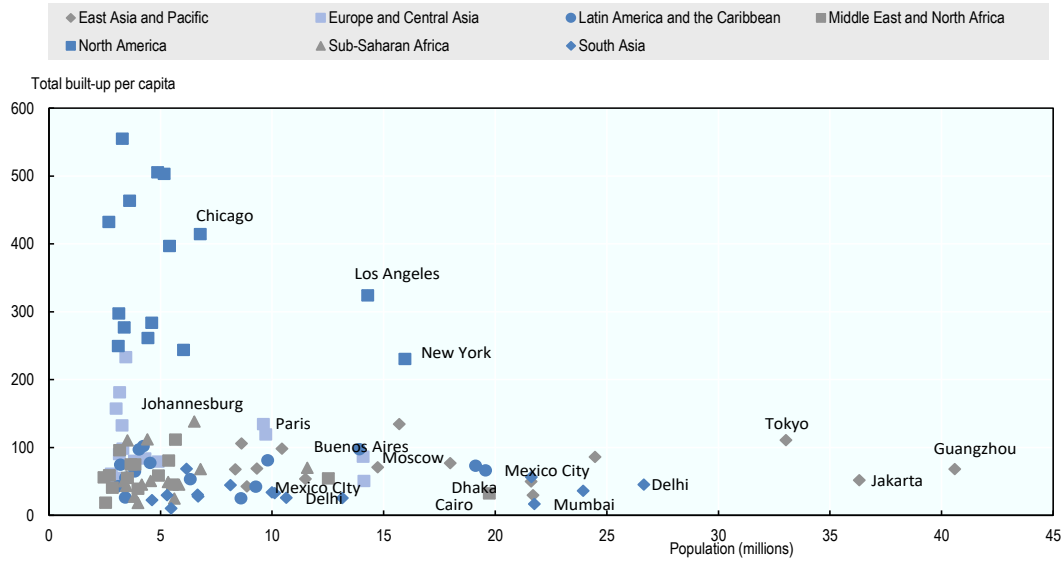
StatLink https://doi.org/10.1787/888933922441

Despite overall growth of cities, population declined in 1 159 cities with more than 100 000 inhabitants worldwide, or 25% of all cities with a population over 100 000. Most declining cities were relatively small. Among cities with 100 000-500 000 inhabitants, 996 cities (27%) experienced population decline while only 45 cities (14%) with over 1 million people did.

Urban density depends more on the region than on city size

Population density is a key characteristic of cities that influences many policy-relevant outcomes, such as the intensity of agglomeration economies and the costs of public transport provision. Figure 4.6 shows that on a global scale, population density levels across cities vary strongly by continent. North American cities are by far the least dense while cities in South Asia have the highest densities. Dhaka, a very dense city in Bangladesh, is more than ten times denser than Chicago, for example. In smaller cities, the difference is even more striking. For example, the average South Asian city with around 100 000 inhabitants is 25 times denser than the average city of the same size in North America.

Figure 4.6. Total built-up area per capita of the 15 largest cities by region



Notes: The figure provides a scatterplot of the 15 most populated cities by region. Built-up per capita is reported in square metres per inhabitant.
Source: Calculations based on the Global Human Settlement Layer (Pesaresi and Freire, 2016[158]).

StatLink https://doi.org/10.1787/888933922460

The rapid population growth in cities over the previous decades has not been fully matched by growth in built-up areas, leading to densification in all but the smallest cities. This densification occurred across all regions and city sizes but was especially strong in megacities that experienced large population inflows that were often not matched by spatial expansion. Yet, sprawl has not necessarily become a less important issue. Many countries that experienced densification in city centres also experienced sprawl in their surrounding areas.

Migration: A global phenomenon that requires local action

Migration is another global demographic trend whose implications are predominantly felt at the regional and local levels. It interacts in many ways with the already discussed trends of population decline and ageing. For example, migration of working-age population from Eastern to Western Europe contributed to the population decline in some Eastern European countries during the previous decades, while it contributed to population growth in Western European destination countries. Given that migrants also tend to be younger than the native population, international migration also has a significant effect on age profiles.

Since the 1980s, net migration flows have increased across regions of the world. Countries in Europe, North America and Oceania combined received on average a net inflow of 3.1 million migrants per year between 2000 and 2010 (UNDESA, 2017[159]). Between 2010 and 2015, net migration decreased and the same countries received an average net inflow of 2.1 million migrants per year (UNDESA, 2017[159]). In 2015, migration figures temporarily peaked as a consequence of the Syrian refugee crisis. During this time, approximately 2.4 million non-EU citizens moved to the EU (Eurostat, 2017[160]), which corresponds to somewhat less than 0.5% of the EU's total population.

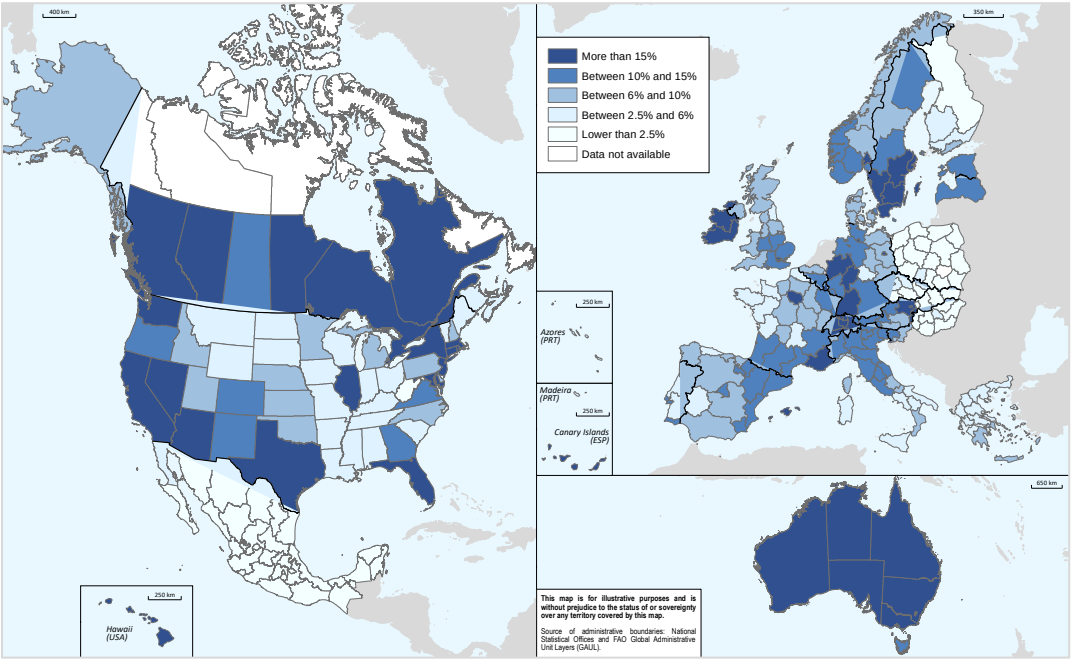
There are multiple factors driving migration. In some cases, countries and regions actively try to attract migrants to meet labour shortages from ageing and enhance economic growth. Many OECD countries, for example, have programmes to encourage immigration by high-skilled foreigners. In other cases, migration is the response to global crises and accepting refugees from war or genocide is a humanitarian imperative. Yet, even in these cases, migration can create opportunities for host regions in terms of economic growth and cultural diversity if the integration of migrants is successful. Compared to the overall population, the share of young and working-age population among migrants is disproportionally high, which is beneficial in ageing societies. Furthermore, many migrants are highly motivated to work hard to seek a better life, which is documented by the often long and perilous journeys many refugees make to reach OECD countries.

Migration: A global phenomenon with local implications

While migration has global roots, many of its consequences emerge at the regional and local level. Migrants tend to be geographically concentrated in specific regions. As Figure 4.9 shows, the regional share varies strongly within countries and some regions have much higher shares of migrants than others. Migrants are particularly drawn to cities: approximately two-thirds of migrants live in metropolitan regions (OECD, 2018[161]). This geographic concentration of migrants has been increasing over time. Between 2005 and 2015, areas with larger existing migrant communities also experienced the greatest increases in the population share of migrants (Diaz Ramirez et al., 2018[162]).

Figure 4.7. Population share of migrants across OECD regions

Large regions (TL2), 2015



Source: OECD (2018[161]), *Working Together for Local Integration of Migrants and Refugees*, https://doi.org/10.1787/9789264085350-en.

The challenges and opportunities of migration are different across regions within a country. Neither the characteristics of host regions nor the characteristics of migrant communities –

such as their education, age or skills – are uniform across space. For example, highly skilled migrants are more likely to settle in regions with a more highly skilled native-born population. Within the population of migrants itself, there are also clear disparities in the geographic distribution and outcomes between recent and settled migrants (OECD, 2018[161]). A territorial approach is required to anticipate the impact of future migration and to design policies that take into account both the characteristics of new arrivals and of the territory receiving them.

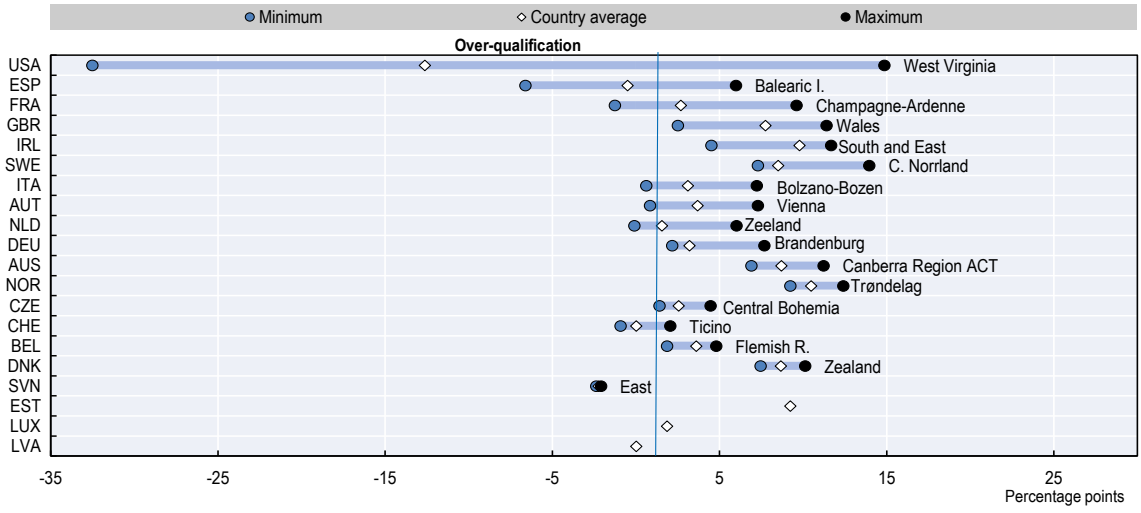
Important differences in migrants' well-being and labour market outcomes across regions

The well-being of migrants often differs substantially across regions of the same country. Subnational differences in housing conditions, income levels, employment rates or over-qualification rates all highlight the importance of regional factors in ensuring that gaps between native born and migrants are addressed (OECD, 2018[161]). The gap in housing conditions between migrants and natives, for example, varies across regions and the share of migrant households living in overcrowded dwellings is greater in urban than in non-urban areas.

Access to employment opportunities for migrants constitutes a challenge for many OECD regions. In 2014-15, 11% of the migrant population was unemployed in OECD countries, i.e. 2 percentage points more than native-born populations (OECD, 2018[163]), but the situation differed widely across regions. In regions in Northern and Central Europe, in particular, migrants were more likely to be unemployed than native born. Migrants, moreover, are more likely than natives to work in positions that fall below their level of education (Figure 4.10).

Figure 4.8. Over-qualification rates of the foreign-born, relative to the native-born across OECD regions

Large (TL2) regions, 2014-15; difference between foreign-born and native-born outcomes



Note: Over-qualification refers to working in a low- or medium-skill position despite a high level (tertiary) of education. Larger values indicate a larger tendency of migrants to be over-qualified.
Source: OECD (2018), *OECD Regional Statistics* (database), http://dx.doi.org/10.1787/region-data-en.

StatLink https://doi.org/10.1787/888933922479

A number of obstacles that migrants face to enter the workforce explain such gaps in labour market outcomes; for example language barriers, discrimination, work permits, visa issues, etc. In addition, the process for validating their educational and professional qualifications is slow and in many cases, migrants from non-OECD countries are required to obtain or complement their education to match national standards. Slow registration and documentation processes can thus substantially slow down migrants' ability to enter the workforce.

Policies to integrate migrants at the regional and local level

In recent years, recognition of the role of cities and regions in contributing to the integration of migrants, and in particular of refugees, has grown. Many cities and regions within the EU responded to the 2015 refugee crisis by scaling up service delivery to meet the needs of arriving migrants. The role of local governments is also reflected in the milestone international agreements for global migration governance, namely the Global Compact for Migration and the Global Compact for Refugees, which 170 countries endorsed at the end of 2018. Their implementation and that of related inter-governmental agreements greatly depends on local level capacities. The OECD has produced a "Checklist for public action to integrate migrants at the local level" based on the experiences collected across 72 EU cities. The 53 tools and 80 practices compiled in this OECD report (OECD, 2018[161]) set a pathway for taking migration into account when planning, implementing and evaluating related local policies.

While migration policy largely remains a national competence, integration policies are often the result of a combination of central/federal and local schemes. Given that integration policies concern several policy fields with shared responsibility across different levels of governments, strong multi-level co-ordination mechanisms need to be in place to avoid the overlap of initiatives and to benefit from complementary action. A good example of multi-level co-ordination is the institutionalised conference of ministers for integration of the German *Länder* (*Integrationsministerkonferenz*), which fosters a dialogue between the national government and the *Länder*, encourages experience-sharing, and develops integration indicators that are comparable across *Länder*.

A local integration strategy and horizontal co-ordination: Key tools for ensuring coherent settling in

Successful integration depends on "integrating" policies that have an impact on the migrant population and other inhabitants living in a specific place: education, housing, labour integration, welfare, health, etc. Thus, horizontal co-ordination is essential to mainstream integration standards across all relevant municipal policy fields and involve non-public actors to ensure that no one is left behind. For instance, the city of Vienna adopted a strong model for incorporating integration across departments within the administration: through contracts, the integration unit within the public administration monitors each department's achievements towards the city's integration strategy.

Integration strategies are increasingly characterised by a balance of measures aiming at ensuring equal access to general public services and specific measures directly targeting migrant populations. For example, many cities set aside dedicated resources for strengthening the skills of social and health workers in dealing with clients with different cultural and ethnic backgrounds. Examples of targeted local support also exist across other dimensions of integration: e.g. language classes, emergency accommodation, legal assistance, top-up welfare allowances, etc. For instance, the city of Paris has invested in

several mechanisms to facilitate the process of applying for residence permits, including free legal consultation services and translation of administrative documents. Other cities such as Berlin, Glasgow and Amsterdam have trained local "guides" to accompany newcomers after their arrival. These provide help with administrative procedures as well as in identifying labour market or educational paths.

Explicit local objectives for integration and appropriate tools to monitor progress towards them can help to prevent attempts to use migration as a political tool to stoke tension. Cities play a major role in shaping the public discourse, providing objective data and informing about the possible positive impacts of migration through a wide range of communication tools (i.e. public meetings, campaigns, billboards, information points across the city, etc.). Some cities, such as Berlin, have built their public image campaigns around diversity while others, like Barcelona, have made all citizens responsible for increasing tolerance and inclusion by training volunteers as "anti-rumour agents". Such initiatives increase cities' capacities to change the narrative: i.e. seeing migrants as an asset rather than a liability.

Non-governmental organisations (NGOs) are important service providers that complement cities' actions towards the most vulnerable groups in society (OECD, forthcoming[164]). During the 2015 migration crisis, many NGOs provided basic services for a rapidly increasing migrant population in need. Many cities have sought reinforced collaboration with non-public actors to implement initiatives that foster integration and social cohesion. This translated into collaboration mechanisms that organise objectives, budget and activities, such as the Athens Coordination Centre for Migrant and Refugee Issues. Such mechanisms are important to ensure that government-led initiatives and NGO-led initiatives are aligned with each other and do not overlap or leave gaps in their efforts.

Enabling migrants' participation into the labour market is among governments' most important objectives. However, local governments often have only limited authority in these areas, since labour permits and the validation of professional and educational qualifications are competences belonging to higher levels of government. Nevertheless, local governments can implement a wide range of initiatives to facilitate migrant access to the labour market. In particular, municipalities often invest in facilitating the transition from education to initial work experience of students with migrant backgrounds through vocational education training. This is undertaken in partnership with employers who engage to integrate migrant pupils through trainings and apprenticeships (e.g. in Berlin), and sometimes beyond the city boundaries through national public employment services or chambers of commerce (e.g. in Vienna). Furthermore, local governments can raise awareness among businesses concerning the opportunities of working with migrants. An example is the city of Berlin, which targeted employers through a billboard campaign stating "Refugee is not a job". Some professional associations established in collaboration with local authorities enacted pathways into employment for qualified doctors or engineers arriving as refugees (e.g. Glasgow in the United Kingdom and Gothenburg in Sweden). Other cities also undertake a skills assessment for newly arrived migrants to better match them with available jobs.

The future of demographic changes

Demographic change is gaining pace in most countries. Projections until 2050 show that the population in nearly all regions is expected to shrink and that nearly 30% of the population living outside metropolitan areas is expected to be 65 or older (Figure 4.1). This section first previews the results of a high-resolution population projection exercise for

selected OECD countries. Next, it provides suggestions and examples for turning demographic challenges into opportunities.

Looking ahead – high resolution population projections for 2030

Demographic changes at the national level can be forecast with a high degree of confidence. Birth rates and mortality rates change only slowly and those born today will be alive for many decades. Thus, long-term demographic projections at the national level are more accurate than many other long-term forecasts. However, for many policies, it is the demographic composition at the local level that matters more than national aggregates. Decisions such as where to build schools and what infrastructure to provide depend on the demographic composition of a neighbourhood.

Unfortunately, demographic projections at the local level are more difficult to obtain with accuracy than national-level projections because they have to factor in regional and local population movement within countries. Such population movements include age-dependent patterns not only across regions, but also within regions, which are difficult to capture. For example, young people from rural parts of a region can move to attend university in the region, move again once they find their first job and might move back to less dense parts of the region when they start a family. Once retired, people tend to move less within the region.

Population projections with a high spatial resolution for France, Italy, the Netherlands, the Slovak Republic and Slovenia (Box 4.1) show stark disparities in the expected demographic and population changes across and within regions and cities. Rural areas tend to be more strongly affected by population decline than cities, but many small and medium-sized cities will also have to prepare for decline. More than one in five functional urban areas is expected to lose population by 2030 and many more will see concentration of population within their urban centres at the expense of decline in the commuting zones. Some of these projections might be attenuated by technological progress, especially through automation of transport (see Chapter 3).

European TL3 regions with a per capita GDP level that is 25% below the (unweighted) average within the country are projected to have a share of elderly residents that is 1.8 percentage points above the (unweighted) average within the country in 2050, whereas those with a per capita GDP of 25% above the (unweighted) are projected to have a share of elderly residents that is 2 percentage points below the (unweighted) average. In other words, the regions 25% below country average GDP are projected to have an approximately 4 percentage points higher share of elderly residents than those 25% above the country average.

Box 4.1. Europe in 2030: High resolution ageing projections

Working with the European Commission's Joint Research Centre (JRC), the OECD has adapted the regional population projections of the main scenario of Eurostat's "Europop2013" model (Eurostat, 2015[165]). Europop2013 projects the current developments for fertility, mortality and net migration to 2080 at the national level and includes a component that projects demographic change at the regional level until 2050. These projections are combined with the JRC's large-scale land-use model "LUISA". LUISA considers the distribution of population and land use at the high-resolution (grid cell) level across Europe and allows to assess how aggregate trends or different policy scenarios affect the distribution of people and economic activity across Europe (Batista e Silva et al., 2018[166]).

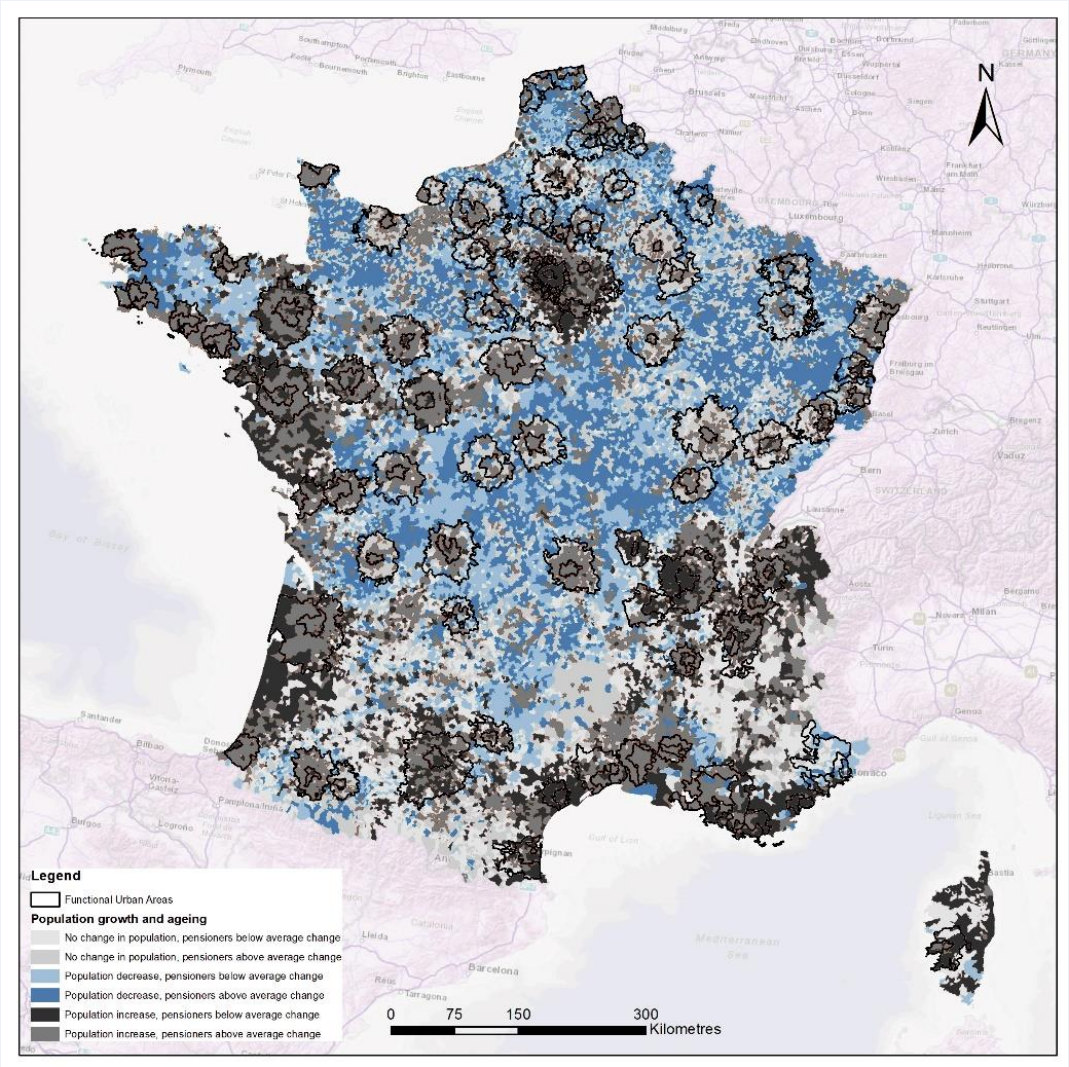
The high-resolution projections break the regional development down to the 100m x 100m grid cell level. To this end, the existing population distribution at the finest available level is distributed across grid cells. The process combines data on actual land coverage; population distribution; and a model that accounts for competing potential land uses, population movement and settlement patterns. The model distributes the population projections from Europop2013 within TL3/NUTS3 regions, which allows to assess not only aggregate population changes, but also to project where within a region these changes are most likely to occur.

The number of people moving in a region depends on projected annual mortality, estimated annual intraregional mobility per age class and the population composition of the region. Total pooled population is subsequently allocated at the grid cell level using functions describing local attractiveness for residence, modelled urban expansion and assumptions on the local housing stock. The newly allocated population is then further broken down into broad age classes, assuming that empty housing previously inhabited by a specific age group is slightly more attractive for that age group than for other age groups, while new housing stock is assumed to follow regional demand per age group. Housing stock may be empty as a consequence of resident mobility or as a consequence of mortality. The probability of movements and mortality are assumed to be constant for all members of an age class, regardless of their location. Finally, an iterative fitting procedure ensures that the population breakdown is consistent with modelled total population at the grid cell level and total regional population projections per age group.

About one in three functional urban areas are likely to stagnate or even slightly decline in terms of overall population. In many functional urban areas, growth is unlikely to be universal within their boundaries. For example, Figure 4.9 shows that for urban areas located in the centre and the north-east of France, the concentration of population within the urban centre is expected to increase, while population in the commuting zone is expected to decline. Most of this concentration is accompanied by more rapid ageing within the urban centre than in the rest of the country.

The complexity of projected changes becomes apparent at high resolutions. Detailed projections for all of France show strong disparities in the development between rural and urban areas, as well as within those two groups (Figure 4.4). Cities, at first glance, seem to fare better than rural areas, with most places expected to decline in population being located outside urban centres and their commuting zones. However, rural areas along the coastlines of the Atlantic and the Mediterranean Sea, as well as rural areas in the French Alps, are expected to grow in terms of population and at the same time experience slower ageing than the country as a whole.

Figure 4.9. Projected demographic change and ageing in France, 2014-30



Note: Population projections based on the main scenario of Eurostat's "Europop2013" projections.
Source: (Jacobs-Crisioni et al., forthcoming[167]). For the maps Esri, © OpenStreetMap contributors, and the GIS User Community.

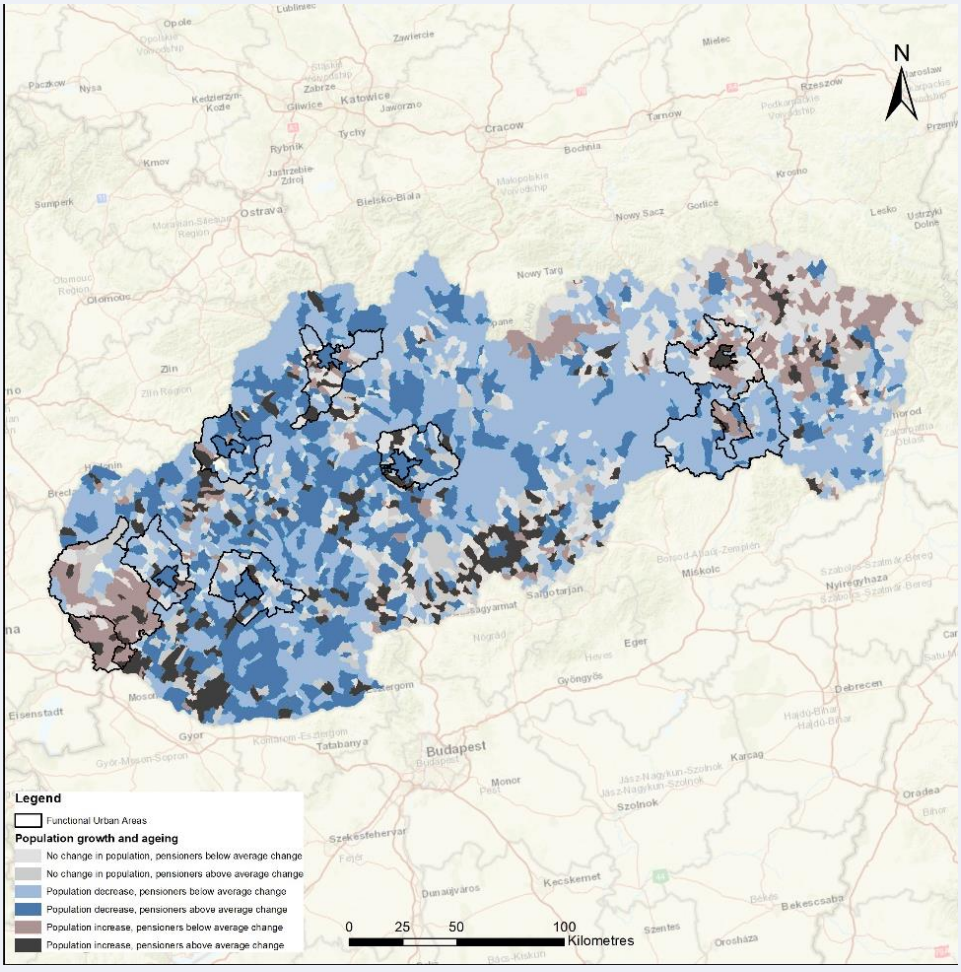
Medium-sized cities, similar to coasts and the French Alps, are for the most part also expected to grow. At the same time, the centres and large parts of the commuting zones are expected to age faster than the rest of the country. This pattern could create challenges for local municipalities in raising funds and providing adequate services. On the other hand, the geographical concentration of growth in the elderly population simplifies the challenge of efficiently providing health and care services, as well as adequate access to public infrastructures and housing.

The projected development for Paris and Lyon, the two largest cities in France, is notably different than that of other cities. The percentage of residents who are 65 years or older is growing much more slowly than in the rest of the country and is projected to be among the lowest in 2030. The urban centres of the two cities are also expected to age more slowly than the commuting zone, whereas urban centres of other French cities face above-average

ageing, at least in some parts. The projected resilience to population decline is evident in the largest metro areas of other countries as well. For example, the urban centres of Rome and Milan in Italy or those of the Randstad area in the Netherlands are expected to continue to grow and age more slowly than other parts of the country.

In Eastern Europe, the demographic divergence between the largest cities and smaller ones is even more pronounced. In the Slovak Republic, the population of the capital city Bratislava is expected to continue growing within the urban centre and most parts of the commuting zone (Figure 4.5). The demographic shift is also more subdued, as opposed to the surrounding rural areas where rapid ageing is more prevalent. Other than Bratislava, only Košice, the second largest city in the east of the Slovak Republic, and the smaller city of Prešov are projected to grow. Smaller cities between the major urban areas are projected to decline and age rapidly, in particular within their urban centres. For Košice, the trend towards population concentration within the urban centre is extremely strong. The commuting zone and some parts of the urban centre are expected to lose population, but the projected overall growth of the city is still the highest among all Slovak cities.

Figure 4.10. Projected demographic change and ageing in the Slovak Republic, 2014-30



Note: Population projections based on the main scenario of Eurostat's "Europop2013" projections.
Source: (Jacobs-Crisioni et al., forthcoming[167]). For the maps Esri, © OpenStreetMap contributors, and the GIS User Community.

Adapting to demographic change

Well-managed ageing can have upsides beyond the obvious advantage that people live longer lives. They include lower housing costs, lower environmental pressure and less congestion, which will create opportunities for space-intensive activities and flexibility in land use. Concerning population ageing, capital investments in OECD countries are already attenuating its negative economic and productivity effects (Acemoglu and Restrepo, 2017[168]). On the one hand, countries undergoing more rapid population ageing have adopted more industrial robots and automated technologies, which are capable of performing tasks previously undertaken by human labour. On the other hand, to adapt to an ageing workforce, a wide range of tools exist to alleviate the physical strain of work. For example, basic aids like hydraulic trolleys can help lift heavy materials.

Table 4.2. Possible implications of demographic change

	Potential benefits and opportunities	Potential costs and challenges
Population decline	– Less congestion will create opportunities for space-intensive activities and flexibility in land use – Lower environmental pressure – Lower housing costs	– Shrinking labour force – Smaller domestic market – The loss of tax base will create challenges to efficient service delivery – Building stock and infrastructure will need to be adjusted to meet lower population levels
Population ageing	– High life expectancy – New demand for goods and services and new market opportunities (the "silver economy")	– Shrinking labour force relative to the total population – Rising burden of pensions and age-related services – Less demand for "non-silver" goods and services – Less entrepreneurship and innovation

Source: OECD (2016[157]), *OECD Territorial Reviews: Japan 2016*, http://dx.doi.org/10.1787/9789264250543-en.

Nevertheless, this silver lining does not automatically mitigate the effects of demographic change in all regions. Facilitated loans, strategic investment schemes or tax incentives for innovative activity could financially support structurally disadvantaged regions to adapt to new technologies.

Even regions where technology facilitates the shift away from physically intensive work face their own challenges. Indeed, although new technologies alleviate the pressure of an ageing society for firms and regions, the aggregate gains are not necessarily helping elderly workers. Physically intensive work is dominated by repetitive ("routine") tasks, but the alternative "knowledge-intensive" work often requires familiarity with modern information and communication technologies (ICT), which can be difficult to acquire for older workers who have little experience with it. New technologies may therefore even amplify age-related inequalities. The pace of digital technological progress is also likely to accelerate skills obsolescence, thereby further reducing the knowledge advantage of elderly workers (OECD, 2017[169]).

A successful adaptive strategy therefore requires an integration of training and skills development for elderly workers through scholarships, apprenticeships and lifelong learning programmes. For training and skills development to sustain the local economy, it can be important to tailor programmes to the specific needs of the place. Engaging with local employers and jointly planning the development of the local workforce can help align both supply and demand of skills and avoid training programmes in regions that result in an outflow of the newly upskilled workforce.

At the local level, governments also need to adjust infrastructure to ensure that public spaces, transport and buildings are accessible for people with limited mobility (EC, 2017[151]). Provision of care and health services is more efficient in dense urban settings, but at the same time the cost of housing in these areas is particularly high and contravenes the benefits of short distances. An important effort is therefore to ensure adequate access to facilities via affordable and accessible housing options.

It is important to recognise that rural communities with a larger share of senior residents and a smaller working-age population will face stronger labour market shortages and service provision costs (e.g. higher rates of healthcare consumption, particularly in the last years of life) (OECD, 2017[170]). To address the challenges in rural areas, the OECD's Rural Policy 3.0 calls for integrated policy packages across economic and social domains that incorporate the effects of demographic trends in rural areas in the design of public services, the functioning of rural labour markets, and commuting and migration patterns (OECD, 2018[171]). Effective solutions need to consider mobile and digital service delivery solutions.

An example is the region of Västerbotten in northern Sweden, which is home to about 265 000 residents and has a very low population density for an OECD region. To facilitate service delivery, the government has embraced digital solutions including telemedicine to improve accessibility to healthcare for rural communities. Physical services are concentrated in a small number of places and telemedicine is utilised to deliver services to more remote communities and connect with different services and specialist medical staff. Since the mid-1990s, close to 40 different health applications and 230 videoconferencing facilities have been created across the county, which has resulted in increased efficiency, improved competencies among staff and reduced travel times (OECD, 2017[70]).

The policies discussed above are not sufficient to address ageing. National level policies, for example related to the reform of pension systems, are equally important. However, sub-national policies are indispensable elements of a comprehensive strategy to address ageing. Without a well-aligned mix of national and sub-national policies it is not possible to mitigate the effects of demographic change sufficiently.

Migration as an opportunity

Migration can offer opportunities to most OECD regions, but in particular to those with ageing and declining populations. For example, in predominantly rural regions, less than 44% of the population are of working age, with more than 19% of the population being 65 years or older. An inflow of mostly young, working-age migrants can mitigate this problem. Well-functioning national dispersal mechanisms of refugees and asylum seekers can revitalise local economies. For instance, asylum seeker and refugee dispersal mechanisms in countries such as the Netherlands and Sweden take into account local demography and labour shortages to match the characteristics of migrants with local labour market profiles. Given the above-mentioned movement of migrants into large urban areas, it is unlikely that all of them will stay permanently in their allocated regions, but those who will can generate important benefits to the region.

Some regions have anticipated the future shortages their labour markets will face and set up mechanisms to attract or train migrants with the appropriate skills. Gothenburg did for engineers, Amsterdam for software and digital experts, Stockholm for teachers, and Glasgow for medical doctors. The Atlantic region in Canada is testing a pilot approach which regionalises migrant selection mechanisms through a platform gathering job

openings from local enterprises. Once selected by a business, migrants are supported in the process of obtaining a visa and settling in the region.

More analysis is needed to identify how migration can respond to specific local development needs. Further research could estimate how local variables interact with migrant arrivals (OECD, 2016[173]). This includes the complementarity of migrants' and local workers' skills, the potential effect on wage and inter-regional mobility, the impact of new arrivals on the housing market, the contribution of migrant workers on local public revenues, and their impact on local firms' productivity. Better evidence on these outcomes would allow an adjustment of national migration policies to differing demographic and economic needs across territories.

Travelling for leisure – the growing importance of tourism for regional development

The previous section discussed domestic and international migration, i.e. long-term population movement that is often driven by economic motivations. This section focuses on tourism – the short-term movement of people for leisure. Even though the impact of tourism is mostly economic, it is closely linked to demographic developments. Ageing societies will demand different forms of tourism than younger societies. Growing urban middle-classes especially in China are already reshaping the tourism industry in many regions and will have even stronger impacts in the future. International migration has introduced foreign cultures and cuisines to many societies and has created interest in experiencing other countries during vacations. In some countries and regions, tourism is such a major factor that it even has a noticeable effect on the population composition. Iceland, for example, received almost seven overnight visitors for each resident in 2017, while in other countries, tourists can outnumber locals in popular locations during high season.

Tourism is not a new phenomenon and plays a key role in global economic activity, job creation, and as a source of export revenue and domestic value added. Global tourism has grown significantly in recent decades, culminating in an estimated 1.3 billion visits in 2017 (UNWTO, 2018[174]). This figure is forecast to rise to 1.8 billion by 2030. Global expenditures on travel more than doubled between 2000 and 2017, rising from USD 495 billion to USD 1.3 trillion, thus accounting for 7% of global exports in goods and services (UNWTO, 2018[175]). In OECD countries, tourism accounts for, on average, 4.2% of GDP, 6.9% of employment and 21.7% of service exports. On average, domestic and inbound tourism account for 76% and 24% of internal tourism consumption respectively in OECD countries for which recent data are available.

Tourism has benefited from the rise of globalisation and technological advances that have led to cheaper airfares, and also make it easier for people to plan and book their own travel, and share their experiences with friends in real time. When considering its likely evolution over the coming decades, it is clear that tourism will be transformed by large-scale social, economic, political, environmental and technological changes. Once such "megatrends" have taken root, they will exercise a profound and lasting influence on human activities, processes and perceptions.

While it is impossible to predict exactly how these megatrends will shape tourism, it is almost certain that the structure of the visitor economy will evolve significantly between now and 2040 (OECD, 2018[176]). In particular, four factors will reshape tourism over the coming decades:

1. Evolving visitor demand. Income and education levels increase in emerging economies, the global population continues to age and new consumer groups emerge.
2. Enabling technologies. The digital economy, automation and artificial intelligence, blockchain, virtual/augmented reality, and peer-to-peer usage platforms continue to create new tourism marketplaces and business models.
3. Travel mobility. The mobility of tourists is affected by developments in travel facilitation policies and access to infrastructure, safety and security concerns, transport innovations, changes to transport and aviation regulations, and the broader geopolitical environment.
4. Sustainable tourism growth. The global economy continues to shift towards low-carbon and resource efficiency, and sustainable tourism growth is key to addressing the potentially damaging impacts associated with unchecked tourism growth on both the natural environment and host communities.

It is critical for industry and governments at the national and regional levels to explore and understand the multidimensional implications of these trends. This will help bring currently unforeseen and emerging issues onto the strategic policy agenda, develop potential scenarios and policy responses, and assist public and private actors to respond to opportunities and challenges as they arise. The subsequent sections provide a discussion of these four trends and outline policy responses.

Evolving visitor demand

Changing demographics will have a major impact on visitor demand in the coming years. In particular, trends such as the continued growth of the global middle class and ageing populations (see above) mean that the global population will generally be richer and older in the decades ahead.

These demographic factors appear to present significant growth opportunities for the tourism industry. As the population ages and more people enter the retirement phase of their lives, they are more likely to spend income and savings on leisure activities such as travel. Similarly, the overall growth of the middle class will mean that more people are likely to spend on luxuries such as tourism.

Additionally, the rise in prominence of emerging generations will also contribute to change the tourism market. Millennials (i.e. those who reached adulthood in the early 2000s) currently account for approximately 20% of international travel. By 2040, the oldest ones will be approaching retirement and their proportion of total tourism spending is expected to increase substantially. The impact of the latter Generation Z is also expected to be significant due to their sheer numbers – they are forecast to account for the largest share of the global population by as early as 2020.

Data indicate that emerging generations take more trips annually compared to other generations – four or more per year, on average. However, trips tend to be shorter in duration compared to other demographic groups and they are more likely to pick travel experiences that they consider to be "authentic" – preferring to head off the beaten track and "live like a local" (Future Foundation, 2016[177]).

Nevertheless, it is uncertain whether the growth of the global middle class will be sustained, or whether labour shortages as a result of an ageing population will impact the long-term outlook of the tourism sector. The extent to which emerging generations may reduce travel expenditures as a result of unstable work and insecure economic conditions is also unclear.

Despite these uncertainties, several general strategies can be pursued by policy makers to prepare the regional tourism industry for changing visitor demand:

- Regional policy makers and industry should prepare for growing demand among elderly tourists by investing in infrastructure to support those with mobility challenges, physical disabilities and cognitive impairment.
- Promote cross-cultural understanding and awareness in regions and cities in light of expected higher numbers of visitors from emerging markets, particularly from Asia.
- Regions and cities should rethink how travel experiences are framed and marketed. Changing demographics are likely to dramatically shift the way in which people choose where and how to experience travel – particularly for young travellers and emerging tech-savvy generations.
- Develop and promote authentic and personalised experiences that are likely to appeal to emerging generations and provide opportunities to develop unique tourism experiences in regional areas.
- Policy makers at all levels of government should consider investment strategies within and across destinations expecting considerable growth in tourism demand to balance supply.

Enabling technologies

New technologies continue to reshape markets and sectors around the world, and the pace and scale of disruption is increasing. Many of the technologies discussed throughout this report also have important implications for the tourism industry. The digital economy, automation and artificial intelligence, blockchain and virtual/augmented reality have the ability to make travel experiences more affordable, efficient and accessible to many people.

There are several technologies that have major impacts on the tourism industry in particular. First, online platforms, which are used to advertise and book vacations on line, make it easier and simpler for tourists to plan their travel. Such platforms also provide additional information to travellers through their integrated review options, enhancing the quality of travel experiences. The sharing economy, in particular, has grown quickly in the past five years to capture a sizeable portion of the tourism economic activity. Home-swapping services like Airbnb for example, offer attractive arrangements for tourists: cheaper accommodation, access to practical residential amenities, the possibility to live like a local by interacting with neighbours or staying in "non-touristy" areas as well as the feeling of being in a home over a hotel, which some tourists prefer (Guttentag, 2015[178]). Transportation- and accommodation-sharing platforms could see global revenues jump from USD 15 billion in 2014 to USD 335 billion by 2025 (PwC, 2015[179]).

Second, rapid advances in automation through robotics, machine learning and artificial intelligence are poised to disrupt labour markets around the world in the next two decades. For instance, autonomous vehicles are already successfully being piloted on the roads in a number of countries (see Chapter 3). With broader application of this technology expected, implications for tourism will include faster, safer and more comfortable travel experiences.

Third, many companies in the tourism sector are using big data and predictive analytics to increase their knowledge of consumer behaviour and customise personal travel experiences accordingly. Blockchain technology, for example, has the potential to revolutionise identity management and provide more secure and efficient travel experiences by serving as the

underlying authentication layer for biometric-equipped mobile and wearable devices. Such devices would digitise the verification of identities, the purchase of travel products and services, and communication with airlines, thus allowing passengers to go from home to their final destination without standing in a single line or exposing personal financial information (Gjerding, 2017[180]) (Aitken, 2016[181]).

In short, digital technologies will help to connect people with more information, people and experiences, more quickly than ever before. Digital technologies will also make marketplaces and operations across a range of endeavours more efficient. These changes, therefore, are likely to be disruptive to a variety of sectors, including tourism, and in the short term they might dislocate many workers from their existing working patterns. Increasing fluency and the ability to take data-driven decisions in an environment with vast amounts of information will become increasingly important.

Policy makers can take several steps to support regional tourism industries in their adaptation to new technologies. Most of the measures should be aligned with policies that support small and medium-sized enterprises (SMEs) more broadly in their adaptation to technological change, taking into account the specificities of the sector (e.g. seasonality, access to finance, labour intensity).

- Support innovation and digitisation in tourism by providing the necessary regulatory frameworks, fostering a start-up culture in cities and regions, and attracting tourism investment, for example through facilitated loans, tax incentives for innovative activity, or incubation and accelerator programmes.
- Work with industry, universities and training institutes to ensure that the tourism workforce of the future is equipped with the right skills to work with new technologies. This can include supporting tourism SMEs with specific skills-training schemes.
- Facilitate SME access to technical knowledge and specialised inputs – e.g. linkages with service and technology providers, including research centres and universities – to increase ICT adoption, learning and innovation.
- Regional policy makers should support businesses in their efforts to attract and retain tech-savvy staff, e.g. via mentoring and business support networks and access to relevant training.

Travel mobility

Transport is an essential component of the tourism system and plays a vital role in moving tourists efficiently from their place of residence to their final destination and on to various touristic attractions. Air passenger traffic is expected to nearly double between now and 2035, from 3.8 billion to 7.2 billion passengers (IATA, 2016[182]). The International Transport Forum (ITF) has also forecast strong growth in global road and rail passenger travel to 2050, with growth estimates ranging from 120% to 230%. In 2018, global cruise passengers are expected to exceed 25 million before reaching 30 million in 2024 (CLIA, 2015[183]).

In the context of increasing travel flows, security and border measures play an important role both for travel mobility and customer experience. The International Air Transport Association reports that security wait times are among the top grievances of travellers, and these complaints are likely to worsen in the coming years (WEF, 2016[184]). Travel and tourism are also highly sensitive to the threat of terrorism, pandemics and other large-scale crises.

In order to build transport systems that meet the needs of tourists and the industry providing them, several overarching principles need to be considered:

- Ensure that the medium- to long-term needs of the tourism industry are considered as part of the regional transport and infrastructure planning process.
- Encourage tourism and transport policy makers and industry to work closer together to design transport services and infrastructure that respond to the needs of all travellers.
- Governments should strategically invest in transportation infrastructure to support travel mobility (i.e. such as multimodal transit hubs), and collaborate with private transportation providers to improve efficiency and cost-effectiveness.
- Encourage integrated ticketing/pricing and destination smart cards to provide a convenient travel experience in cities and improve accessibility to regional destinations and attractions.

Sustainable tourism growth

Tourism is widely recognised as a human activity that is dependent on natural resources, while at the same time contributing to the depletion of these same resources. As for many sectors, tourism is involved in the consumption of energy and generation of GHG emissions: it is estimated to contribute to around 5% of global GHG emissions (UNWTO, 2017[185]). In a business-as-usual scenario, the emissions of the international aviation sector are estimated to triple between 2015 and 2035 (CREST, 2016[186]).

Without mitigating policy measures, rapid and unplanned tourism growth can therefore have negative impacts – such as overcrowding, environmental degradation and unsustainable water consumption – with impacts on both the communities and the environment upon which it depends.

For tourism to become sustainable at a global level, policy makers should consider pricing mechanisms that reflect the true social cost of tourism activities at the local or site-specific level, achieve greater resource efficiency, and pursue collaboration at the international level to meet sustainability goals. Due to its close connections to numerous economic sectors, tourism can play a key role in driving the transition to a low-carbon and resource-efficient economy. When built upon broad stakeholder engagement and sustainable development principles, tourism can contribute to more inclusive growth through the provision of employment and economic development opportunities in both urban and rural areas, and promote social integration.

The following policy responses can encourage a shift towards sustainable tourism:

- A more strategic and co-ordinated approach to support sustainable tourism growth will require closer integration of multiple policies and horizontal and vertical policy co-ordination.
- Take steps to better manage tourism flows in destinations that are more susceptible to environmental and social degradation, and encourage tourism development in alternative areas to spread the benefits and minimise potential negative impacts.
- Introduce measures to price the environmental externalities of tourism, such as carbon emissions. Include them in a long-term strategy for green growth that provides stable signals to market participants.

- Better educate the general public and tourism businesses concerning the environmental and economic benefits associated with adopting and supporting sustainable business practices.
- Mainstream investment and financing practices that support sustainable tourism to better support the transition to a green, low-emissions and climate-resilient tourism economy.

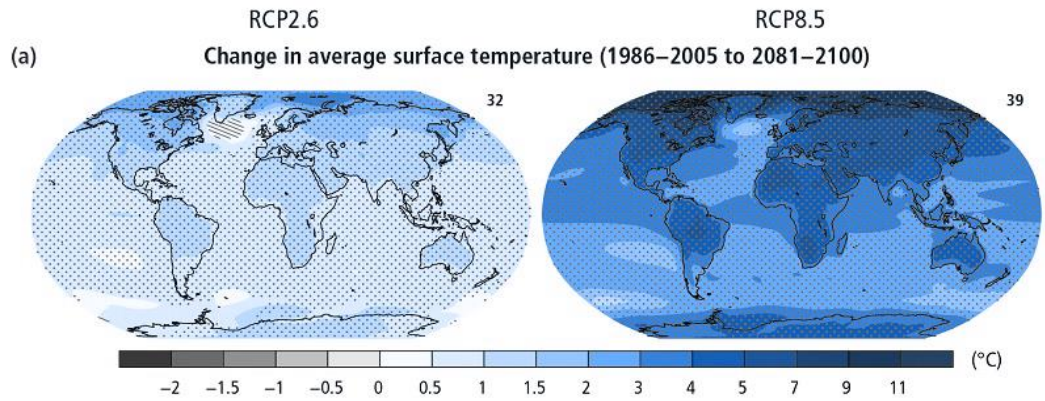
Global and local impacts of climate change

The second group of megatrends discussed in this chapter is related to the environment. While there are many environmental trends that are of global relevance, this chapter focuses on two issues that are particularly relevant for regional policy. First, it discusses climate change, the most pressing of all environmental concerns and a megatrend that will profoundly affect all regions, yet will be felt differently from region to region. Second, this chapter addresses resource availability and resource extraction, an environmental issue that has a particularly strong regional dimension given the place-based nature of resource extraction.

Climate change requires immediate and ambitious action. Approximately two-thirds of the permissible anthropogenic CO_2 emissions to keep the increase in temperature below 2°C by 2100 have already been emitted. In most scenarios, without additional mitigation efforts, global warming is **more likely than not** to exceed 4°C above pre-industrial levels by 2100 (Figure 4.11) (IPCC, 2014[188]). The risks associated with such a temperature rise include substantial species extinction, global and regional food insecurity, consequential constraints on human and economic activities, and limited potential for adaptation (e.g. in certain low-lying Pacific nation-states where migration may be the only solution (Smith and McNamara, 2015[189]) (IPCC, 2014[188]). To avoid such catastrophic risks, mitigation efforts require a reduction in GHG emissions of at least 78% by 2100, relative to 2010 (IPCC, 2014[188]). The international community has committed itself to tackling these issues, notably through adopting the Paris Agreement and the 2030 Agenda for Sustainable Development in 2015, which have generated strong momentum for multi-level, multi-stakeholder climate action in line with global goals (Box 4.2).

Climate change will considerably affect economic growth and human well-being. The OECD's modelling of the economic consequences of climate change projects that in scenarios with a 4.5°C or 6°C temperature increase, annual global GDP losses would rise to 6% and more than 9% respectively, by 2100 (OECD, 2015[187]). Africa and Asia, where regional economies are vulnerable to a range of climate impacts such as heat stress and crop yield losses, would be particularly affected (OECD, 2015[187]). The Intergovernmental Panel on Climate Change projects with **high confidence** that throughout the 21st century, climate change is expected to lead to increases in ill-health in many regions and especially in developing countries with low incomes. These health impacts include greater likelihood of injury and death due to more intense heatwaves and fires, increased risks from foodborne and waterborne diseases, and loss of work capacity or reduced labour productivity in vulnerable populations (IPCC, 2014[188]). For health and economic reasons, the irreversibility of certain consequences of climate change – e.g. the high risk of abrupt and irreversible change in the composition, structure and function of marine, terrestrial and freshwater ecosystems during this century (IPCC, 2014[188]) – thus confers a great urgency to implementing effective adaptation and mitigation policies at the subnational level.

Figure 4.11. Projected change in surface temperature



Notes: The Intergovernmental Panel on Climate Change Representative Concentration Pathways (RCPs) are based on certain factors – population size, economic activity, lifestyle, energy use, land-use patterns, technology and climate policy – and describe different 21st century pathways. RCP 2.6 represents a stringent mitigation scenario aiming to keep global warming **likely** below 2°C above pre-industrial temperatures. RCP 8.5 is the most extreme of baseline scenarios and represents a high greenhouse gas emissions scenario.
Source: Figure SPM .07 in IPCC (2014[188]), *Climate Change 2014: Synthesis Report*, https://doi.org/10.1017/CBO9781107415324.

Box 4.2. The Paris Agreement and the 2030 Agenda for Sustainable Development

The Paris Agreement was adopted at the 21st Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change on 12 December 2015. It aims to strengthen the global response to the threat of climate change over the course of the century by: keeping a global temperature rise below 2°C above pre-industrial levels; and pursuing efforts to limit the temperature increase even further to 1.5°C. To reach these goals, appropriate financial flows, a new technology framework and an enhanced capacity-building framework will be put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives. The Paris Agreement also provides enhanced transparency through a more robust monitoring and reporting framework.

Adopted during the UN Sustainable Development Summit in September 2015, the 2030 Agenda for Sustainable Development aims for all countries to promote prosperity while protecting the planet. The Sustainable Development Goals (SDGs) include a series of climate-related goals, including SDG 13 (climate action), SDG 6 (clean water and sanitation), SDG 7 (affordable and clean energy), SDG 11 (sustainable and resilient cities), SDG 12 (responsible consumption and production), SDG 14 (life below water) and SDG 15 (life on land).

Sources: UNFCCC (2015), Paris Agreement, https://unfccc.int/sites/default/files/english_paris_agreement.pdf; UN, Sustainable Development Goals, https://sustainabledevelopment.un.org.

The local and regional dimensions of climate change

The impacts of climate change have a strong local dimension. For instance, sea-level rise will disproportionally affect coastal areas, with average global flood losses estimated at about USD 6 billion per year in 2005. By 2050, these losses may potentially increase to USD 52 billion in 136 of the world's largest coastal cities, even in the absence of climate change, as projected socio-economic change (i.e. growing populations and assets) alone will lead to heightened vulnerability (Hallegatte et al., 2013[190]). Often, seemingly contradictory weather phenomena, such as floods and droughts, can occur at the same time in different regions of a country.

The OECD's *Environmental Outlook to 2050* projects that climate change will contribute to roughly 40% of the additional loss of terrestrial mean species abundance between 2010 and 2050, in the baseline scenario (OECD, 2012[49]). The extensive loss of biodiversity will also bring about an associated loss of ecosystem goods and services, with marine ecosystems such as coral reefs being especially at risk from ocean acidification (IPCC, 2014[188]). On a regional level, the loss of ecosystems such as the Great Barrier Reef would have significant repercussions for biodiversity as well as for a wide range of economic activities, including tourism.

Nevertheless, the regional economic effects of climate change are diverse. Most regions will be harmed by climate change. For example, of the 143 French Alpine resorts currently skiable with low snow depths, only 123 would remain open in the event of warming by +1°C, 96 if warming reaches 2°C and only 55 in the event of warming of 4°C (Dupeyras and MacCallum, 2013[191]) (OECD, 2007[192]). However, some regions can expect to benefit economically from warmer climate. The OECD ENV-Linkages model projects that tourism in countries such as Canada, the Russian Federation and the United States will experience gains, while Latin America, Africa and developing countries in Asia will experience the largest negative impacts by 2060, underscoring the variability of climate change which requires tailored policy decisions (OECD, 2015[187]), not only across countries but also within countries.

Similarly, the production areas of food crops around the world are expected to shift due to the effects of climate change, but with large differences at the regional scale (IPCC, 2014[188]) (OECD, 2015[187]). On the one hand, climate change without adaptation is projected to negatively impact the production of wheat, rice and maize in tropical and temperate regions for local temperature increases of 2°C or more above late 20th century levels (IPCC, 2014[188]). On the other hand, by 2050, climate change is expected to positively benefit wheat yields in regions with cold climates such as Canada, the Russian Federation and Scandinavian countries (OECD, 2015[187]).

Beyond rising temperatures, the consequences of climate change on water availability will have strong effects on crop yields. Variability in water quality and available quantity is likely to increase competition between water users in rural and urban areas in many regions (OECD, 2016[193]) (IPCC, 2014[188]). Yet, beyond a general pattern of more frequent droughts, regional changes in water availability are difficult to predict (OECD, 2014[194]).

Climate change will pose unique challenges to both rural and urban areas and requires place-based policy responses. In urban areas, climate change will increase local urban heat island effects, which, in addition to increasing local temperatures, alter small-scale meteorological processes (e.g. land-sea breeze effect) thereby increasing the risk of heat-related morbidity and mortality (IPCC, 2014[195]) (IPCC, 2018[48]). At 1.5°C, twice as many megacities could become heat-stressed, exposing 350 million more people to deadly

heat by 2050, under mid-range population growth scenarios (IPCC, 2018[48]). The increased temperatures in urban areas due to heat island effects may increase energy demand for space cooling, further driving up energy demand during higher peak loads (IEA, 2016[196]).

Scaling up regional and local climate action with a whole-of-government approach

In 2013, the world's urban areas accounted for about 64% of global primary energy use and about 70% of global CO_2 emissions (IEA, 2016[196]). Within urban areas, major sources of final energy demand are residential and commercial buildings, industrial processes, transport systems, and generation of electricity and heat. Near-term policy actions must be taken to avoid "lock-in" effects of inefficient urban energy systems during upcoming periods of rapid urban population and GDP growth. If current trends continue, global urban primary energy use would grow by about 70% and global urban CO_2 emissions by about 50% between 2013 and 2050 (IEA, 2016[196]). Such growth in emissions would make the above-mentioned climate mitigation target virtually unachievable.

Subnational governments have an important role to play in mitigating and adapting to climate change (OECD, 2010[197]). Cities are instrumental to mainstream climate resilience into their spatial planning, infrastructure, local policies and investments, through locally tailored climate strategies in line with national objectives (OECD, n.d.[198]). Local governments across the world have increasingly taken ambitious climate action, sometimes beyond the scope of their respective national governments. In the United States, an analysis of city climate action in 2015 reveals that 52 of the 132 cities that reported their climate commitments to public platforms had reduction targets that were equal to or more ambitious than the national government ones (ICLEI USA, 2017[199]). For example, Copenhagen (Denmark) intends to phase out GHG emissions from all sources by 2025, and London (United Kingdom) aims to reduce its CO_2 emissions by 60% by 2025 from 1990 levels. Furthermore, up to 65% of the Sustainable Development Goals agenda may not be fully achieved without the involvement of urban and local actors (UN, 2016[200]). However, the efforts of local government have often been undervalued and subnational implementation of climate action faces certain challenges.

Challenges to subnational climate action differ from case to case, but are often institutional, financial or technical in nature. These may include limited municipal capacity, knowledge or resources; restricted monitoring and reporting; lack of local engagement or authority; non-existent multi-level co-ordination; and insufficient data (GIZ, 2017[201]) (Salon, Murphy and Sciara, 2014[202]). Furthermore, local governments do not always have the legal authority to implement climate-related policies, such as introducing congestion charges.

In addition to facing such challenges, local governments may encounter obstacles in collaborating with the private sector and presenting companies with a compelling business case for climate action (C40, 2016[203]). In some cases, national governments are not well aware or informed of innovative local actions and may thus neither provide the most effective support to local governments nor facilitate the replication of good practices to other places and contexts. Such disconnects represent a barrier for cities and regions to contribute meaningfully to the effective implementation of the Paris Agreement with innovative climate action (OECD, n.d.[198]).

The role of regions, moreover, varies across countries depending on their legal rights and responsibilities. Almost everywhere, they have an important role in climate adaptation. In many countries, regions are also responsible for substantial public investment that can be targeted towards low-carbon infrastructure. As an intermediate tier of government, regions

have also gained much traction in facilitating vertical co-ordination among national and local levels, as well as horizontal co-operation across local authorities within their territories.

Mainstreaming subnational investment

The largest share of climate-related spending occurs at the subnational level in the OECD. Across a sample of 30 OECD countries, subnational governments were responsible for 55% of environment and climate-related spending and 64% of environment and climate-related investment between 2000-16, on average (OECD, n.d.[204]). However, the share of environmental and climate-related spending and investment remains low relative to GDP: subnational climate-related spending represented 1.3% of GDP (2.3% at national level) while subnational climate-related investment represented around 0.4% of GDP (0.7% at national level). The gap between the global need for investment in climate action and the ability or willingness to pay highlights the need for co-ordinated investment across all levels of government.

The real or perceived costs of climate action may lead to subnational opposition, requiring policy makers to manage trade-offs in order to overcome political hurdles. Clear policy signals are essential to guide the transformation of technologies and business models towards a low-greenhous gas economy (OECD, 2017[51]). For instance, where restructuring or plant closures are likely, relevant local authorities should aim for transparency and work with relevant companies, sectors and communities to develop economically sustainable and yet low-carbon alternatives and gain political and social support for policy measures.

Aligning climate policies across levels of government

Policies at all levels of government that are misaligned with policies at other levels of government may potentially result in maladaptation and misallocation of resources. Misalignments with climate adaptation include regulatory regimes for infrastructure that deter investment in resilience, planning policies that encourage development in vulnerable areas and under-pricing of natural resources. Effectively implementing adaptation measures remains a challenge across a range of countries and policy contexts, as is exemplified by the United States National Flood Insurance Program, in which reforms in 2012 to encourage risk reduction were ultimately reversed due to political opposition, illustrating the barriers to reform even if the defects of current arrangements are well understood (OECD, 2015[205]). Implementing aligned climate policies requires pursuing a multi-stakeholder, multi-level methodology that combines both bottom-up and top-down approaches.

Multi-level governance is increasingly a feature of national climate mitigation and adaptation strategies and plans, where regional- and city-level actions contribute to overall national climate policy strategies (OECD, 2012[49]). Aligning incentives and effective co-ordination among different levels of government will help to avoid duplicative or costly policy measures. Moreover, when there is a lack of co-ordination, significant emissions leakage can potentially be transferred across jurisdictions, whereby an emissions reduction in a regulated sector or area may be offset by consequent emissions in an unregulated sector or area (OECD, 2012[49]) (Mehling, Metcalf and Stavins, 2017[206]).

A national urban policy can play a key role in mainstreaming climate policies into a broader urban policy framework (OECD, 2017[207]). As climate change will have an impact across a broad range of sectors, it is critical to identify its impacts at the local level, to assess cross-sectoral synergies and to streamline policy decisions. For example, land-use zoning has significant impacts upon sectors such as transportation, natural resources, built

environment, energy, water and waste, underscoring how urban development requires co-operation and co-ordination at different levels of government and across policy areas to avoid welfare losses. In the Netherlands, the Spatial Planning Act manages land development at the national, state and municipal levels of government. The national planning agency issues broad guidelines for land use that provide an outline for the strategy, policy and purpose of land development, based on the ecological and economic environment of the entire country (OECD, 2010[1]).

Making the most of the comparative advantage of local governments

In light of the interconnectedness across policy sectors, local governments may more easily identify and combine complementary cross-sectoral climate policies than higher levels of government. There are also important co-benefits from policy actions that can be reaped immediately and locally, such as improvements in air quality. Policy makers must consider such co-benefits when determining appropriate policy action. As discussed in Chapter 2, a national urban policy can provide the platform for the required co-ordination effort.

While local governments and the private sector have different, regionally varying functions, they are increasingly recognised as critical to progress in adaptation due to their roles in scaling up the adaptation of communities, households and the civil society, and their management of risk information and financing (IPCC, 2014[188]). In 2015, Acre, the third smallest of Brazil's 27 states, had already achieved 63% of its goal to reduce deforestation by 80% by 2020, largely thanks to Acre's State System of Incentives for Environmental Services (SISA). SISA's reduction of deforestation is both an adaptation and a mitigation measure that is expected to benefit up to 30 000 rural property owners, indigenous peoples and other traditional populations. If Acre's forest conservation efforts were to be scaled up nationally, they could contribute 31% to Brazil's 2020 GHG reduction ambition (Yale University, 2015[208]).

Developing an "interface" to localise the Paris Agreement

The Paris Agreement and the subsequent process of developing nationally determined contributions (NDCs) provide a unique opportunity to develop a "whole-of-government" approach to tackle climate change. The NDCs are required by the Paris Agreement to be implemented in each country, but mainly concern the national level of government. Starting in 2023 and then every five years, governments will take stock of the implementation of the Paris Agreement to assess collective progress and to eventually propose successive NDCs. It will thus be critical to incorporate the subnational level of government into the national climate policy framework in successive NDCs.

Currently, neither subnational governments nor co-ordination across levels of governments are explicitly mentioned in most of the existing NDCs. Little information is available, either, as to whether subnational governments have been consulted or given opportunities to give their opinion in the process of developing their NDCs. While the Paris Agreement is techincally a commitment among national governments, the lack of subnational government presence in the NDCs reveals an important concern since emission-reduction targets and policies may not have fully considered the local and regional governments' emission-reduction potentials. What needs to be urgently developed is an "interface" between national and subnational governments which allows countries to assess the impacts of subnational climate action and incorporate them into national policy frameworks in the NDCs. As the complementary role of different levels of government in climate action has

been well recognised, this is a crucial moment for national governments in setting and implementing a national policy framework that is conducive to subnational actions.

Integrated city-level action to reduce emissions

Local governments have control over a wide range of policy instruments that are crucial to fight climate change. This section highlights some of the most important measures that can be taken locally to reduce carbon emissions and adapt to the adverse effects of climate change. Such measures are related in particular to local governments' regulatory competences on transport, the built-up environment, long-term land-use planning, local resilient infrastructure and inclusive development..

Transport

In order to reduce traffic congestion, fiscal measures such as vehicle licencing fees, parking fees and congestion charges can effectively shift the cost of car usage to vehicle owners. In cities like London, Singapore and Stockholm, congestion-charge systems have resulted in reductions in congestion (13-30%), GHG emissions (15-20%) and fine particulate pollution (up to 10%) (OECD, 2018[209]) (Pike, 2010[210]).

Promoting modes of transport such as electrically powered cars, bicycles and scooters can accomplish a range of goals, including potentially reducing traffic congestion as well as air and noise pollution. In 2016, Norway had the highest electric car market share globally (29%). This was largely due to a favourable policy environment in recent years comprising a large range of incentives, from tax breaks and exemptions to waivers on road tolls and ferry fees (IEA, 2017[211]). Policy makers can also consider a purchase subsidy programme to encourage the usage of electrically powered bicycles and scooters, instead of subsidising car ownership. Subsidy programmes have been used in both OECD and non-OECD countries with considerable amounts of success (OECD, 2018[209]).

The built environment

The concept of zero-energy and near zero-energy building programmes has increasingly gained traction over the past 20 years while the cost-effectiveness of such new constructions is increasingly viable. In the pursuit of reducing emissions, communities also have much to gain from retrofitting old buildings; bypassing the process of demolition and reconstruction alone can make adaptation and reuse of old buildings attractive, along with their environmental benefits and energy savings. Or, when such technologies are not feasible, alternative integrated energy solutions such as district energy or heat pumps can also be viable options. For example, the Yokohama Smart City Project in Japan strives to improve energy management and mitigate climate change. The city introduced a Community Energy Management System to achieve efficient energy management by linking individual emergency management systems (e.g. in homes, buildings and factories) to stationary energy storage. Specific achievements of the programme included the installation of emergency management systems in 4 200 homes, the introduction of 2 300 electric vehicles and of 37 MW of photovoltaic generation, and the reduction of 39 000 tonnes of CO_2 emissions (IEA, 2016[196]).

OECD work on urban green growth demonstrates that green urban investment can contribute not only to environmental sustainability, but also increase economic growth potential. In fact, green urban investment can create jobs, attract firms and workers with an improved urban environment, and spur innovation and entrepreneurship (OECD, 2013[212]). In France, the multi-regional cluster Moveo is devoted to sustainable mobility (notably the

development of electric and hybrid vehicles) and focuses on research on mechatronics and the recycling of materials for automobiles. The cluster has more than 300 members, including 76 large firms. In its three host regions, Haute Normandie, Basse Normandie and Île-de-France, Moveo conducted 70% of the country's automotive R&D and represented 18% of patents filed in France in 2012 (Kamal-Chaoui and Plouin, 2012[213]).

Long-term land-use planning

Land use has been linked to approximately one-third of all anthropogenic CO_2 emissions. As such, land-use practices have major consequences for climate change mitigation as well as for factors that affect public health, like air pollution and the walkability of cities (OECD, 2017[121]). For instance, transit-oriented development is an urban development strategy designed to maximise access to mass-transit systems by promoting relatively dense, mixed-use development around existing or new public transport infrastructure, thereby minimising congestion. Toyama (Japan) renovated its existing mass-transit system and introduced an incentive programme to encourage residential development near the transit stations in urban centres. This resulted in an increase in public transport use and a gradual movement of citizens from the suburbs to the targeted areas (OECD, 2012[215]). Transit-oriented development can thus be an effective instrument for better integrating land-use and transport planning that also reduces urban sprawl (OECD, 2012[215]).

Land-use planning must include a long-term perspective to incorporate potential climate change impacts. Economic incentives can be strengthened to be more aligned with land-use policy objectives. For instance, those who generate liabilities with regards to water management (property developers who build in flood-prone areas) may be required to also bear the costs (OECD, 2014[216]). Such an approach may not be applicable in every context, but can be an effective tool for dissuading land-use planning decisions that are at odds with potential climate change impacts.

Building resilient infrastructure

Investing in resilient infrastructure requires an understanding of potential future risks and threats. Risk assessment is an integral component of climate adaptation measures and begins with the identification of natural phenomena, accidental or deliberate human-driven events ("hazards") that could have a significant adverse impact on society. While countries are generally aware of the major hazards in their environment based on historical experience, collaborations with local universities and (re)insurers can provide detailed information about spatial occurrence, frequency and magnitude. The immediate causes and sources of hazards need to be identified – whether they originate on the national territory or from abroad – as well as any interlinkages (e.g. earthquake leading to a tsunami) or external drivers (e.g. climate change, deforestation, suburban development) that could affect exposure, vulnerability or possibly the hazard itself. Identifying risks arising from interconnections or interlinkages may present complexities, which have to be acknowledged when conducting risk assessment (G20/OECD, 2012[217]).

Improving water resources management is an important adaptation measure that ensures water security. Water resources management currently relies primarily on "grey", human-built infrastucture at the expense of "green", nature-based infrastructure. Nature-based infrastructure can promote a sustainable use of natural resources and generate social, economic and environmental co-benefits, delivering a range of ecosystem services (WWAP/UN-Water, 2018[218]). In the Netherlands, a new paradigm to make "room for the river" combines innovative architecture, urbanisation and landscape solutions to build with nature and live

with water. This new adaptive perspective and the subsequent Delta Programme aim to protect current and future generations from high water levels and ensure a sufficient supply of freshwater (OECD, 2014[216]).

Inclusive climate policies

Climate change is poised to exacerbate the effects of structural inequalities in cities. The impact of climate change on inequalities is still an emerging field of research, and large uncertainties remain; yet, the evidence suggests that climate change, if not mitigated, will increase inequalities and slow down growth (Hsiang et al., 2017[219]). While wealthier populations have more assets at risk from climate change, vulnerable populations are more exposed to its impacts (IPCC, 2014[47]). The vulnerability of low-income populations to climate change impacts is due to several factors, including increased exposure to climate risk and hazards, higher susceptibility to damage, and lower ability to recover (OECD, n.d.[204]).

Policy makers should assess and address *ex ante* potential regressive impacts of climate policies. For example, this includes investing revenues from climate-related taxes in measures that reduce inequality. The intelligent use of carbon pricing revenues is an opportunity to improve fiscal space and make climate policies more inclusive and progressive by reducing other taxes and alleviating the burden on the poorest households (OECD, 2017[51]). For instance, authorities can invest the income earned through carbon-pricing instruments or energy savings from green buildings in sustainable, low-carbon initiatives that benefit low-income populations. Other successful initiatives include the provision of green spaces in low-income neighbourhoods to create a "cooling effect", and the reconversion of the physical landscape of the mining and fossil fuel sectors into tourist attractions in North-Rhine Westphalia in Germany, which, in addition to fostering an inclusive low-carbon transition also generate tourism revenue for the region. Such actions can defray some of the negative impacts of climate action on low-income populations over the long term.

Likewise, regressive impacts from transport taxes have to be avoided. For example, this can involve the provision of alternative transport offers. This has been done in London, where revenues from congestion charges are invested in efforts to extend/improve access and services in public transport (OECD, n.d.[204]). Alternatively, the increased revenues due to transport taxes can be redistributed to low income households.

Managing resources efficiently for the future

Climate change is the most urgent and widespread environmental trend that needs to be addressed by all levels of government. However, it is not the only environmental concern. Another major environmental issue is resource availability and resource extraction. Resource extraction is also closely related to the technological megatrends discussed in Chapter 3, because new technologies will require new resources, and, vice versa, new technologies will transform the extraction of resources.

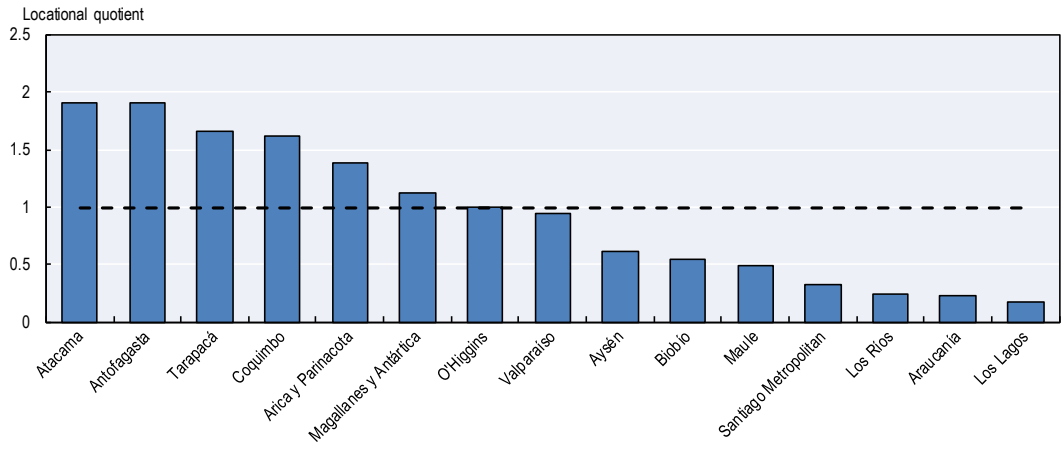
To address resource needs in an environmentally, socially and economically sustainable fashion, two steps have to be taken. First, resource extraction needs to become more sustainable. Since extractive activities are usually localised, this is to a large extent a regional issue. Second, resources need to be used and reused more efficiently. In this context, the concept of circular economy has been gaining ground in recent years. The term

describes the idea of using a side or waste product of one production process as an input to another production process.

Sustainable resource extraction

Specialisation in mining and extractive activities fosters dynamics such as greater volatility in economic performance, high wages, changes in land use, and transport movements that generate costs and impacts upon local quality of life. Mining and extractive activities (see Figure 4.12 for the case of Chile) are concentrated in particular places, in which the costs and negative externalities are amplified.

Figure 4.12. Specialisation in mining and extractive activities (employment), Chile



Notes: The locational quotient is the ratio between the sector weight in the regional employment and the weight of the same sector in the national employment. A value above 1 implies that the region is more specialised in that sector than the rest of the economy.
Source: OECD (2019), *OECD Regional Statistics* (database), https://doi.org/10.1787/region-data-en.

StatLink https://doi.org/10.1787/888933922498

If poorly managed, resource extraction can increase inequality. A higher natural resource share in the economy is often associated with higher income inequalities. Often, only a very low share of the workforce and the population benefits from the high productivity (which supports the high wages) of this sector. This workforce is also increasingly mobile and characterised by "fly-in/fly-out" dynamics (OECD, 2017[220]). Moreover, increasing inequalities can undermine long-term economic performance at a national and subnational level. Therefore, a greater focus is needed on making resource-related growth more inclusive.

Mining and extractive activities also generate environmental impacts and externalities, which need to be carefully managed to ensure long-term quality of life and well-being for local residents and to minimise impacts on other industry sectors. Across OECD countries, mining and extractive activities are closely regulated to reduce environmental risks and impacts such as the erosion of soil, sinkholes and contamination of water. For some mining activities, the use of water has to be carefully planned in relation to other users (such as residents and agricultural producers), particularly in remote areas which may lack the necessary infrastructure. Overcrowding of infrastructure and public services in mining regions is another externality that can occur during a period of rapidly increasing

investment and prices. Subnational arrangements for the distribution of resource rents have been established across different countries in order to mitigate these externalities.

These negative externalities of mining and extractive activities can reduce both the support of local communities for mining operations and the resilience of these regions when market conditions deteriorate or resources are depleted. Mining regions are strong drivers for economic growth; however, there is a need to deliver high quality life for citizens and protect the natural environment.

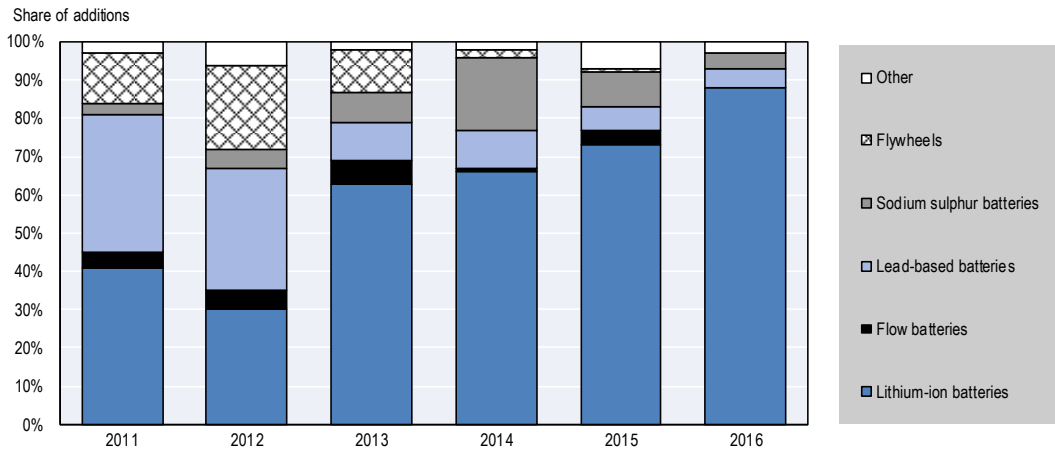
Successfully dealing with future megatrends such as climate change, the energy transition, urbanisation and technological innovation by meeting future demand for metals and minerals is dependent on local communities benefiting from these activities. This can be achieved through "bottom-up" economic development strategies that focus on regional competitive advantages and open up opportunities for related diversification and participation in global value chains. Among the future transformations for the mining and extractive industries that will also have important local and regional implications are the increasing demand for "new" natural resources, and the automation of mining.

An increasing demand for new natural resources for new technologies: Lithium, cobalt and nickel

A key driver of future resource demand is the transition to a low-carbon economy, discussed above. A cornerstone for decarbonising the economy is electricity storage. Most sources of renewable energy, including wind and solar power, produce electricity only intermittently. To use them on a large scale, storage is thus essential to balance electricity demand and supply. Storage based on rapidly improving batteries and other technologies will also permit greater system flexibility. Electricity storage allows for a transport sector dominated by electric vehicles, enables effective 24-hour off-grid solar home systems and supports 100% renewable mini-grids (IRENA, 2017[221]).

Pumped hydro is still the dominant form of energy storage, representing more than 90% of storage capacity (IEA, 2018[222]), but other technologies are progressing. Currently, the best-performing batteries for electricity storage are lithium rechargeable batteries. Lithium rechargeable batteries are the power source of choice for sustainable transport and are being used in the next generation of electric vehicles. Lithium-ion battery capacity (excluding pumped hydro) represented 28% of the storage capacity in 2017 and its usage over other technologies has been increasing over time (Figure 4.13).

Figure 4.13. Share of annual battery storage growth, by technology



Source: IEA (2018[222]), *Energy Storage, Tracking Clean Energy Progress*, www.iea.org/tcep/energyintegration/energystorage.

StatLink https://doi.org/10.1787/888933922517

Lithium is highly concentrated in just a few regions. Five countries – Argentina, the Plurinational State of Bolivia, Chile, the People's Republic of China (hereafter "China") and the United States – represent roughly 90% of global lithium resources. The most important lithium brines are those located in the Andes and China. The Salar de Atacama in Chile is the world's largest producing deposit of lithium, while the Salar de Uyuni in Bolivia is estimated to contain the largest lithium reserve in the world, though it currently does not produce lithium (Egbue and Long, 2012[223]).

The materials used in electrodes are notably rare metals, such as cobalt and nickel, which are scarce and expensive. Cobalt is often a by-product of copper and nickel mining. It requires capital-intensive processes to be produced, involving roasting, flash smelting and the use of poisonous gases (Turcheniuk et al., 2018[224]). Half of the current production of cobalt-rich minerals is concentrated in the Democratic Republic of Congo. As to nickel, rising demand has boosted its price by about 50% since 2015 (Turcheniuk et al., 2018[224]). The growing use of lithium batteries can further boost the demand for cobalt and nickel and outstrip the supply. Therefore, other materials have been tested for use in lithium-ion batteries, such as iron and copper. Nevertheless, batteries from alternative metals are still less efficient at holding charge than cobalt- and nickel-based batteries.

The automation of mining

The automation of mining activities is a trend with significant implications for local communities and economies. Technological change will make mines more autonomous, operated primarily from distant centralised control centres that rely on Geographical Information Systems, GPS, remote equipment monitoring and automated algorithms. This automation will have an impact on local spending and employment, which ultimately will change the benefit for local communities.

The future of mining will be determined by data and the ability to organise, manage and process it. The transition to future digital mines will change core mining processes and encompass the automation of physical operations and digitalising assets. This includes the

adoption of autonomous vehicles, drones, 3D printing and wearable technologies, all potentially operated through a connected network using Internet of Things sensors to capture and process data in real time. For example, at the Yandicoogina mine in Western Australia, self-driving trucks work 24 hours a day, hauling high-grade iron ore. This driverless technology led to a 15-20% increase in output, a 10-15% decrease in fuel consumption and an 8% decrease in maintenance costs (Cosbey et al., 2016[225]).

Thus, automation is likely to reduce the number of operational jobs for tasks such as drilling, blasting, and train and truck driving. These tasks typically constitute over 70% of employment in mines (Cosbey et al., 2016[225]). New roles will be created in the development and monitoring of remotely controlled autonomous equipment and in data processing, but it is unlikely that these jobs will be open to all workers in operational roles.

To fully embrace the transition and distribute the extractive industry's benefits to local communities, policy makers should seek to improve the skills of and retrain the local workforce. Identifying and supporting one or more new and profitable regional activities is also a needed strategy to reduce regional dependence on extractive industries as well as create backward productive linkages with existing industries (Cosbey et al., 2016[225]).

The transition towards a circular economy in cities and regions

Sustainability will not only be achieved through more sustainable resource extraction. Using and reusing resources more sustainably is equally important. This is reflected in the idea of the circular economy, i.e. a concept that aims to improve economic and resource efficiency by linking production processes so that a side or waste product of one production process is used as an input to another production process. In an ideal scenario, this would allow for an almost complete elimination of waste and a strong decrease in the need for new resources.

While cities are great producers of wealth, they are also great consumers of natural resources and the cause of negative environmental externalities. Globally, cities are responsible for up to 80% of GHG emissions (World Bank, 2010[226]) and 50% of global waste (UNEP, 2013[227]). In recent years, the "circular economy" has increasingly gained traction at both national and subnational levels of government. In contrast to a linear system, waste is not necessarily the end of the consumption processes, but constitutes the beginning of new production. The circularity implies putting resources back into environmental and economic systems, and postponing material losses through reusing and reducing waste. This can occur through different means, from product design to more pro-environmental behaviours.

Circular economy in cities is expected to have a positive impact on economic growth and the creation of new jobs, and to reduce the negative impacts on the environment generated by unsustainable production and consumption patterns. For example, in London, benefits from circular approaches applied to the built-up environment, food, textiles, electricals and plastics are estimated at GBP 7 billion every year by 2036.[3] In Amsterdam, projections show that the construction sector can save EUR 85 million per year from material reuse, while decreasing GHG emissions by 500 000 tonnes of CO_2 along the construction chain. In the Île-de-France, about 50 000 jobs linked to the circular economy are estimated to be created by 2030.[4]

At city level, dedicated soft and hard infrastructure can pave the way for the development of broader circular economy strategies. Some cities have put in place infrastructural systems that connect several sectors, saving natural and financial resources. Examples are

the industrial symbiosis in Kalundborg (Denmark), which fosters eco-innovation among eight public and private companies to reuse water and energy and recycle materials, and the Eco Park in Kitakyushu (Japan), which allows to recycle waste, while producing energy, saving water and creating new business opportunities. In the future, cities would need to think about the consequences of infrastructure investments on future generations, to consider green infrastructure and decoupling alternatives, such as new electric vehicles, solar panels, smart-grids, retrofitting of buildings, recycling facilities (Wijkman, 2016[228]).

The potential of the circular economy still needs to be unlocked. Today, less than 10% of the global economy is circular (Circle Economy, 2018[229]). Unlocking the potential of the circular economy in cities implies going beyond solely technical aspects and putting the necessary governance in place to create incentives (legal, financial), stimulate innovation (technical, social, institutional) and generate information (data, knowledge, capacities). It would also mean looking at the barriers for businesses, to "close the loop" by rethinking business models towards the transition from linear to circular ones (e.g. by including the use of leasing and sharing), and analysing the economic instruments that could support the transition in several sectors, including waste, food, built environment and water.

The role of local governments in the transition to a circular economy

Investments, innovation and infrastructures for the transition from a linear to a circular economy in cities and regions are gaining in importance. By 2030, USD 6.3 trillion per year will be needed for global investments in energy, transport, water and telecoms to support economic growth and development. This figure is estimated to be higher when considering further climate action (OECD, 2017[230]). Subnational governments play an important role in public investments. Worldwide, in fact, they are responsible 40% of public investment – 57% in OECD countries (OECD, 2018[50]).

Compared to upper levels of government, cities and regions are laboratories for innovation and pilot-test experimentations (see Chapter 5). In fact, because cities take key decisions on public services, transport, solid waste, the built environment, water and energy, they can contribute to circular approaches by developing a forward-looking vision promoting synergies across sectors (water, waste and energy). However, innovations are not only technical; social and institutional innovations consist in new forms of businesses, partnerships, information sharing and co-ordination across levels of government and within city departments.

Cities and regions have an important role in promoting, facilitating and enabling circular economy strategies. Cities such as Paris, Brussels, London and Amsterdam have developed strategies that identified priorities and promoted a number of concrete projects engaging several stakeholders. Local governments also act as intermediary actors and facilitators. They connect stakeholders that operate along the value chain but are not necessarily used to collaborating with one another, directing and facilitating contacts, informing about existing projects, and providing soft and hard infrastructure for new circular businesses. For example, Circular Glasgow, an initiative by the Glasgow Chamber of Commerce, supports businesses of all sizes interested in the circular economy, through capacity building and co-operation. The city of Amsterdam created a revolving sustainability fund for businesses to pay back within 15 years with a very low interest rate.

Lessons learnt and ways forward

Circular economy is not a panacea for all the problems that cities will be facing in the future (e.g. climate change, natural resource decline, increasing population). However, it provides

the opportunity to do more with less and is a possible to achieve green growth – improving environmental sustainability and increasing economic productivity. At the same time, it is a vehicle to achieve global agendas, such as the Agenda 2030 and the Paris Agreement. For example, the 3Ps framework – people, policies and places (OECD, 2016[193]) – can provide a valid conceptual framework to implement a circular economy in regions and cities.

Circular economy should be a shared responsibility across all levels of governments: it is important to clearly define the role of stakeholders and strengthen co-ordination. Co-ordination across national and subnational strategies can help clarify concepts and definitions, as well as identify objectives. Co-ordination across local government departments is needed to avoid greys areas and overlaps.

In addition to co-ordination among stakeholders, the issue of scale is key for the circular economy in cities: it is important to adopt a functional urban approach at the appropriate scale. Cities are not isolated systems, but a space for inflows and outflows of materials, resources and products, in connection with surrounding and more distant areas. The reflection on the broader benefits and costs of circular economy strategies beyond the administrative boundaries of cities requires a discussion on the interlinkages across urban cores, neighbouring and rural areas.

Furthermore, due to its systemic nature – i.e. the fact that in every case somebody's waste can be a resource for somebody else – the circular economy also provides the opportunity to foster complementarities across policies. Often, these complementarities are overlooked, and the lack of a systemic approach might lead to the implementation of fragmented projects both in time (over the short or medium run, rather than sustainable long-run policies) and in space (isolated initiatives, experiments and pilots).

To build such a co-ordinated, interlinked and complementary system, the circular economy should rely on the engagement and mobilisation of a wide range of stakeholders as well as of the civil society. This is important for inclusive decision making and concrete implementation. For example, the circular economy Strategy of the Greater Paris (Mairie de Paris, 2017[232]) has been developed by 240 stakeholders from over 120 different organisations. The Italian Ministry of Environment promoted a two-month online consultation for the national strategic document on the circular economy (Ministry of Enviroment and Ministry of Economic Development, 2017[233]). About 3 900 people took part in the consultation and 300 organisations and institutions provided specific comments on the proposed text.

Notes

1. See also *OECD Regional Statistics: Regional Demography* (database); accessed 30 October 2018.
2. The section uses preliminary data that will be subject to minor revisions in the future as the estimates of urban population become more precise.
3. Amec Foster Wheeler: see focus area profiles in this document (pp. 20-30) (2015), https://www.lwarb.gov.uk/wp-content/uploads/2015/12/LWARB-circular-economy-report_web_09.12.15.pdf.
4. https://www.paris.fr/economiecirculaire.

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Chapter 5. Innovative multi-level governance to address future challenges

This chapter describes the expected impacts of technological, demographic and environmental changes on subnational fiscal systems. It then discusses innovative approaches to the governance of regional policies, and focuses on public investment at the subnational level.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Stronger multi-level governance and finance systems can help countries to seize future opportunities. Adjusting the multi-level governance and fiscal systems is all the more important when global megatrends risk deepening territorial disparities. Many trends discussed in this report will affect subnational fiscal systems. The tax base of some regions and cities might fundamentally change due to demographic shifts, changes in the labour market and business income, as well as changes in land values and housing prices. This could lead to increasing disparities in fiscal capacity among regions. Thus, vertical and horizontal equalisation mechanisms across regions will become increasingly important. These mechanisms can ensure that total per capita revenues of subnational governments within the same country do not diverge too much from each other.

Likewise, multi-level governance systems will have to be adapted to mitigate increasing disparities across regions and cities. The previous chapters have shown that considerable territorial disparities exist that will become worse unless counteracting policies are implemented. Moreover, the administrative capacity of subnational governments varies considerably in all OECD countries. The ongoing development of asymmetric multi-level governance approaches in many countries that differentiate across regions can be an effective response to this diversity and should be further pursued.

To be fit for the future, other characteristics of multi-level governance systems are equally important. Policy making has to occur at the right scale, taking into account, for example, functional urban areas and rural-urban linkages. To ensure this, appropriate co-ordination mechanisms across levels of government and across local jurisdictions should be developed. Furthermore, national governments have to pursue coherent policies for urban and rural areas, respectively, that ensure the various national policies are co-ordinated with respect to their impact on these territories.

Various stakeholders beyond the public sector should be taken into account in multi-level governance practices. Developing a strong, trusting, and co-operative relationship with the private sector, the civil society, and other communities can facilitate the alignment of objectives and incentives. Communication – such as regular dialogue and simplicity of feedback procedures – is a critical approach, as it helps clarifying what is expected from the different parties. While these procedures may imply some transaction costs in the short term, policy makers should bear in mind the long term benefits, especially as a way to be well- prepared for the potential challenges arising from the megatrends (OECD, 2018[234])

In many instances, it is not clear how to best proceed in practice. In this context, experimental governance can help to try out new governance arrangements or new policy solutions on a small scale to test whether they work. Experimental governance can thus foster public sector innovation and help to develop new solutions to future challenges.

The current level of total investment is less than half of what is required to address future needs from global megatrends.[1] Subnational governments, which are in charge of 57% of public investment in OECD countries on average, will play a key role to help fill the gaps. National and subnational governments need to invest more – by better exploiting existing and potential fiscal resources for investment – and better – by improving the planning, selection, governance of investment – to ensure a balanced development of countries. However, as public sources of funding will be insufficient to cover the investment needs demanded by megatrends, cities and regions will need to seek financing for suitable projects from the private sector.

This chapter is structured as follows. First, it describes the expected impacts of technological, demographic and environmental changes on subnational fiscal systems. Second, it discusses innovative approaches to the governance of regional policies. Third, it focuses on public investment at the subnational level.

Improving the efficiency and resilience of subnational fiscal systems

Established sources of subnational tax revenues will be put under increasing pressure

In the medium term, the tax base of some regional and local governments might fundamentally change due to new technologies, demographic changes and changes in the labour market that could, for example, affect households' and businesses' income, land values and housing prices substantially. For example, profits in the digital economy accrue disproportionally to large companies that are based in a just a few regions. Thus, ongoing digitisation is likely to lead to a concentration of corporate income tax revenues in a few regions.

The impact of megatrends on subnational revenue depends on two factors that vary significantly among countries: 1) the weight of taxes in subnational revenues; and 2) the tax structure (Box 5.1). The tax structure includes the proportion of shared taxation and own-source taxes, the categories of taxes (on households, companies, property, etc.), subnational taxing power over rates and bases, the size of tax bases, etc. All these dimensions vary significantly among countries. As a result, tax revenues are likely to be increasingly unequally affected across regions. Table 5.1 summarises some of the main effects on taxes that can be expected from the trends discussed throughout this report.

Assuming that there will be no radical changes in tax rates or tax mix (i.e. no new major tax instruments introduced) in the short or medium term, digitalisation and demographic changes are likely to put pressure on tax revenues in many regions. For instance, in remote rural areas, population ageing and outmigration may erode income tax bases dramatically. If such development persists, less prosperous regions will become more reliant on central government transfers and other revenues.

International tax competition puts strong pressures on corporate tax rates and thereby on corporate tax revenues all over the world. Even though the economic literature usually argues that corporate tax is not an optimal source for revenue for subnational governments (Bahl, Linn and Wetzel, 2011[235]), in many countries corporate tax revenue is shared between central government and subnational governments. While business headquarters are often concentrated in large urban areas, there can still be considerable activity (such as manufacturing or mining for example) in other regions. Increasing concentration of businesses over time, particularly in large agglomerations – which may be accelerated by digitalisation – would further reduce tax revenues in less developed regions,

Property taxation is seen as the best tax for financing local public goods for several reasons. One of its main advantages is that it approximates the benefit principle, i.e. those who benefit from public services will pay the tax. It is also a geographically equitable tax and provides stable tax revenues. However, in reality, property tax makes up only one-third of all municipal tax revenues (Slack, 2018[236]). Large metropolitan areas usually have a larger per capita property tax base because of higher property values and more commercial and industrial properties, which are often taxed with higher rates than residential buildings (Slack, 2018[236]). If ongoing urbanisation and increasing economic concentration in cities drives up land and property values further, regional differences in property tax are also likely to further increase.

Table 5.1. Possible effects of global megatrends on different types of taxes at the regional level

	Environmental changes	Demographic change			Technological change	
	Energy transition	Ageing	Urbanisation	Migration	Digitalisation	Automation
Personal income taxes (PIT)		Reduces PIT revenues.	May increase PIT in cities as more people move to urban areas; reduces PIT in rural areas.	In areas with positive net migration the PIT revenue can increase.		Reduces PIT in regions that see large job losses from automation.
Corporate income taxes			May increase, especially in urban areas due to agglomeration effects.		Profits in the digital economy accrue disproportionally to large companies that are based in just a few regions. Thus, ongoing digitisation is likely to lead to a concentration of corporate income tax revenues in a few regions.	
Property taxes		Equity issues may arise if elderly population relying on pension income has problems to pay the property tax.	Urbanisation may push up the price of land and increase property tax revenue in urban areas. In non-urban areas, the property values and property tax revenue can diminish.		Technologies such as Geographic Information System tools can help identify properties and thus increase the efficiency of property tax collection.	
Taxes on goods and services	Petrol tax base may diminish or disappear if shift to electric vehicles is successful.				Online retailers may increase the complexity of value-added tax collection and regulation; but some technologies may also help track consumption and services.	

Note: Assuming a business-as-usual scenario, i.e. countries do not carry out policies to intervene/change these impacts.

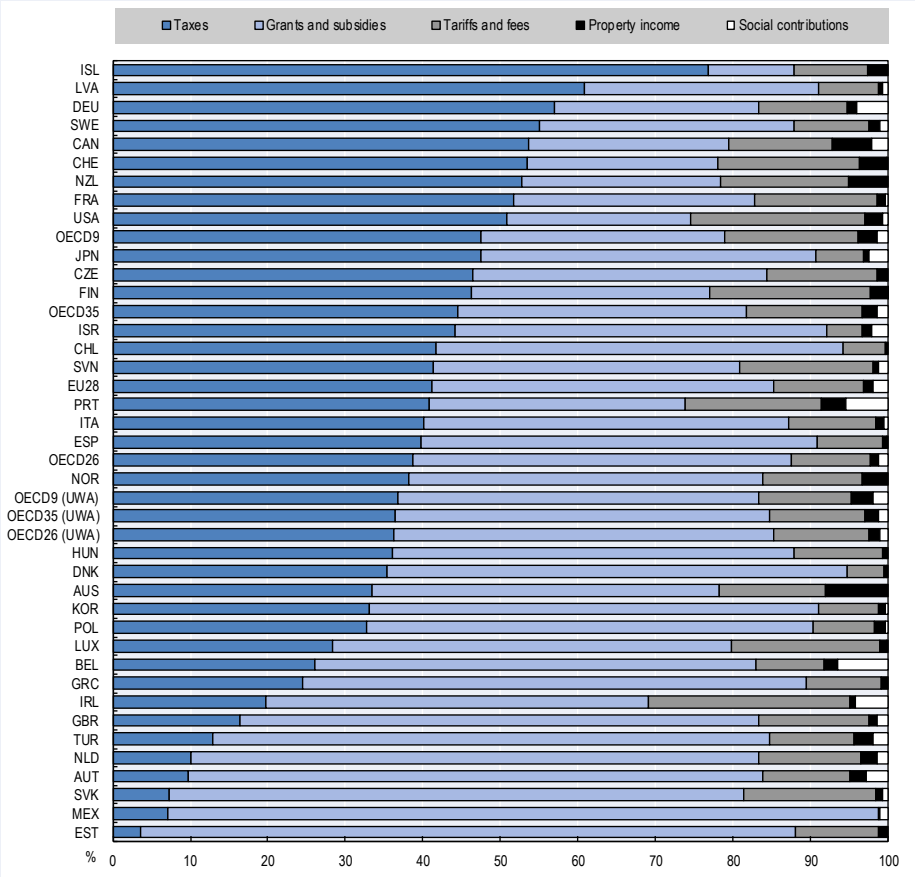
In order to make the right budgetary choices, subnational governments may need more ability to raise own-revenues and enjoy more flexibility in managing them. In the area of climate change, for example, the ability to benefit from tax resources, through tax-sharing arrangements and own-sources taxes, is particularly important. All categories of taxes can potentially be used to finance climate objectives. However, taxes or user fees specifically targeting environmental protection in the areas of energy, transport, pollution, water and natural resources can also benefit subnational governments exercising functions in these sectors. Central government co-ordination is needed, however, in implementing such taxes locally to ensure that the national environmental protection targets are met. Also, to the degree that environmental taxes (such as petrol or, more generally, carbon taxes) succeed in changing behaviour towards becoming more environmentally responsible, revenues from them may gradually disappear.

At the same time, digitalisation opens an opportunity for governments to achieve a better taxation system. Blockchain, robotic process automation and Geographic Information System (GIS) in particular may enhance the transparency, efficiency and resilience of the taxation system and improve tax collection and management. These technologies can be particularly useful and of great interest for subnational governments. However, they raise specific legal, technical and capacity challenges (Box 5.2).

Box 5.1. The structure of subnational government revenues in OECD countries

In the OECD, tax revenue – which includes both shared and own-source taxes – represented around 45% of subnational revenue on average in 2016, while grants and subsidies amounted to 37%. User charges and fees and property income represented respectively 15% and 2%. Beyond these averages, national data show a very diverse situation from one country to another (OECD, 2018[50]).

Figure 5.1. Structure of subnational government revenue, 2016



Note: Tax revenues do not include here social contributions.
Source: OECD (2018[50]), "Subnational governments in OECD countries: Key data", https://www.oecd.org/regional/regional-policy/Subnational-governments-in-OECD-Countries-Key-Data-2018.pdf.

StatLink https://doi.org/10.1787/888933922536

For example, subnational tax revenue ranges from 3.5% of subnational revenue in Estonia to 77% in Iceland. Although recurrent property taxation is the cornerstone of local own-source taxation, particularly for municipalities, its weight in subnational tax revenues differs from one country to another. It represents 35% of subnational tax revenue in the OECD (unweighted average), but accounts for 90-100% of local tax revenue in Australia, Ireland, Israel, New Zealand and the United Kingdom, and less than 10% in Estonia, Luxembourg, the Nordic countries, Switzerland and Turkey (OECD, 2018[50]).

Box 5.2. Improving subnational tax systems with new technologies

Blockchain business models change the way tax administrations operate, co-operate and collect taxes. Blockchain creates an environment in which every transaction is public, verified and available in real time. Its application in tax has the potential to move the function from retroactive analysis and historical financial information gathering to a position where transactions, expenses, assets and liabilities can be recorded in real time and publicly scrutinised. By verifying things such as land ownership, other assets and identities, Blockchain and distributed ledger mechanisms can assist governments in mitigating the risk of mistakes and fraud as well as assessing and collecting tax payments. However, the application of Blockchain technology in taxation, especially on local taxation, may raise new technical and legal difficulties such as value determination, with a risk of the "tokenisation" of the assets and great variations of the value of existing assets across jurisdictions. Before the wide adoption of this new technology, policy makers will need to update legislation to close loopholes and potentially unfair tax treatment and to create standard guidelines regulating the "tokenisation" of the assets. The public sector might also need new competency for co-ordination among governments at different levels, as well as for generating clear guidance for citizens and businesses to apply this new technology for their assets.

Robotic process automation can also be applied in the taxation system to increase efficiency and transparency. Applications such as "TaxBot'' are already being used to transform tax function operations. By tracking business expenses and mileage, it helps users automate and simplify tedious accounting processes to save time and money, which in the end helps with such matters as provision, sales and use compliance.

Geographic Information System (GIS) tools can help enhance area-based systems, i.e. tax at a fixed rate per square metre of land area or building size. Traditionally, property taxes based on area do not capture changes in relative values over time. Revenues from this source will therefore be inelastic unless the fixed charges are frequently readjusted. Yet, with more advanced digitalisation tools, such as big data technology, one can expect that changes in relative values of assets can be easily identified or calculated, or can be forecasted in advance, which helps governments set the tax rates in a more flexible way. Cadastral maps can be updated regularly, and valuations made more consistently and in an up-to-date manner. Information flows from property registries, local building license authorities, public utilities, can be smoother. Other "land-based" subnational taxes – for example, betterment charges, levies on the sales of assets, licences to operate and even transfer taxes to a limited extent – may also benefit.

Countries may also rely on non-tax revenues, in particular to finance the maintenance and renewal of urban infrastructure. When well-exploited, tariffs and fees can help finance a number of local public services and facilities that are key to cope with megatrends, in particular in areas such as water treatment and distribution, collection and treatment of waste, public transport, and energy, among others. To reduce the environmental impacts of climate change, subnational governments could, for example, develop a fiscal strategy based on climate-friendly user fees and charges like congestion charges (OECD/The World Bank/UN Environment, 2018[237]).

Subnational governments can also better exploit land-value capture policies to bridge the financing gap. Land-value capture refers to fiscal instruments through which public authorities can capture increases in property values that are unrelated to actions of land owners. Typically it aims to capture either the windfall gain to land owners that can occur through zoning decisions or through public investments that raise the value of land and property.

Better budgeting by all levels of government

The long-term impact of global megatrends is generally hard to predict and thus difficult to incorporate into subnational expenditure frameworks. For regions with a large ageing population, the most obvious change in public expenditures may be pensions, medical care and long-term care. However, healthcare expenditure depends not only on the trend of an ageing population; the supply of medical goods and services, which is determined by technological progress, accessibility of medical services and institutional frameworks, also play a role. OECD analysis show that without reforms to contain health and long-term care costs, total expenditure in these areas is projected to increase by 7.7 percentage points of gross domestic product (GDP) between 2010 and 2060, on average, across OECD countries (3.3 percentage points of GDP in a cost-containment scenario) (de la Maisonneuve and Oliveira Martins, 2014[238]). This is a concern for national and subnational levels of government alike – health is the second highest budget item for subnational government in the OECD, accounting for 18% of subnational expenditure, the equivalent of 2.9% of GDP (OECD, 2018[50]).

A robust budgetary framework should thus be in place to meet the diversity of local needs and the potential short-, medium- and long-term challenges associated with the megatrends. This includes improved budgeting frameworks and processes, particularly in terms of time frames, stakeholder engagement and indicators used. For example, integrating multi-year forecasting or scenario planning into budgeting processes should be a priority to establish robust budgetary frameworks in subnational governments (see Chapter 2). Multi-year budgeting allows subnational governments to better cope with the impacts that megatrends can have on the expenditure or revenue sides. A multi-year framework needs to be complemented with mechanisms to regularly ensure reviews and updates. In Nordic countries, for example, all municipalities are legally required to have both annual budgets and four- to five-year fiscal plans, which are useful for both central government monitoring and subnational planning purposes.

In some cases, however, a full-blown multi-year budget approach may be a complex and administratively costly tool that ends up diverting attention and resources from the more fundamental task of developing adequate annual budgets. This is especially the case for small municipalities or local governments with limited resources and capacities. As such, subnational governments should bear in mind that a multi-year budgeting framework should be associated with the regional or local development strategy, including objectives pursued, development priorities identified and the approach chosen (Boex, Mcnad and Martinez-Vazquez, 1998[239]).

Participatory budgeting, a process which citizens are engaged in the decision making of spending and investment, can also help increase the robustness of the budgetary framework. When properly conducted, participatory budgeting may contribute to improving information flows between policy makers and service users, leaving the former better equipped to provide goods and services that more closely match the citizens' needs and preferences. It also strengthens accountability, as it stimulates more frequent checks on

policy makers and politicians by the citizens (Gonçalves, 2013[240]). There is a growing trend of greater citizen involvement and participation in budgeting processes, in particular at the city level. Participatory budgeting is on the rise in particular in Latin America (Brazil, Chile, Dominican Republic, Peru, etc.) as well as in Europe (Madrid with 15% of municipal budget in the hand of citizens, Reykjavik, Lisbon, Cologne, Paris, etc.). This trend is likely to continue with further increasing digitalisation.

Rethinking the governance of regional development policies

The quality of governance arrangements has a critical impact on spending effectiveness and investment outcomes. Governance that facilitates co-ordination and integration of sectoral policies is essential for effective regional policies in general. Appropriate governance arrangements have to ensure, for example, that policies are designed and implemented at the right scale and that public actors, the business community and civil society are involved. Rethinking governance arrangements might be required to ensure that regions are prepared to make the most of current megatrends. Three areas have generated significant new insights and opportunities in the governance of regional development policies: behavioural approaches, digitalisation and experimental governance.

Regional development policies inherently involve multiple stakeholders at all levels of government and are defined by a long-term time horizon. Interactions are often difficult, as there are asymmetries in the information among stakeholders, and unconscious biases when forming objectives and their opinions (OECD, 2018[234]). Insights derived from the behavioural and social sciences can be used as a public policy tool to address these biases.

Digitalisation opens up new ways for governments to reassess how policies are developed and services are provided. Utilising digital technologies can fundamentally alter the way governments engage with citizens. Through digital mechanisms, providing detailed information to help citizens take informed choices is just as feasible as direct feedback mechanisms that give citizens the opportunity to provide instant feedback on plans and policies that are still in development. With demographic decline raising the cost of service provision, physically or in person, relying on digital service delivery or even virtual service centres can be a solution that maintains access to public services.

The main challenge in addressing different megatrends is the uncertainty that surrounds the trends themselves, as well as their impact on different places. No single policy or governance mechanism offers the perfect response to any, let alone all, megatrends. Learning-by-doing and trial and error processes will therefore be essential to ensure that policies are sufficiently flexible to adapt as megatrends shape regions and cities and are in turn shaped by them. Experimental governance is a framework that embeds learning as an integral part of the policy design process.

Applying behavioural insights to regional policies

"Behavioural insights" are lessons derived from the behavioural and social sciences, including decision making, psychology, cognitive science, neuroscience, organisational and group behaviour (OECD, 2017[242]). Although their use in regional development policies has not been deeply explored, behavioural sciences offer a series of insights and tools worth considering when designing regional development policies. This can be done by "nudging" whole organisations via the people inside of them and via the policies and procedures defined to get results. "Nudging" people responsible for the design and implementation of regional development policies refers to the effort that can be made to

modify their behaviour by influencing their decision making as opposed to doing so through compliance-oriented measures (OECD, 2018[234]). Behavioural nudges can, for example, improve the effectiveness of tax collection. In the United Kingdom, the Behavioural Insights Team has encouraged tax payment by making reference to social norms in reminders to people with overdue tax payments. Results show that both norm-based and public-good messages increased the likelihood of individuals paying their overdue taxes (OECD, 2018[234]).

Understanding the behaviour of policy makers or policy implementers can make a significant difference to the quality of policy outcomes, regardless of whether one is deciding which conditions to include in a contract or which indicators should be used to evaluate performance (Box 5.3) (OECD, 2018[234]). In the context of regional policies and investments, behavioural insights can bring useful responses by helping explain biases linked with communication problems, engagement challenges, priority misalignment, funding gaps or misallocations, among others. Behavioural insights can, for example, provide guidance on how to define conditions for transfers from national to subnational governments that can be effectively met, and how to design territorial contracts across levels of governments that better nudge the parties to collaborate (OECD, 2018[234]). More generally, behavioural insights can help to align incentives that are provided within a public administration and outside of it more closely with policy objectives.

Digitalisation of government services in cities and regions

Across OECD countries, the use of digital government services has tripled since 2006, with around 36% of OECD citizens submitting forms via public authorities' websites in 2016 (OECD, 2017[247]). Across the European Union, the digitalisation of services has somewhat or even substantially reduced operating costs for 85% of cities (ESPON, 2017[248]).

Digitalised services are provided by the national, regional and local governments in different services or sectors, including citizen engagement (e.g. obtaining information, administrative procedures and online voting), spatial planning and construction, social and welfare services, as well as public infrastructure. In the European Union, for example, digital services for spatial planning and construction are often available at the local level. A high proportion of cities offer online applications for planning and building permits and dedicated GIS services to explore land-use plans and proposals. A majority of cities also enable citizens to trace their council's decision-making process on line to promote e-inclusion of citizens in local governance (Figure 5.2). By contrast, social and welfare services are less digitalised compared to other services (ESPON, 2017[248]). In response to the megatrends, governments can make more effort to promote digitalisation in these fields.

The degree to which digital services are "localised" varies across regions. In the European Union, for example, larger cities generally tend to provide a wider range of digitalised services at the local level. While this suggests that in some parts of Europe and for some types of digitalised services a higher share of these services are provided at regional and/or national levels, it may also imply persistent differences in the use of digital government services across various population groups. Governments need to be aware of these differences in order to develop tailored public service delivery approaches and avoid creating new forms of digital exclusion as the digitisation of the public sector progresses (ESPON, 2017[248]).

Box 5.3. Applying behavioural insights to regional development policies

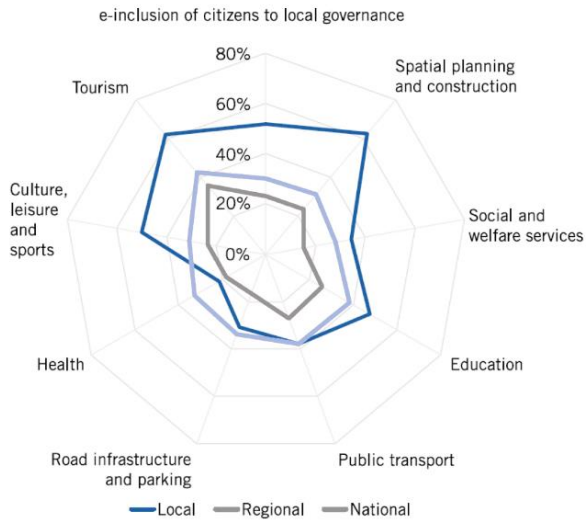
Behavioural insights can explain biases linked with communication problems, engagement challenges, priority misalignment, funding gaps or misallocations, among others. A step forward in regional development policy design is assessing and responding to those biases by integrating possible solutions provided by behavioural theory when deciding who to engage, which activities to fund and how to assign that funding.

Behavioural insights can be taken into account when designing regional development policies in order to:

- **Better use funds and select projects:** improving organisational or "group decision making" can significantly improve allocation of project funds; using behavioural insights might also help to improve effectiveness and transparency in the use of funds by using fair procedures to select projects and due processes.
- **Improve co-ordination and collaboration among actors:** behavioural insights can offer techniques that improve communication between parties and facilitate stakeholder engagement. Behavioural insights can also provide useful information on how to align individual and organisational goals among levels of governments. Collaboration can be enhanced through the use of behaviourally informed tools and products that aid in the process.
- **Simplify procedures:** behavioural insights have proven to be a successful tool in areas where the use of traditional forms of regulation is no longer effective. The use of plain language, or even visual instructions, can be more effective than lengthy instructions. Nudging principles can be applied in interventions that aim to simplify processes within an organisation, for example, in relation to public procurement or grant applications.
- **Use data more effectively:** behavioural science can also make sense of data by helping to answer the following questions: how can the available data be used better? How can the data be presented to different stakeholders involved in defining regional development policies with a view to increasing uptake? Which data should be used, provided to or asked of subnational governments in order to align objectives? Which data can be more effective to reward, monitor or evaluate performance?
- **Improve performance and uptake:** behavioural insights can contribute to a better understanding of the use of rewards or incentives in organisations, structuring rewards and measuring performance in line with the intended outcomes. They can also help build a culture of risk-taking to encourage and stimulate innovation.

Source: OECD (2018[234]), *Rethinking Regional Development Policy Making*, http://dx.doi.org/10.1787/9789264293014-en.

Figure 5.2. Share of digitalised services provided at local, regional and national levels in the European Union by type



Source: EPSON (2017[248]), *The Territorial and Urban Dimensions of the Digital Transition of Public Services*, https://www.espon.eu/sites/default/files/attachments/ESPON%20Policy%20Brief%20on%20Digital%20Transition.pdf.

GIS is a highly flexible digital tool with applications in numerous contexts, and is commonly used in urban planning, especially for construction and public transport design. Generally speaking, it allows spatially referenced data from diverse sources to be linked, thus providing a clear picture of what is going on within a given territory, such as a city. For example, when seeking to decrease the incidence of a specific disease, health departments can identify disease clusters by mapping each case. They can then layer the map with other information, including pollution levels, literacy levels, crime levels, etc. in an attempt to find correlations that either help determine causation or help guide an appropriate response to the health problem. An increasing number of cities have been using GIS to make it easier for the public to report potholes and other problems like water leaks, abandoned vehicles, potential gas leaks, graffiti, etc. (Walden University, n.d.[249]). In recent years, the application of GIS has spread to medium and small cities and regions in developed and developing countries (Box 5.4).

One significant characteristic of the digital era is the booming quantity of data – the volume of digital data is almost doubling every two years (Song et al., 2017[250]). Machine-learning techniques is a new line of research that facilitates exploiting the large amount of data increasingly available to public institutions and researchers. Machine learning tries to develop purely data-driven models that result in the best prediction for beneficial outcomes from targeted interventions (De Blasio, Lembcke and Menon, 2018[251]). In other words, it avoids identifying causality, which is often difficult in policy design, but uses empirical evidence and data to build a favourable policy model using algorithms. Software developed by the city of Los Angeles is processing big data to address traffic congestion. Using magnetic sensors, real-time updates on traffic flow are transmitted with simultaneous data analysis making second-by-second adjustments possible to avoid bottlenecks.

The increasing need for data sharing, analysis and protection in public services will challenge vertical silos in public administrations and require more co-operation among jurisdictions and levels of government. Governments should prioritise the adoption of an

overall sharing strategy to co-ordinate efforts and exploit synergies (OECD, 2014[252]). This can be applied to facilitating the use of linked data and create a shared view of data and information, including open data, within and across levels of governments (OECD, 2017[253]). Open data enables public access to information and more direct involvement in decision making. For example, the Urban Open Data movement aims to foster understanding of government information by the average citizen. In Helsinki, data are released and managed through the city's Urban Facts Agency in collaboration with neighbouring municipalities, who in turn release regional data through Helsinki Region Infoshare (Sulopuisto, 2014[254]). In the United Kingdom, the Greater London Authority has set up the London DataStore, a free and open data-sharing portal where people can access over 500 data sets for a better understanding of local issues and possible solutions. Some international initiatives offer cities support in their quest to develop and use open data for public services. For example, the World Council on City Data works on standardising city metrics and is implementing a dedicated standard in many regions (WCCD, 2018[255]).

Box 5.4. Applying Geographic Information System to public services

Geographic Information Systems (GIS) are used by subnational governments to support public service delivery. In New Jersey (United States), the New Jersey Turnpike Authority operates and maintains one of the nation's most travelled toll roads, co-ordinating more than 800 lane closure requests a week, in order to help keep traffic flowing and to best serve the traveling public. Historically, staff would manually and meticulously review each lane closure request, combing through pages of spreadsheets to check for conflicts. Now, with the assistance of a web-based system powered by GIS, when the New Jersey Turnpike Authority receives a lane closure request, a geo-processing engine automatically checks for conflicts. In just minutes, the manager receives a recommendation from the system to accept or deny the request, depending on the results of the query.

GIS tools have become more accessible to small regions, cities and rural areas. In Santander (Spain), solid waste, parking spaces, air pollution and traffic conditions are monitored through 12 000 sensors installed around the city, providing city officials real-time information on service delivery. The Sussex County (New Jersey, United States) government developed a mobile application for citizens to find government services such as libraries, police stations and post offices. It also publishes instant information of Sussex County bridges and roads on line, including whether the bridge/road is open, whether it is single lane and so on.

Sources: Asuo-Mante, E. et al. (2016[256]), "The application of Geographic Information Systems (GIS) to improving health systems in the Upper East Region of Ghana", https://doi.org/10.7916/D8QN678V; Siegel, J. (n.d.[257]), "Innovative GIS applications help public infrastructure agencies do more with less", https://geographic-information-system.cioreview.com/cxoinsight/innovative-gis-applications-help-public-infrastructure-agencies-do-more-with-less-nid-15022-cid-52.html; ESRI (n.d.[258]), "Rethinking GIS for local government", https://assets.esri.com/content/dam/esrisites/arcgis/products/arcgis-for-local-government/assets/rethinking-gis.pdf.

Subnational governments still face various obstacles to digitalisation. In a survey of 136 cities and towns across the EU, around 40% reported the absence of an overall digital strategy as a major challenge. Insufficient funding and a lack of skills are considered particularly acute for local authorities wishing to implement a digital transition, especially for medium and small regions and cities (ESPON, 2017[248]). Moreover, they may also have fewer incentives to support the development of digital tools in policy making and implementation due to a relatively small population size, further hindering progress in ensuring more efficient public service delivery and investment. There are also challenges associated with changing the public's behaviour and improving knowledge about how to use digital services.

Experimental governance in cities and regions: An avenue to address megatrends

To address challenges associated with globalisation, climate change or disruptive technologies, governments need to become more agile, experimental and innovative, especially at the regional and local levels. Experimental governance is one way to approach this challenge by introducing experimentation and learning-by-doing into policy design and implementation processes. A willingness and capacity to experiment with policy approaches – testing, adjusting and retesting – is particularly relevant when confronted with megatrends, as these can dramatically shift, catching policy makers off-guard and requiring a rapid policy response.

Trial-and-testing: Using experimental governance for regional policies

To manage differences in terms of subnational autonomy, responsibilities or capacities, experimental governance approaches that embed learning-by-doing and trial-and-error processes into policy design, can help governments effectively respond to shifts in policy challenges and adapt approaches to specific and different local needs (Box 5.5). This is particularly true in an increasing fast-paced and changing world, where rigid and fixed policies defined by the central level can rapidly become obsolete.

A flexible and sound multi-level governance framework is fundamental to experimental governance and to empowering subnational-level policy makers to create placed-based, feasible and innovative solutions that address old and new challenges, and to facilitate mutual learning among different levels of government. Adopting more flexible policy mechanisms can help ensure that resources are more efficiently used and that service delivery and investments at the local level are effective. However, it is often unclear which governance arrangements work well and which do not in different contexts.

Implementing experimental governance means developing a culture of trial-and-testing in the public sector that allows policy makers to learn from successes and failures through pilot experiences (Morgan, 2018, forthcoming[76]). This experimentation can be conducted through top-down (state-led) or bottom-up (state-sponsored) approaches. The People's Republic of China (hereafter "China") and the Russian Federation, for example, have implemented the most radical top-down examples of state-led experimentalism. In 2017, China created the Xiongan New Area to explore ways to build smart and ecologically friendly cities, develop better infrastructure, and efficient transportation networks. Similarly, the Russian Federation attempted to create a Silicon Valley in Skolkovo, near Moscow, but so far with limited success (Morgan, 2018, forthcoming[76]). Other countries have implemented bottom-up approaches to experimental governance in which state, industry and universities work in concert to discover joint solutions to common problems. The Nesta innovation

foundation in the United Kingdom, for example, is a public sector lab dedicated to addressing societal challenges through evidence-based local experiments. Nesta supports projects such as "rethinking parks", which develops and applies innovative business models to the management of the public parks across the United Kingdom (Nesta, 2018[259]).

The experimental governance approach can be particularly challenging for subnational governments, which might lack the capacity to implement it – weak institutional environments, highly codified processes and cultures with limited room for failure can all be impediments. If implemented well, however, these models can help regional and local policy makers react to megatrends. Yet, regional and local governments should consider the experimental governance approaches and models as food for thought while they further enhance their strategic planning and co-ordination capacities to react to societal changes, thereby also improving government agility (Morgan, 2018, forthcoming[76]).

Box 5.5. Experimental governance: A definition

Experimental governance can be defined as "a recursive process of provisional goal-setting based on learning from the comparison of alternative approaches to advancing them in different contexts" (Sabel and Zeitlin, 2012, p. 169[260]). Experimental governance involves a multi-level process in which four elements are linked in an iterative cycle:

1. Broad framework goals and metrics are provisionally established by central and local authorities.
2. Local authorities are given broad discretion to pursue these goals in their own way.
3. As a condition for this autonomy, local agents must report regularly on their performance and participate in a peer review in which their results are compared to others who are using different means to the same ends.
4. The goals, metrics and decision-making procedures are revised by a widening circle of actors in response to the problems and possibilities revealed by the peer review process, and the cycle repeats.

This model is both compelling and politically challenging: compelling because it is grounded in a learning-by-monitoring evidence-based methodology; but challenging because public bodies, particularly in less developed regions, may not have the institutional capacity to manage experimental governance processes.

Source: Morgan, K. (2018, forthcoming[76]), *Experimental Governance and Territorial Development*.

Towards more differentiated multi-level governance

Since the 1970s, the overall trend in the OECD has been in favour of decentralisation. Decentralisation has gone hand-in-hand with an increase in subnational governance through municipal co-operation, metropolitan governance, and "regionalisation", i.e. the

strengthening of regions (OECD, forthcoming[261]). Most importantly, the trend has been towards more differentiated governance systems at the subnational level, with different responsibilities assigned to different cities and regions – at the same level of government. This trend is likely to intensify, as it is both a consequence of, and a response to, the megatrends discussed in this report.

Inter-municipal co-operation, metropolitan governance and regionalisation trends

Legal frameworks and policies supporting inter-municipal co-operation have been significantly enhanced over the last 15 years. Inter-municipal arrangements are now extremely diverse, varying in their degree of co-operation. In the OECD, there are a variety of formats for inter-municipal co-operation, ranging from the softest (single or multi-purpose co-operative agreements/contracts for shared services arrangements or shared programmes in Australia, England/United Kingdom, Ireland and New Zealand) to the strongest forms of integration, e.g. supra-municipal authorities with delegated functions in France, Portugal and Spain. Between the two, there is a spectrum of different forms of co-operation, ranging from single purpose to multi-purpose and from co-operation focused on technical issues to more strategic co-operation (OECD, 2017[262]).

Metropolitan governance bodies

Metropolitan governance reforms address the issue of fragmentation at the scale of functional urban areas. In an increasingly urbanised world, cities are not only growing in size, they are also outgrowing their historic administrative boundaries. Nearly one in 4 of the 281 OECD metropolitan areas has more than 100 local governments within its functional boundaries and more than half of them have to co-ordinate among at least 25 local governments.[2] This "administrative fragmentation" can create challenges for the effectiveness of public policies and raise difficulties in the planning and delivery of public services.[3]

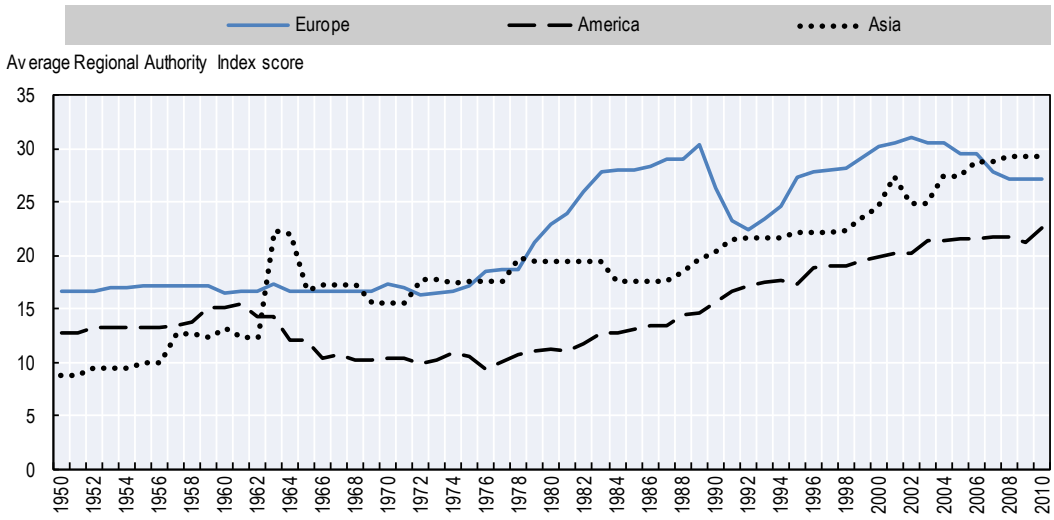
Enhancing the co-operation and co-ordination of public policies on a metropolitan-wide basis, in particular with regard to the provision of public infrastructures and services, aims at improving the quality of life and international competitiveness of large cities. (OECD, forthcoming[261]). The number of metropolitan governance authorities of all types has increased considerably since the 1990s and there has been a renewed momentum in reforms of metropolitan governance bodies. As of 2013, around two-thirds of the metropolitan areas in the OECD had a metropolitan authority (Ahrend, Gamper and Schumann, 2014[263]). The main responsibilities given to metropolitan areas are typically in infrastructure and planning tasks such as public transport, environment, spatial planning and services targeted at local business. They help to improve information flows across local jurisdiction and encourage cross-border planning. The trends toward metropolitan governance are likely to further accelerate in the coming decades as urbanisation continues to increase and successful cities continue to expand their functional boundaries.

Regionalisation

Since the 1970s, there has not only been an increase in metropolitan governance arrangements, but countries are increasingly decentralising responsibilities from the national level to the regional level (second tier).[4] Indicators that measure the authority of administrative regions, such as the Regional Authority Index, show that decentralisation to the regional level is pervasive in all parts of the world with available data (Figure 5.3). In western (mostly

European) countries, the trend started in the 1960s and 1970s, with countries in Asia and the Pacific region following suit since the 1980s. To a lesser extent, regionalisation has also taken place in Latin America since 1980s. Of the 81 countries covered by the Regional Authority Index, 52 experienced a net increase in the degree of regional authority and only 9 experienced a net decline (OECD, forthcoming[261]).

Figure 5.3. Regionalisation in America, Asia and Europe



Notes: Shown are average Regional Authority Index scores for 29 American, 11 Asian and 41 European countries. **America:** Argentina, Bahamas, Barbados, Belize, Plurinational State of Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, Trinidad and Tobago, the United States, Uruguay and the Bolivarian Republic of Venezuela. **Asia:** Australia, Brunei, Indonesia, Japan, Korea, Malaysia, New Zealand, Philippines, Singapore, Thailand and Timor Leste. **Europe:** Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, Malta, Montenegro, the Netherlands, Norway, Poland, Portugal, Romania, the Russian Federation, Serbia and Montenegro (until 2006), Serbia, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, and the United Kingdom.
Source: Schakel, A. et al. (2018[264]), *Final Report on Updating the Regional Authority Index (RAI) for Forty-Five Countries (2010-2016)*, https://publications.europa.eu/en/publication-detail/-/publication/5562196f-3d3a-11e8-b5fe-01aa75ed71a1.

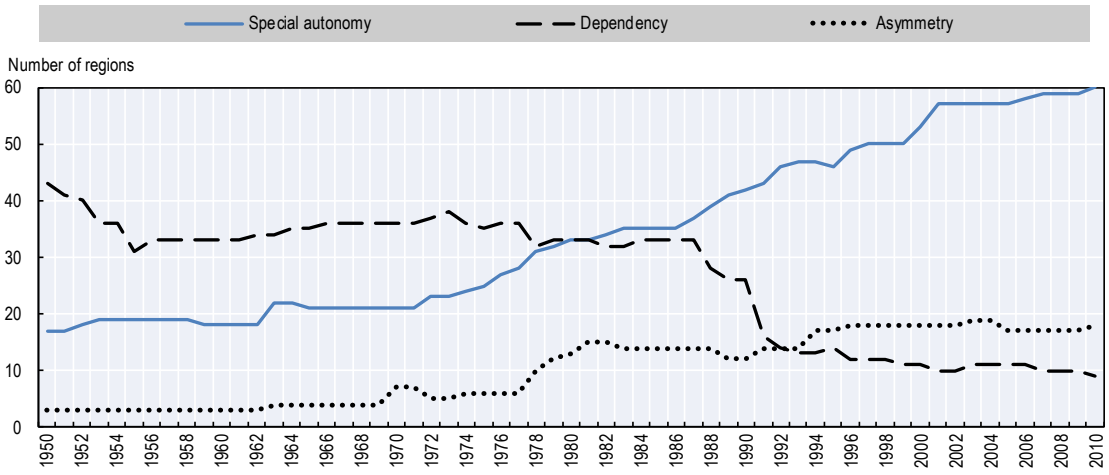
StatLink https://doi.org/10.1787/888933922555

Through regionalisation, countries aim at taking advantage of economies of scale in public service provision, better responding to widening functional labour markets, improving co-ordination between municipalities and intermediary levels of government, and increasing competitiveness, among others. Relative to local governments, regions have more resources to implement effective regional development strategies and the ability to foster intra-regional co-ordination and to implement more integrated territorial planning. They may better target regional comparative advantages through access to local knowledge, compared to the national government, or to fragmented local governments (OECD, forthcoming[261]).

Asymmetric decentralisation to tailor governance to local needs and capacities

Asymmetric governance arrangements have been common since at least the 1950s and are still growing in popularity. In 1950, around half of the countries covered by the Regional Authority Index had some kind of differentiated governance at the regional level. In 2010, almost two-thirds of the countries had implemented asymmetric arrangements in some form. Asymmetric decentralisation, however, is in transition: whereas between the 1950s and the 1970s asymmetric arrangements were a tool used mostly at the regional level, the present trend seems to apply asymmetric decentralisation in major urban areas. There can be political, economic or administrative motives for asymmetric decentralisation (Bird and Ebel, 2006[265]).

Figure 5.4. Number of special autonomous regions, dependencies and asymmetric regions in 81 countries since 1950



Notes: Asymmetric and special autonomous regions and dependencies are subject to a different kind of autonomy regime than standard regions. Dependencies are directly ruled by central government and have very limited autonomy. The decline in the number of dependencies is largely based on change of dependencies into standard regions in South America.
Source: Hooghe, L. et al. (2016[266]), *Measuring Regional Authority: A Postfunctionalist Theory of Governance*.

StatLink https://doi.org/10.1787/888933922574

Box 5.6. What is asymmetric decentralisation?

Asymmetric decentralisation occurs if governments at the same subnational government level have different political, administrative or fiscal powers (Congleton, 2015[267]).

Political asymmetric decentralisation refers to situations where some regions or subnational governments have been given political self-rule that deviates from the norm or average assignment.

Administrative asymmetry is a "*de facto*" asymmetric arrangement: even if subnational governments belonging to same government tier were treated symmetrically in terms of the politico-legal system, there might be a "*de facto*" asymmetry in implementation. Administrative asymmetry may, for example, include sequencing a national policy so that the subnational governments that fulfil certain predetermined standards are given greater autonomy in spending and revenue.

Asymmetric fiscal arrangements consist of a wide variety of measures, including special spending responsibilities, revenue bases or taxation rights, and additional transfers.

Source: OECD (forthcoming[261]), *Making Decentralisation Work: A Handbook for Policy Makers*.

Asymmetric decentralisation arrangements can help regions, cities and rural areas that are particularly affected by megatrends to better respond to opportunities and challenges. These types of arrangements allow subnational governments to adopt institutional and fiscal frameworks that are better targeted to local capacities, and may allow to better respond to local needs. In general, asymmetric decentralisation favours experimentation, learning-by-doing and innovation in policy making. Ultimately, it represents an advanced form of place-based policy (OECD, forthcoming[261]).

Differentiated subnational governance systems, such as asymmetric decentralisation, are likely to increase as they are both a consequence of, and a response to, global trends that have increasingly asymmetric regional consequences. They are no silver bullet and, crucially, they need to be put in place in a careful way, as they also entail risks (Box 5.7).

Box 5.7. Recommendations for asymmetric decentralisation

The OECD has identified a number of guidelines to make effective asymmetric decentralisation systems (OECD, forthcoming[261]):

- Asymmetric decentralisation should be part of a broader strategy to multi-level governance and territorial development.
- Asymmetric decentralisation should be supported by effective vertical and horizontal co-ordination mechanisms.
- Asymmetric decentralisation needs to go hand-in-hand with an effective equalisation system.

- The type of asymmetric decentralisation should be well-defined (political, administrative/management or/and fiscal) and have a clear rationale as the objectives and instruments will differ in each case.
- The scale and scope should be clear (large part of the territory vs. restricted, regional, metropolitan, local levels; permanent vs. transitory, timing, pilot/experimental).
- The way asymmetric responsibilities are allocated should be explicit, mutually understood and clear for all actors. An asymmetric decentralisation approach should be based on dialogue, transparency and agreements between all of the main stakeholders.
- To the extent possible, participation in an asymmetric arrangement should remain voluntary. The central government or other higher level of subnational government can take responsibility for service provision in non-participant areas.
- A variety of incentives (not just financial) should be used to foster participation in voluntary schemes or pilot experiences.
- The effects of asymmetric decentralisation should be carefully monitored on a regular basis and the results of such evaluations should be used to revise the plans if needed (including the effects on equity and national cohesion).

Adopting an integrated framework for rural policies

National policies that differentiate between different types of places are an important complement to differentiated governance systems. In 2015, all 33 OECD countries surveyed had an overarching framework for rural development. Rural development policies are still driven by sectoral approaches, as agricultural production remains at the core in most countries. But there is also a trend towards more cross-sectoral approaches and greater differentiation. In 10 out of 24 countries that responded to the OECD survey, rural-urban linkages were already considered a high priority (OECD, 2016[268]). This linking between strategies for different types of areas is likely to become more important as places adapt to ageing, globalisation and technological progress.

The coming decades bring new opportunities for rural areas, pressing governments at all levels to respond in novel ways. From additive and distributive manufacturing to decentralised energy systems, new and emerging technologies support deconcentrated and network-based distributive production systems that have the potential to reshape the geography of economic activity, benefiting rural areas. At the same time, there are emerging threats as well. Climate change, including more frequent and unpredictable weather events and their wide-ranging effects on infrastructure, natural resources and ecologies more generally, alongside the global and enduring phenomenon of population ageing, challenge communities to adapt.

Addressing these complex issues demands an upgraded set of policy tools. Investments that offer a positive return to society should be the main instrument for rural development and community capacity building underpins the success of this approach. But, in situations where markets fail due to incomplete information, negative externalities, insufficient

competition or because of a lack of provision of public goods, governments may have to be more directly involved in order to ensure that well-being in rural areas is improved. Place-based policies have always required multi-sector co-ordination and multi-level governance, and with such complex and interconnected emerging trends, this is ever so the case. Growing recognition of the strong interdependencies that are present between rural and urban regions demands the integration of rural and urban policies at various levels of government (national, regional and local). The questions are: how to deliver on these goals; how to design smart policy investments and set the right incentives to make the most of public investments and help places realise their potential.

Co-ordinating rural policies

The evolution of rural policies towards a more multidimensional view of rural development leads to the question of how it should be organised within ministries and departments at the national and regional levels. Policies should be integrated horizontally, through management arrangements and development plans among different sectors, services and agencies within a given level of government. They should also be vertically integrated, from the national (or supranational in the case of the EU) down to the local level of government, wherein the capacity of subnational governments is critical in order for them to be meaningful partners. Interventions should be territorially integrated and consider the inter-relationships and interdependencies between different territories. These are the general principles articulated in the OECD's rural policy paradigm "Rural 3.0" (Box 5.8).

Box 5.8. The OECD rural policy framework: Rural Policy 3.0

In 2006, OECD member countries adopted the New Rural Paradigm as a core approach to develop better rural policy. The main principle of this approach was that rural territories can be places of opportunity, but for these places to achieve their potential, a spatially sensitive development approach is required (OECD, 2006[269]). In 2016, the New Rural Paradigm was updated with the Rural Policy 3.0, which reflects the new knowledge acquired in the intervening decade.

The core idea in Rural Policy 3.0 is that economic growth occurs in different ways in rural areas than it does in urban ones. The rural growth process takes place in a "low-density economy" where agglomeration effects do not occur and distance plays an important role in production costs and the lives of the people. Moreover, because the opportunities and constraints in different types of rural places vary, so does their economic function. Rural economies tend to have niche markets because they are small and specialised, except for those places producing natural resources, such as agricultural commodities, minerals or forest products. Table 5.2 illustrates the evolution of OECD thought on rural policy.

Table 5.2. Rural Policy 3.0

	Old paradigm	New Rural Paradigm (2006)	Rural Policy 3.0: Implementing the New Rural Paradigm
Objectives	Equalisation	Competitiveness	Well-being considering multiple dimensions of: 1) the economy; 2) society; and 3) the environment
Policy focus	Support for a single dominant resource sector	Support for multiple sectors based on their competitiveness	Low-density economies differentiated by type of rural area
Tools	Subsidies for firms	Investments in qualified firms and communities	Integrated rural development approach – spectrum of support to public sector, firms and third sector
Key actors and stakeholders	Farm organisations and national governments	All levels of government and all relevant departments plus local stakeholders	Involvement of: 1) public sector – multi-level governance; 2) private sector – for-profit firms and social enterprise; 3) third sector – non-governmental organisations and civil society
Policy approach	Uniformly applied top-down policy	Bottom-up policy, local strategies	Integrated approach with multiple policy domains
Rural definition	Not urban	Rural as a variety of distinct types of place	Three types of rural: 1) within a functional urban area; 2) close to a functional urban area; 3) far from a functional urban area

Source: OECD (2016[270]), "Rural Policy 3.0", http://dx.doi.org/10.1787/9789264260245-7-en.

In terms of the various dimensions of rural policy, there is an obvious need to improve co-ordination across a wide range of ministries that each have control of specific policy domains that affect rural development. While some of these ministries, such as Health, Education or Public Safety, focus on people, irrespective of their place, others have more of a territorial focus, in that differences in geography influence the forms of policy –

e.g. agriculture, mining, fisheries. How can stronger co-ordination be achieved between these types of ministries and where should the "voice" of rural issues sit within government?

Some countries make their Ministry of Agriculture the lead agency for rural development while others assign this role to another ministry, such as a Ministry of Regional Development, Transport or Infrastructure or some other entity. Some countries have no identified lead ministry for rural development – leaving these issues to regional governments instead. Others have allocated responsibilities to different ministries over time because they were unsatisfied with the initial choice. In essence, the problem with the choice of lead ministry reduces to two different issues. The first is that a Ministry of Agriculture, by its very nature, will focus more on farming than on broader rural development issues. As farming starts to play a smaller role in rural areas, the mismatch between "interests" and "needs" becomes more evident. Second, while ministries involved in regional development have a much broader perspective on economic development, such ministries do not necessarily have a strong commitment to rural areas, especially as urban areas begin to play a larger role in terms of population share and share of economic activity. Resolving these two contradictions has been difficult for all OECD member countries.

In countries where the president or prime minister has a strong interest in rural areas, the issue is resolved by the leader directing rural policy. However, this is an increasingly rare event. Some countries have tried to establish a specific council of ministers with a rural mandate, but once again, in meetings of equals there can be no leading authority. Finland has adopted a unique approach to co-ordinating rural policy across sectors – one that combines elements of broad rural policy along with forms of vertical and networked governance. Finland's Rural Policy Committee is a 35-member co-operation body appointed by the Finnish government that draws its membership from national ministries, regional co-operation bodies, trade unions, the Federation of Higher Education and Training Institutions, the Association of Finnish Local and Regional Authorities, the ombudsman for the LEADER programme, associations of producers of agriculture and forestry products, and the Village Action Association of Finland. The committee is presently led by a representative of the Ministry of Agriculture and Forestry. There are also seven thematic networks that support the work of the Rural Policy Committee and the realisation of Finland's National Rural Policy Programme 2014-2020. Given that Finland's Rural Policy Committee involves multiple levels of government from the European Union to decentralised local government and several non-governmental actors, it can be described as a form of new governance or governance network (Sørensen and Torfing, 2007[271]) (Pierre, 2009[272]).

An alternative approach to the co-ordination of national policies that impact rural areas is "rural proofing", which was first adopted in the English context. Rural proofing entails considering the likely impact of policy decisions on rural areas, and, where necessary, adjusting the policy to take into account the particular needs of those who live in, work in or enjoy the countryside. This approach encourages the early assessments of expected, or likely, impacts in rural areas. Canada adopted a similar approach at the end of 1990s with a "rural lens" – a checklist of considerations to determine if a policy or programme addresses priorities for rural areas. More recently, Canada's focus on rural development has been strengthened by the appointment of a Minister for Rural Economic Development in January 2019. The new Minister will oversee the creation of a rural development strategy to spur economic growth and create jobs in rural Canada. This Minister will also work with municipalities, provinces, territories, and Indigenous partners to meet the unique and diverse infrastructure needs of rural communities, including the provision of internet infrastructure in rural and remote areas of the country.

The effectiveness of "rural proofing" is a matter of debate, with some arguing that it can act as a form of tokenism that does not, in fact, adequately inform policy development at an early stage. In an assessment of rural proofing in England and Northern Ireland, Shortfall and Alston (2016[273]) find that it has had limited effectiveness due to a lack of commitment across government to the policy; that the tendency for policy makers is to argue that rural proofing is not pertinent to the policies reviewed; and that it has led to little consideration of appropriate targets, outcomes or goals. In effect, rural proofing is only as effective as underlying commitments to rural development. It is also connected to the nature of the social welfare state in the country in question and its commitment to the territorial redistribution of public resources. As such, it may have greater utility in some counties than in others (Shortall and Alston, 2016[273]).

Sweden is one of the most recent OECD countries to have devised a new approach to co-ordination of rural and regional policy. Its new framework for rural policy has been framed in part by debates about whether rural Sweden is being left behind in the country's growth and development. Rural policy issues have not been sufficiently represented in Sweden's growth policy and there has been an ongoing discussion about how to develop new measures for rural development and how to better link them with the regional growth policy, and other sector policies. Recent reforms strengthening the role of regions are an important part of this. As a result of that, in 2018 Sweden's parliament accepted the government bill on a new coherent rural policy.

There is no single best practice solution to overcome inherent divisions between regional, rural and agricultural policies. The type of network approach that Finland has adopted is enmeshed in its culture of decentralisation and multi-level governance; applying the same approach in different institutional and cultural settings is therefore difficult. Similarly, rural proofing does not offer a one-size-fits-all model. However, beyond governance structures, the inherent silos between these policy domains can be addressed at an organisational level as well. For example, relationships and knowledge sharing between ministries can be strengthened through opportunities for short-term secondments, and co-ordinating professional development opportunities and training for staff.

The benefits of national urban policies for managing urban transformations

In contrast to national rural policy frameworks, a dedicated and explicit national urban policy framework is (not yet) prevalent among OECD countries. Only 15 have an explicit national urban policy and in 2016, one-third of them were still in the formulation stage. However, almost 90% of OECD countries do have partial elements of a full national urban policy already in place (OECD, 2017[207]).

A coherent framework, a national urban policy, provided by the national government is an important tool to allow cities to address the challenges they face. Cities around the world face challenges such as population growth or decline, ageing, development and maintenance of urban utility services, changing land use, fluctuations in real estate and housing markets, and the introduction of new technologies.

A national urban policy is a government-led, coherent set of decisions to co-ordinate various actors in order to promote more productive, inclusive and resilient urban development (UN-Habitat, 2014[274]). National urban policies can cover a wide range of national policies with a profound effect on urban development, including economic development, land use, housing, transport, environment, labour, health and education.

Across the globe, 150 countries have developed national urban policies, although some are not labelled as such. Many countries are currently reviewing their existing national urban policy to adapt it to the context of recent global agendas. For example, after the adoption of the New Urban Agenda of the United Nations and the Urban Agenda for the European Union in 2016, Spain is in the process of redefining its National Urban Agenda. Indonesia is in the process of incorporating the Sustainable Development Goals (SDGs) into its National Urban Policy framework, especially SDG 11 on making cities and human settlements inclusive, safe, resilient and sustainable.

The New Urban Agenda (the outcome document of Habitat III) has put explicit emphasis on national urban policies as one of its five implementation pillars and calls for measures to enhance the ability of governments to develop and implement national urban policies (UN, 2016[275]). The growing spread of national urban policies and their complex natures increase the benefits of global knowledge sharing.

Box 5.9. Co-ordinated international support for national urban policies

The complex nature of the national urban policy development and lack of capacity and resources, observed not only in rapidly urbanising countries but also in many developed countries, calls for co-ordinated and collaborative efforts by international communities. To this end, a few priority areas have been identified:

1. **Regular monitoring of the development of national urban policies.** A first step in monitoring has been made with the Global State of National Urban Policy (OECD/UN-Habitat, 2018[276]), launched in February 2018, but broader country participation and an extended methodology could take the knowledge base even further.
2. **Enhanced knowledge-sharing.** For example, the International Conferences on National Urban Policies provides a unique opportunity to learn from the latest developments across countries, take in the view of different stakeholders and experts, and exchange among peers.
3. **Tailored country support.** Different country support programmes, including OECD National Urban Policy Reviews, can help countries effectively identify implementation gaps, promote evidence-based policy making and enhance capacity building for national urban policy development.

The National Urban Policy Programme (NUPP), a global partnership co-led by the OECD, UN-Habitat and Cities Alliance, is an important vehicle in which all interested partners can co-ordinate with each other in implementing these different supporting activities and create synergies.

National urban policies can help align different sectoral policies that affect urban areas so that they can coherently support cities. For instance, Switzerland has had a National Urban Policy in place since 2001 and has recently adopted a new strategy for the coming ten years, Federal Agglomeration Policy 2016+. This policy has been implemented in parallel with a policy targeting rural areas to ensure coherent spatial development. The National Urban

Policy's overarching objectives are higher quality of life, higher economic attractiveness, quality urban developments and efficient collaboration.

Implementing national urban policies

The institutional arrangements for implementing national urban policies at the national scale are highly diverse and closely tied to national historical, economic, social, political and geographical contexts. A large majority of countries do not have a specialised national urban agency in charge of implementation. Among the 35 OECD countries studied, only 3 have specialised urban agencies, whereas other countries have a general national planning authority to oversee the policy (OECD, 2017[207]). This underlines the importance of co-ordination at the national level for successful implementation. It is not possible to generalise whether a specialised urban agency is a desirable form of governance, as such a decision has to take into account a country's political and organisational context. In the same vein, strong national leadership on a national urban policy does not mean strengthening national control over local governments; rather, a national urban policy should empower local authorities and communities.

Engaging stakeholders in the national urban policy processes

Although occasionally characterised as a top-down approach whereby the national level dictates standards for subnational government, a national urban policy framework requires multi-level co-ordination, inclusiveness and stakeholder engagement in order to be effective (UN, 2016[275]; OECD/UN-Habitat, 2018[276]). Subnational governments not only have knowledge of local conditions and close proximity to citizens, but also the capacity to adapt policies according to context. They should be engaged at every stage of the national urban policy process and not be considered solely as agents of implementation (OECD/UN-Habitat, 2018[276]).

A national urban policy must be accompanied by an effective institutional framework and governance processes that allow for the co-ordination and collaboration of a variety of urban stakeholders (OECD/UN-Habitat, 2018[276]). When institutional and governance frameworks only require some form of engagement, without a clear mandate on the exact form and the matter concerned, a "tick-the-box" approach to stakeholder engagement may occur (e.g. the minimum level of engagement is promoted), which will alienate stakeholders and miss key opportunities for synergies. Preliminary research indicates that the extent of stakeholder engagement tends to reflect the degree of refinement of a national urban policy, with greater stakeholder engagement generally associated with advanced national urban policies (OECD/UN-Habitat, 2018[276]).

National urban policies can also provide an interface across all levels of government and other stakeholders. Their processes can function as forums for the co-creation of a shared vision and as a framework that enables stakeholders to move as one towards stated goals. National urban policies do not replace local urban policies, but complement them to create the necessary conditions for sustainable urban development.

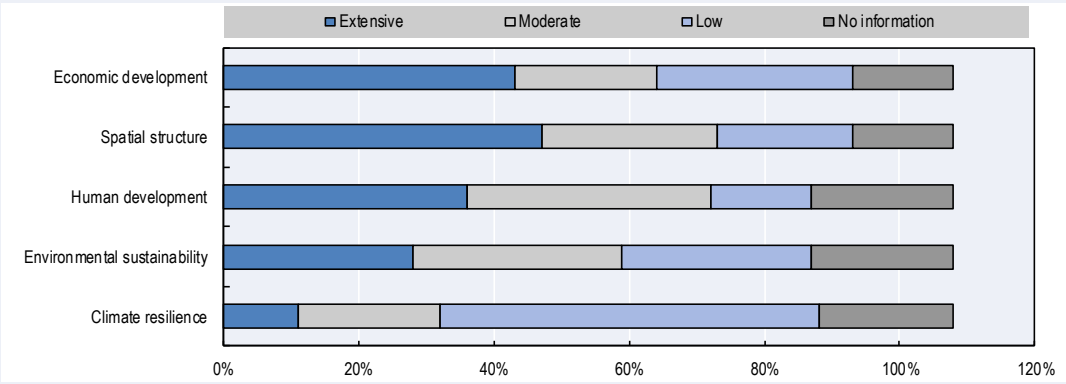
Box 5.10. Explicit national urban policies are becoming more common

While a national urban policy can take a number of different forms, two broad classifications have been used to analyse the form of national urban policy. Explicit national urban policies are observed where a policy has a title of "national urban policy" or a variant such as "national urban strategy" or "national urban development strategy". Implicit, or partial, national urban policies refer to a policy form in which many of the elements of a national urban policy exist but they are not yet brought together as a formal, or explicit, national urban policy. Approximately half of the analysed countries have adopted an explicit national urban policy, while the other half have an implicit national urban policy that incorporates some elements of an explicit national urban policy. However, explicit national urban policies are becoming more common, especially in countries that are experiencing rapid urbanisation (OECD, 2017[207]; OECD/UN-Habitat, 2018[276]).

While the differentiation between explicit and implicit national urban policies provides some indication to the effectiveness of a national urban policy, the degree of clarity with which a national urban policy is spelled out is most important. A more clearly formulated national urban policy can be more effective in ensuring policy cohesion at the national level. This is not necessarily related to whether the policy is explicit or implicit. Some well-formulated implicit national urban policies have the potential to achieve the overall outcomes as explicit national urban policies but without the deliberate framing as such (OECD, 2017[207]).

An analysis of all 150 national urban policies around the world demonstrates the variety of context-specific thematic priorities. Economic development and spatial structure receive the most attention, both in the OECD and globally. Environmental sustainability receives extensive attention in OECD countries, but is much less emphasised in national urban policies outside of OECD countries. Likewise, climate resilience receives little attention. Only 5 out of 31 national urban policies in OECD countries and 11 out of 108 national urban policies outside of OECD countries grant significant attention to this area (Figure 5.5).

Figure 5.5. Thematic areas covered by national urban policies



Source: OECD-UN-Habitat (2018[276]), *Global State of National Urban Policy*, http://dx.doi.org/10.1787/9789264290747-en.

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Public investment in the face of global megatrends

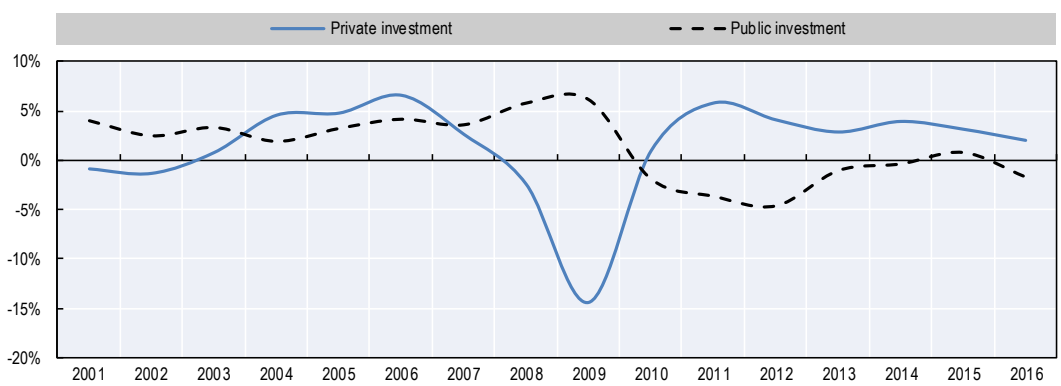
A significant investment gap remains

In advanced countries, public investment has steadily declined, from 5% of gross domestic product (GDP) in the 1970s to approximately 3% GDP in 2017, remaining at a lower level compared to emerging and developing countries (OECD, 2018[50]; IMF, 2015[78]). Behind this long-term downward trend is the fact that many OECD countries focus on maintaining existing and well-developed infrastructure rather than investing in new infrastructure. This may also be due to a shift in investment from traditional areas of physical investment to intangible and knowledge-based investments (Allain-Dupré, Hulbert and Vincent, 2017[278]) that are not always classified as investment in accounting systems.

In contrast, after years of decline, public investment as a share of GDP has started to recover in emerging and developing countries.[5] Still, public investment rates in most developing countries are significantly below 6-8% of GDP, with the exception, for example, of China. Many middle-income countries, such as Brazil, India, the Russian Federation and South Africa, still have low-quality infrastructure, which constrains future economic growth (Brookings Insitution, New Climate Economy, and Grantham Research Insitute, 2015[279]).

The 2007-08 global financial crisis had a strong impact on investment, both public and private. Public investment was used as an adjustment variable in the fiscal consolidation strategies that followed the investment recovery plans in the early phase of the crisis (OECD, 2011[3]; 2013[281]). This drop in public investment has been particularly significant in EU countries. In the OECD, this drop has not entirely reversed, with the level of public investment in 2016 in many countries still remaining behind pre-crisis levels (OECD, 2018[50]). In OECD countries, and particularly among emerging market economies, total public and private investment remains below 2008 pre-crisis levels (IMF, 2018[282]; OECD, 2018[283]). Some studies show that for OECD countries, the current gross fixed investment spending needs to be raised by about 12% to ensure that the productive net capital stock can grow at the same pace as before the global financial crisis (OECD, 2018[283]).

Figure 5.6. Annual changes in public and private investment (gross fixed capital formation) in real terms in the OECD33



Note: Private investment is obtained as gross fixed capital formation of the total economy minus general government gross fixed capital formation (appropriation account). Iceland, Lithuania and Turkey not included.
Source: Calculations based on OECD National Accounts.

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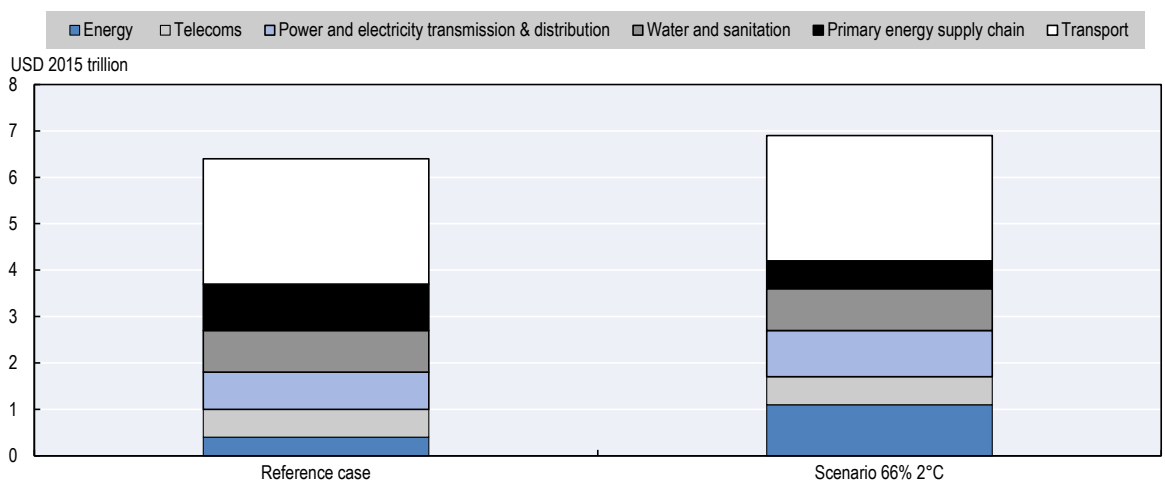
The Global Infrastructure Hub (GIH) estimated that although global infrastructure spending has gradually increased, from USD 1.8 trillion in 2007 to USD 2.3 trillion in 2015, there is a shortfall in necessary spending of USD 18 trillion between 2016 and 2040. This is 19% of the forecast spending needs, which means that spending would need to grow from 3% of GDP to 3.7% to close the gap (GIH, 2017[284]). Among the 50 countries analysed, the GIH estimates that the United States has the largest infrastructure investment gap (i.e. the difference between investment needs and current trends in investment) at USD 3.8 trillion, which is twice as high as the next largest gap – China at USD 1.9 trillion – followed by Brazil at USD 1.1 trillion and the Russian Federation at USD 0.7 trillion (GIH, 2017[284]).

More and smarter investment is needed

The OECD estimates that approximately USD 95 trillion in public and private investment will be needed in energy, transport, water and telecommunications infrastructure at a global level between 2016 and 2030 in order to sustain growth and development, without considering further climate action. This equals approximately USD 6.3 trillion per year over the next 15 years (OECD, 2017[51]). When taking into account climate concerns, i.e. the 2°C 66% scenario,[6] Paris Agreement commitments and the 2030 Agenda for Sustainable Development, there will be a need for an increase of about 10% in total infrastructure investment (USD 600 million) per year from the reference estimate (Figure 5.7) (OECD, 2017[51]). The GIH forecasts global infrastructure investment needs to reach USD 94 trillion by 2040 in order to keep pace with profound economic and demographic changes across the globe. Adding the commitments for achieving the SDGs, the total cost rises to USD 97 trillion, i.e. an annual investment need of USD 3.7 trillion between 2016 and 2040 (GIH, 2017[284]).

Figure 5.7. Global annual infrastructure investment needs for a 66% scenario 2°C, 2016-30



Note: Reference case assumes no further action by governments to mitigate climate change.
Source: OECD (2017[51]), *Investing in Climate, Investing in Growth*, https://dx.doi.org/10.1787/9789264273528-en.

StatLink https://doi.org/10.1787/888933922631

Around two-thirds of the infrastructure investment will be required in emerging and developing economies (OECD, 2017[51]). Rapid rates of urbanisation and population growth as well as commitments to reach the SDGs entail an expansion of transport and electricity infrastructure as well as broadband access, universal access to energy, sanitation, potable water and basic public services.

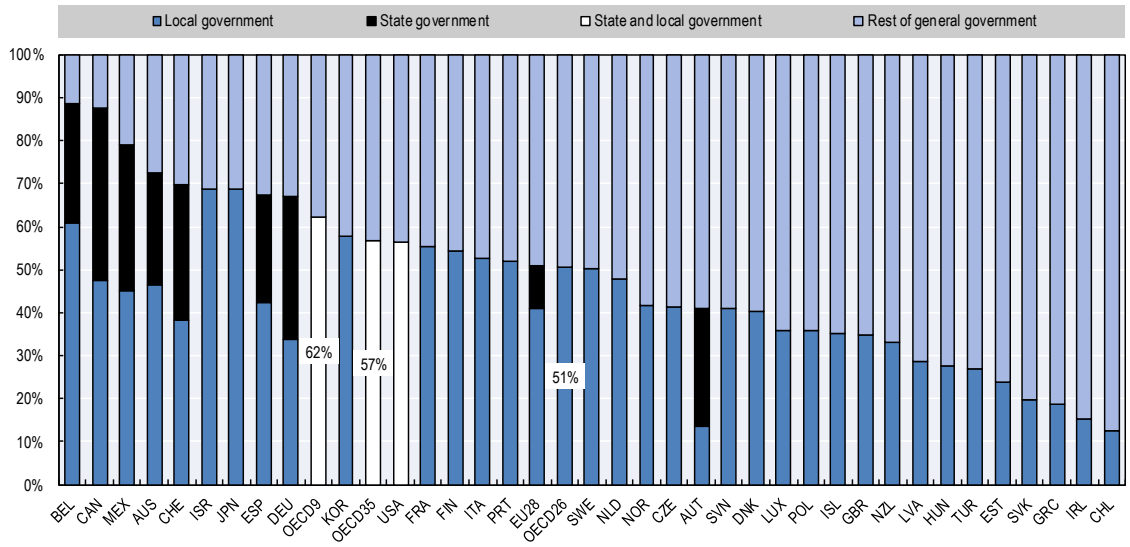
For their part, developed economies also have substantial infrastructure investment needs, ranging from maintenance and operation to infrastructure upgrades. Current deficiencies in infrastructure, in terms of quality and quantity, can hamper productivity and socio-economic opportunities for regions, as well as their resilience in the face of megatrends. In the United States, for example, almost one in ten bridges are structurally deficient and the average age of those deficient bridges is 67 years (ARTBA, 2018[289]). The US Department of Transportation (2015[290]) estimates that it could cost as much as USD 1 trillion just to bring the country's current highways and transit systems up to date. In the European Union, 43% of municipalities surveyed in 2017 by the European Investment Bank expect their investment from 2017 to 2022 to focus on repair and maintenance instead of modernisation and capacity expansion (EIB, 2017[291]).

OECD countries also need new investments in transport (including new transportation modes such as self-driving cars), broadband, housing, energy, water supply, sanitation and waste management. Investment needs for human capital development and skills upgrading, as well as in the social sector (education, lifelong learning, healthcare, long-term care, housing, etc.) are also significant. In the EU, an investment gap of EUR 100-150 billion per year has been identified in social infrastructure alone (European Commission, 2018[292]). The European Investment Bank estimates that Europe needs to invest 3.6% of GDP, including in social infrastructure, for Europe's economy to continue recovering and be set on a path of sustainable growth.

Key responsibilities in the policy areas that are most affected by megatrends

Subnational governments play a pivotal role in public investment. In 2016, subnational government investment accounted for approximately 57% of total public investment, on average, in OECD countries (OECD, 2018[50]) and 40% at a global level (OECD-UCLG, 2016[293]). Combining investments by states and local governments, this ratio tends to be higher in federal countries (70%) than in unitary countries (51%) (Figure 5.8).

Figure 5.8. Public investment by levels of government, 2016



Note: OECD9 and OECD26 refer to average for OECD federal countries for OECD unitary countries, respectively.
Source: OECD (2018[50]), "Subnational governments in OECD countries: Key data (brochure)", https://www.oecd.org/regional/regional-policy/Subnational-governments-in-OECD-Countries-Key-Data-2018.pdf.

StatLink https://doi.org/10.1787/888933922650

Subnational governments have key investment responsibilities in the policy areas that are the most affected by megatrends. A recent OECD pilot study in 30 sample countries shows that subnational governments were, on average, responsible for 55% and 64% (unweighted) of environment and climate-related public spending and investment over the 2000-16 period. However, the share of environmental and climate-related investment is nonetheless very low relative to GDP, representing around 0.4% of GDP on average over 2000-16 (OECD, 2018[294]).

More public investment is needed to implement the global agenda on climate, urban policy and the SDGs in developed and developing economies (OECD, 2017[51]). Most of the challenges are linked to public goods, such as water provision, sanitation, health, education, air quality, civil security and natural disasters management, social protection, etc., which need to be addressed jointly by governments and private actors.

Tapping into external finance: From borrowing to innovative financing

Subnational governments face multiple obstacles when it comes to external financing, limiting their potential for more and better investment. The first obstacle is linked to complex regulatory frameworks that may limit the use of borrowing by subnational governments and that can constrain public-private partnerships. A second obstacle is low credit ratings, particularly among cities. Only 4% of the 500 largest cities in developing countries are considered creditworthy in international financial markets and only 20% in local markets (World Bank Group, n.d.[296]). Creditworthiness can be affected by the inability to collect revenue, which limits a city's capacity to borrow and enter into partnerships with the private sector.

In a tight fiscal environment, it is critical to diversify sources of financing for infrastructure investment and to use public investment to leverage private funding in an effective way. Public sources of funding, and traditional budgetary sources, are insufficient to cover the investment needs demanded by climate change, ageing and the emergence of new technologies. Therefore, subnational governments need to tap into external financing, be it through borrowing or mobilising the private sector and institutional investors. Mobilising the private sector, however, should be done for the right reasons, at the right time, in the right place and with the right incentives. Otherwise, costly failures and disappointments may occur, on both the public and the private side.

Developing borrowing, bond financing and pooled financing

Long-term borrowing to finance investment permits a better allocation of resources over time. In many countries, borrowing is also a financial necessity due to a lack of local savings and capital transfers. Borrowing frameworks should be adapted to allow borrowing on the credit and capital markets for subnational investment, at least for the most capable regions and cities. These financing tools can help subnational governments access more capital and increase their financial resilience, especially in face of multiple challenges brought on at the same time.

Bond financing is widespread in federal countries (mostly for state governments), and is common at the local level only in Canada and the United States. In a unique approach, Mexico introduced a specific tool to facilitate joint borrowing by subnational governments (OECD, forthcoming[297]). Bond financing is developing in unitary countries such as Japan, Korea, New Zealand and Norway.

Climate and social bonds could be further developed to finance investment needs generated by climate change, ageing and automation. These bonds are fundamentally the same as traditional bonds, except that they are applied to environmentally and socially related investments. Green bonds, for example, meet the eligibility criteria for the Climate Bonds Initiative's Climate Bond Certification. Meanwhile, social bonds are intended to finance socially responsible investment. The green and social bond markets are still modest but are growing, including at the subnational level, and in 2017 issued green bonds exceeded USD 150 billion.

For their part, subnational pooled finance mechanisms (SPFMs) can facilitate subnational government access to capital markets in order to finance infrastructure. SPFMs provide joint access to private capital markets for subnational governments that have similar roles and credit characteristics, but lack the financial scope and scale, expertise and credit history to access credit markets on their own. These mechanisms can be particularly helpful for small projects as they mitigate debt service payment risk, diversify project risk and provide the technical professional management required to enable sustainability and access to private finance. SPFMs have been used in the United States; the Nordic countries where local government funding agencies are well-established; and are developing in France, New Zealand and the United Kingdom (OECD, 2017[298]).

Subnational public-private partnerships

Public-private partnerships (PPPs) represent an alternative to traditional government procurement and have the potential to improve value for money. Yet, they are complex and sometimes risky arrangements that require capacity to undertake them that is not always readily available in governments. Despite a growing proportion of infrastructure services that have been delivered through PPPs in the last decade, current levels of infrastructure

investment taking place through PPPs is still moderate. Most OECD countries (83%) reported to have 0-5% of public sector infrastructure investment taking place through PPPs in the last three years (OECD, 2018[299]).

The merits of private participation lie not only in providing financial resources, but also in the potential efficiency gains that may arise from their involvement (Engel, Fischer and Galetovic, 2009[300]). For instance, by bundling the responsibility for the initial capital investment with future maintenance and operating costs, PPPs can encourage firms to minimise costs and potentially keep a check on "white elephant" projects. They may also help insulate projects from stop-and-go funding, and protect maintenance expenditures by conditioning payments on service quality and availability (ITF, 2013[301]). Additionally, the private sector may contribute to important cost savings through innovations in project design and technological and managerial efficiencies.

There have been many examples in recent years of PPP failures or misuse, and they are not well-suited for all subnational governments. They work best in larger jurisdictions that already have the general fiscal and institutional capacities required. Likewise, they should be used primarily in those infrastructure sectors where the public sector has sufficient expertise. More generally, subnational governments should strengthen their capacity to engage in PPPs, for example, by establishing dedicated PPP units at the national or subnational levels.

Effective public investment requires investing in governance

A growing body of work points to the positive effects of public investment on growth. Recent OECD research shows that countries with higher levels of public investment increase their productivity faster than those with lower levels of public investment (Fournier, 2016[302]): in the long-run, increasing the share of public investment in primary government spending by 1 percentage point could increase the long-term GDP level by about 5% (Fournier, 2016[302]; OECD, 2013[281]).

Better governance of public investment helps achieve higher returns on investment and improve its effectiveness. The impact of public investment on regional development policy depends, to a significant extent, on how governments manage investment. Some studies show that improving the management of public investment could lead to substantial savings and enhanced productivity (OECD, 2013[281]; 2014[252]) (IMF, 2015[78]) (MGI, 2016[303]). The International Monetary Fund, for example, has estimated that, on average, about 30% of the potential value of public investment is lost due to inefficiencies in the investment process (IMF, 2015[78]).

Addressing the capacity issue to invest more efficiently

Capacity limitations – be they in investment financing, policy design and implementation, or governance more broadly – can inhibit the ability to introduce new polices, adapt existing ones or finance the initiatives that will help address the demands and pressures of megatrends. The financing dimension can be particularly problematic for cities and local governments that often have limited capacity to use funding tools and to combine different streams of financing and funding (OECD, 2018[234]).

When considering regional development policy, given differences in the capacity levels among regions, there is a risk of primarily benefiting those regions where governments have sufficient implementation capacity. This can result in excluding regions with less capacity, which are often also those with the lowest level of development and which stand

the most to gain from supportive regional development policies (OECD, 2018[234]). Improving governance capacities should be a priority for all countries, for all levels of government and for all types of regions (OECD, 2013[281]).

Capacity building is a "learning-by-doing" process in which all levels of government learn by repeated interactions. It is crucial to limit excessive administrative procedures and constant changes in the rules. For this learning-by-doing process to be in place, it is important to gradually provide more autonomy to subnational governments in the accomplishment of their tasks by decreasing rules and procedures, increasing monitoring and *ex post* evaluations. However, this "learning-by-doing process" needs to go hand-in-hand with differentiated and targeted capacity-building activities and technical assistance. This process might need a differentiated approach to specifically target different needs in different types of regions (OECD, 2018[234]).

Focusing on performance

A results-oriented public investment strategy – one that focuses on the performance of investments through the entire investment cycle – can help countries be more agile in their response to the risk and impact of megatrends and future developments. Setting evaluation processes for regional development policies and investments is necessary to increase their efficiency, learn from experiences and adapt policies to better fit specific subnational needs. Evaluating policy implementation not only refers to *ex post* programme evaluation, it also refers to technically sound project appraisals and effective investment- monitoring systems that monitor policy performance during the entire investment cycle, from its design to its execution (OECD, 2018[234]).

Ex ante appraisals are essential for minimising sustainable investment decisions, and for minimising investment risk. Such appraisals need to integrate an assessment of all the different types of risks associated with public investment: not only fiscal risks, but also financial, political, social and environmental risks in the short and long terms (OECD, forthcoming[297]). Despite its relevance, *ex ante* assessment is one of the weakest aspects of government capacity to take proper public investment decisions.

Overall, evaluation and monitoring criteria and mechanisms need to be defined in the early stages of the policy design process and should not be limited to budget execution. Integrating evaluation early in the planning process allows countries to allocate the resources needed to define the evaluation methodology and produce the appropriate data for this purpose (OECD, 2018[234]).

A focus on EU Cohesion Policy

Evidence from the European Union shows that the quality of government can be a determining factor in economic growth and the efficiency of Structural and Cohesion Funds expenditure. Estimates show that investments that simultaneously target regions and quality of government make a difference for regional economic growth. The evidence also shows that beyond a certain threshold of investment in cohesion and regional development, the quality of the regional government becomes a vital factor in determining the extent to which a region grows. In this sense, the most efficient way to achieve greater economic and social cohesion is by improving the quality of government; otherwise, improvements in economic growth would require massive amounts of additional investment (Rodríguez-Pose and Garcilazo, 2015[310]).

As the EU's main investment policy – providing funding equivalent to 8.5% of government capital investment in the EU – Cohesion Policy has successfully boosted investments and regional convergence. However, the global financial crisis of 2007-08 and the subsequent Eurozone crisis significantly affected Cohesion Policy results by putting a break on the progress in regional convergence (OECD, 2018[8]). This suggests that there is scope to make cohesion spending more effective in the next programming period.

Cohesion Policy plays a key role in addressing megatrend challenges, strongly supported EU member country investments to protect the environment, reduce emissions and adapt to climate change, for example. For the post-2020 period, Cohesion Policy investments need to be more effective at delivering on the EU's environmental and climate goals – for example by shifting towards more energy efficient and cleaner transport and making existing transport infrastructure more efficient (European Commission, 2017[311]).

Strengthening the results-oriented governance framework of EU Cohesion Policy

Performance monitoring and evaluation mechanisms allow bridging the gaps and diminishing information asymmetries between the EU level, that negotiates and monitors programmes, and the level of government where operations take place and where the beneficiaries (e.g. firms, municipalities) are located (OECD, 2018[234]). Cohesion Policy requires monitoring progress with respect to defined targets in terms of financial/input, output and, in certain cases, result/outcome indicators. This monitoring seeks to ensure that project beneficiaries and programme managers are likely to achieve their targets. It requires indicators that are relatively unaffected by outside factors. This tight link forms the basis for the allocation of a performance reserve (6%), which aims to reward good performance in the implementation of programmes if they have achieved their milestones ahead of schedule (Downes, Moretti and Nicol, 2017[313]).

However, the focus on performance in the 2014-20 period has not been without challenges. Countries have encountered difficulties in formulating well-defined specific goals and setting programme targets (OECD, 2018[234]). A large number of indicators which are not always consistent across the different funds has also been a barrier to performance monitoring. For these reasons, the OECD has recommended focusing on high-quality indicators and streamlining both *ex ante* and *ex post* budget reporting (OECD, 2018[315]).

For the 2021-27 programming period, the European Commission plans to strengthen the focus on performance monitoring through the Cohesion Open Data Platform and mid-term reviews. The Cohesion Open Data Platform allows following the evolution of project selection and payment rates, as well as the progress of EU investments against pre-established targets. In 2021-27, EU member states will have to report implementation data every two months, allowing citizens to follow the progress almost in real time. In addition, a mid-term review of the programmes will take into account each programme's progress in achieving the objectives set at the beginning of the period. Based on performance, the mid-term review will determine the need to change programmes and the need to transfer resources within programmes. For these initiatives to be successfully implemented in the next programming period, it will be crucial that reporting requirements do not result in additional administrative costs.

Making rules simpler and ensuring flexibility

It has been widely acknowledged that reducing the administrative burden is necessary to make Cohesion Policy more effective. Too much legislation and guidance and/or the proliferation of multiple conditions coupled with weak capacities may lead to a low or

inefficient use of Cohesion funds by subnational governments. If the administrative burden exceeds the expected benefits of regional policy outcomes, project beneficiaries might not even bother applying for European grants to fund their initiatives. Administrative burden affects particularly small beneficiaries (e.g. small or weak subnational governments, SMEs, start-ups), and could potentially increase regional disparities instead of sustaining convergence. It is thus crucial to compare the administrative burden with the expected policy benefits to avoid an excessive amount of guidance and legislation (OECD, 2018[234]).

The excessive administrative burden partly stems from the need to align priorities and compliance requirements in an environment with low levels of trust and confidence (Eurocities, 2017[317]). This is particularly challenging when diverse actors from different levels of government need to co-ordinate and collaborate or when regional policies are operating in areas with low governance capacity or risks of corruption. Simplifying administrative procedures requires, among other things, trust among the various actors involved (OECD, 2018[234]).

The European Commission has made simplicity a fundamental priority. For example, in the 2014-20 period, countries draft just one document to apply for funding (previously it was one per fund) and can use pre-defined accounting methods to simplify cost options (OECD, 2018[315]). A high-level group to advise on the simplification of rules and of the architecture of funds in preparation of the post-2020 framework has also been established. For the 2021-27 programming period, the European Commission aims to strike the right balance between accountability, simplification and performance, while still maintaining strict rules for the sound management of EU funds.

In the context of megatrends, simplicity goes hand-in-hand with the need for greater flexibility in Cohesion rules in order to better adapt programmes to local circumstances and development needs. Flexibility represents the capacity of the budget to react rapidly without major legislative changes to emerging challenges and unexpected priorities. A good level of flexibility allows reprogramming when necessary, while maintaining a long-term approach and avoiding the burden and uncertainty of continuous change (OECD, 2018[234]).

Notes

1. The OECD estimates that approximately USD 95 trillion in public and private investments will be needed in energy, transport, water and telecommunications infrastructure at global level between 2016 and 2030 in order to support growth and sustainable development. This is equivalent to approximately USD 6.3 trillion per year over the next 15 years (OECD, 2017[51]). Different sources estimate the current global infrastructure spending around USD 2.5 trillion per year (GIH, 2017[284]) (MGI, 2016[303]). This level of investment is less than half of what is required to address the megatrends.
2. Calculations based on OECD (2019), *OECD Regional Statistics* (database), https://doi.org/10.1787/region-data-en (accessed 20 December 2018).
3. Empirical evidence highlights the adverse effect of administrative fragmentation on economic outcomes and suggests local growth policies, transport and land-use policies, among others as channels that lead to adverse outcomes (e.g. Cheshire and Magrini (2009[359]) and Ahrend et al. (2017[360])).
4. See Ahrend, Gamper and Schumann (2014[263]) for dates of creation of OECD metropolitan governance bodies.
5. This rise has been driven by China, whose public investment accounted for 60% of public investment in developing and emerging countries in 2014 (OECD, 2018[142]).
6. A scenario with 66% probability of holding global warming below 2°C suggested by the International Energy Agency.

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Part II. Policy forum

Chapter 6. Addressing global megatrends through EU Cohesion Policy

by
Corina Crețu,
EU Commissioner for Regional Policy

The European Commission has proposed five main objectives for Cohesion Policy after 2020: 1) a smarter, 2) greener and low-carbon, 3) more connected, 4) more social Europe; and 5) a Europe that is closer to its citizens. Thanks to Cohesion Policy, regions and cities in the EU can invest in innovation, energy efficiency, digital, energy and transport networks. They can ensure that education and training gives people the new skills needed in their local labour market. And, above all, Cohesion Policy gives regional and local authorities the power to identify their own projects and priorities in an integrated and participatory way. They can find the best solutions for their community to address and take advantage of these megatrends.

Technological change has always raised both fears and hopes. The Luddites destroyed machinery in early 19th century England because they feared for their jobs in the textile industry. In 1930, John Maynard Keynes expected that by 2030 people would only work 15 hours a week. These two extremes can help frame the debate on the future impact of technological change. They capture the fear that there will not be enough jobs in the future, and the hope that the distribution of innovation benefits will allow everyone to lead a better life.

Today, with a shrinking share of gross domestic product (GDP) paid out as wages and a growing concentration of wealth in the hands of a few, it should not come as a surprise that many are worried about how technological change will affect their future. This worry is not only about who will benefit, but also about which places will benefit. Will the livelihood of my region or city decline?

Until 2008, regional economic disparities were shrinking in the EU. Since then, these disparities in GDP per capita have stopped converging. This is partly due to the crisis, but maybe it is also because productivity growth no longer spills over to neighbouring regions. Many EU member states have a single, highly productive region, typically the capital, and a large (and growing) productivity gap with other regions.

What has halted the EU convergence machine? A growing concentration of innovation in a few firms can make it harder for firms in other regions to catch up. Some have argued that this concentration is due to the nature of the digital economy because it costs so little to serve additional customers. Differences in the regional innovation systems may be too large, making it difficult for innovations to thrive outside the most productive region. The network of public and private actors, including research laboratories and venture capitalists, may not be strong enough to attract innovative firms or allow local innovative firms to scale up. This would explain why some regions seem stuck in a middle-income trap.

Cohesion Policy is helping regions to respond to globalisation by encouraging them to identify new, but related, economic activities in partnership with the private sector and the research community. By investing in training, Cohesion Policy can help firms find the skills they need and help people find a (better) job. This will become even more crucial as more and more jobs can be performed by machines. While automation so far has mainly replaced low-skill jobs, in the future medium-skill jobs will also be replaced. The faster these jobs disappear, the more difficult the adjustment process will be. Therefore, regions need to invest in skills, promote entrepreneurship and improve their business environment. In this way, people who lose their job will be able to quickly find a new job or even create a new firm.

These jobs, however, are not evenly distributed across the EU. The most innovative and productive regions will have a much smaller share of jobs at risk of automation than less productive regions. Already today, some regions are more exposed to global competition.

That is why the Globalisation Adjustment Fund helps regions which have been hit hard by redundancies and firm closures due to changing trade patterns. The megatrends identified in this report may lead to growing territorial disparities, with the more productive regions becoming even more competitive, while the less productive regions are facing increasing pressure through a combination of growing automation and global competition. To avoid these trends from increasing the gaps between the winners and the losers, Cohesion Policy helps in particular the less productive regions to become more innovative and upgrade their skills.

Cohesion Policy has significantly increased its investment, improving the capacity of public administration. An efficient and modern administration is necessary to foster an attractive and dynamic business environment. E-government, for example, can reduce costs and delays, while increasing transparency and trust for both firms and residents.

Although innovation tends to concentrate in metropolitan areas, rural areas benefit in multiple ways from new technology. Broadband and the even faster next generation networks have opened up a wide range of services that were simply unavailable in rural areas. Cohesion Policy has helped to ensure that all urban and rural areas have broadband access today. In addition, it will ensure that everyone has even faster access by 2020, which has many benefits. For example, such networks can provide access to education, training and healthcare in new ways that improve quality, expand choice and reduce costs. It will also allow firms in rural areas to become more active in the digital single market.

To limit climate change, the EU is transitioning to a low-carbon economy, but regions and cities will still need to adapt to ongoing climate change, which will present both risks and rewards. Floods, storms, heatwaves, droughts and forest fires have already increased in frequency and intensity in the EU. Cities and rural areas will need to invest more in risk prevention to protect their residents. The transition, however, also offers opportunities. Increasing renewable energy and augmenting energy efficiency will create new jobs in both cities and rural areas. Reducing energy consumption will generate substantial savings. New ways to reduce greenhouse gas emissions can be marketed globally, as can new strategies to reduce disaster risks.

Ageing in Europe will continue through a combination of increasing life expectancy and a low birth rate. Although migration from outside the EU tends to slow down ageing, it will not reverse it. Active ageing can help the elderly stay healthy, but this requires an environment that is more attuned to the elderly, and healthcare investments will still need to grow.

Migrants from outside the EU tend to concentrate in metropolitan regions mostly in the pre-2004 enlargement EU member states (EU-15). While some are quick to pick up the local language and find a job, others struggle. That is why Cohesion Policy invests in the integration of migrants to help them learn the language, get a degree, find a job or start a new business.

In the EU-15, the population over 65 is already overrepresented in rural regions. Their share is higher in rural areas because many young people move out to gain a tertiary education and start their career, while retirees move in to avoid the high costs, congestion and pollution of living in a city. In the EU-15, most rural areas can offer good access to services and a high quality of life. As a result, these rural regions have seen a significant inflow of people over the last decade.

In the eastern EU member states, the population over 65 is still quite evenly distributed between urban and rural regions, but the population in rural regions is shrinking faster than in the urban regions. The key question for the future is whether the EU-13 (the member states that have joined the EU since 2004) will become more like the EU-15 or vice versa – or will each continue on its separate path?

In terms of population decline, the EU-15 will become more like the EU-13. The EU's natural population growth became negative in 2015 and will become even more so in the future. As a result, more and more areas, both urban and rural, will have to learn how to manage population decline: adjusting public services to demand; downscaling neighbourhoods; and refocusing population in selected villages, towns or cities. This will be particularly challenging in areas where the decline is rapid, which can lead to the collapse of the local housing market, making it very difficult for people to move out.

This report is of great value as it highlights a number of critical trends. Although much is still uncertain about how they will affect different regions and cities in the EU, they will have a major impact on our future. Together with our regions and cities, Cohesion Policy can help shape that future.

A future where hope triumphs over fear.

Chapter 7. Winner-take-all cities

By
Richard Florida,
University Professor at the University of Toronto's School of Cities and Rotman School of Management

The shift from the industrial to the post-industrial knowledge economy has not only caused growing economic inequality and new class divide, but growing spatial inequality and the rise of regional winners and losers, of which the populist backlash across the world is a consequence. Coping with this will require developing policies that can deal with spatial inequality, and even more so, devolving political, economic and fiscal power to cities and communities who can best deal with local problems.

While much has been made, and is being made, of economic inequality, the biggest single problem facing the world today is spatial inequality – the growing divide between large and small cities and between cities, suburban and rural areas (Piketty, 2014[320]). These spatial divides define a set of geographic winners and losers which vary greatly in terms of productivity, innovation and living standards, and which also underpin the growing politics of anger and division which have fomented the rise of populism across the advanced nations of Europe, Canada and the United States, and across parts of Asia, Latin America and the developing world as well. Our cities remain key to innovation and economic progress, as well as being our truest beacons of equity and inclusion, and social progress.

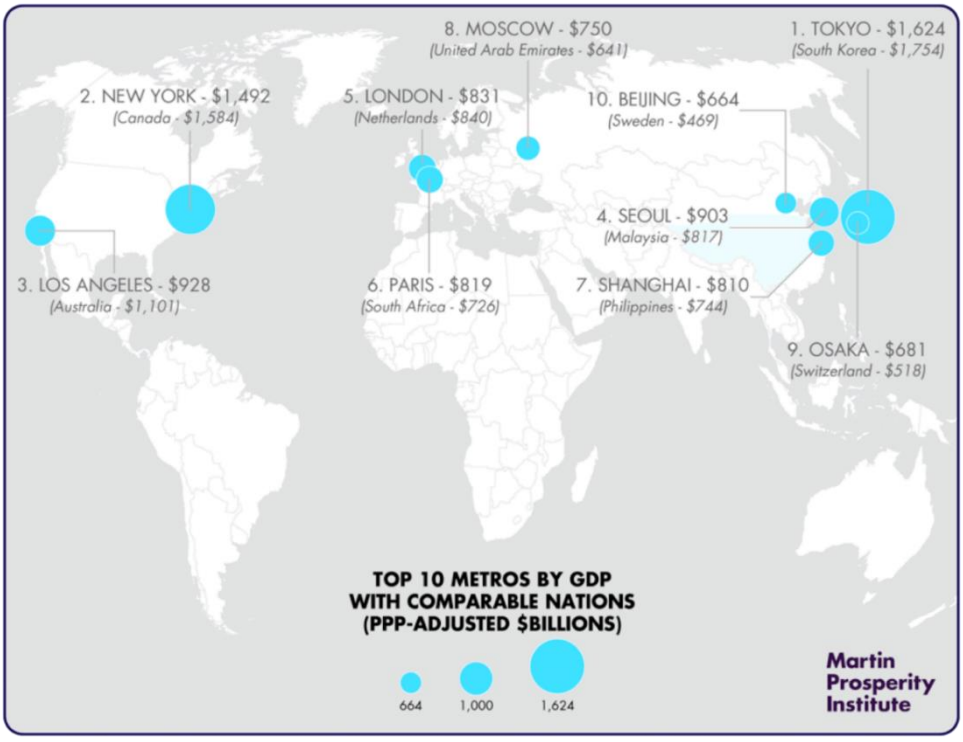
Many have written about the winner-take-all economy of economic winners and losers that define our age (Frank and Cook, 1996[321]) (Rosen, 1981[322]). But, our time is also defined by what I dub "winner-take-all urbanism"[1] or "winner-take-all cities" (see Florida, 2017 ([323])). Increasingly, across the globe, a small group of winner cities concentrate a disproportionate share of the world's talent, knowledge, innovation and other economic assets, while a much larger group of smaller and medium-sized cities, and suburban and rural areas fall further behind forming a much bigger pool of losers.

Many have outlined the transition from the rigid industrial economy to the flexible, post-industrial knowledge economy (Bell, 1996[324]) (Inglehart, 1971[295]). The knowledge revolution is also an urban revolution. The basic engine of the new economy is no longer the corporation, but the city. Place – or the clustering of knowledge, ideas, talent and economic assets in place – has become the basic platform for growth and prosperity. A hundred years ago the majority of workers worked on farms; 50 years ago more than half of workers were employed in industry; now the great bulk of workers are employed in service, knowledge and creative industries, which are clustered in cities (Florida, 2012[326]).

These economic shifts are reflected in human society's growing urbanisation. In 1900, roughly 15% of people on earth lived in cities, and by 1950, about 30% did. Today, that figure stands at more than 50%, and it is projected to level off at 85% over the next century – which will account for approximately 8.5 billion people. This incredible tide of urbanisation is accompanied by the rise of mega-cities and mega-regions. In 1900 there were 12 cities with a population over 1 million; in 1950, 83; in 2005, 400; and in 2017, 500 (UN-Habitat, 2016[327]) (UNDESA, 2016[328]).

These cities are concentrating ever-greater proportions of the world's wealth and productivity. The world's 300 largest metropolitan areas produce nearly half of the world's economic output, despite hosting just 20% of the world's population, according to Berube et al. (2015[329]). The largest, most productive metros are as economically powerful as major countries, as Figure 7.1 shows. Tokyo's economic output is comparable to that of Korea, the world's 15th largest economy; New York's is comparable to Canada; Los Angeles to Australia; and London to the Netherlands (Florida, 2018[330]).

Figure 7.1. The largest, most productive metros are as economically powerful as major countries



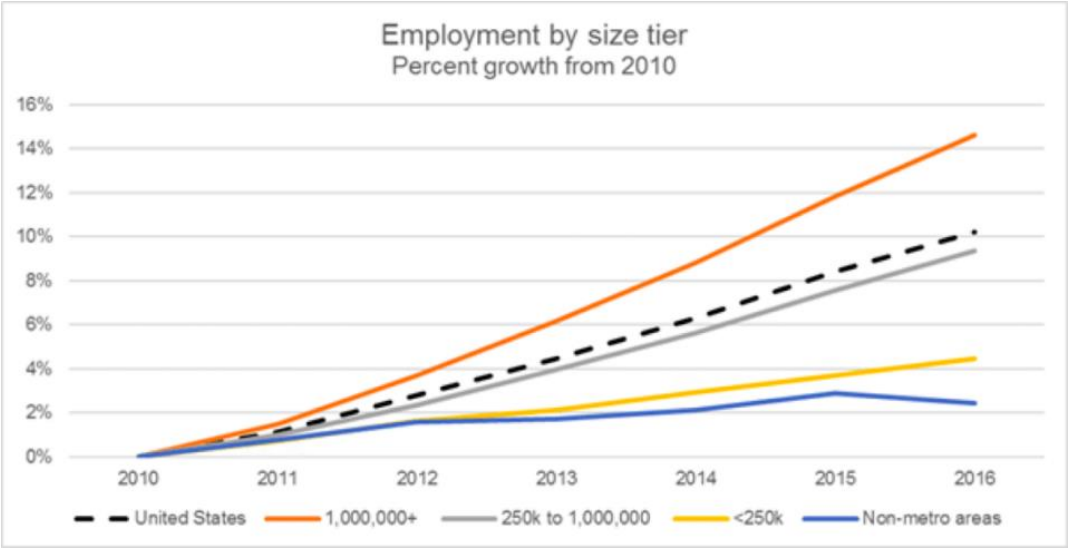
Innovation and start-ups which power economic growth are even more concentrated (Florida and Citylab, 2016[331]), with more than 40% of venture capital-backed start-ups in the world concentrated in the San Francisco Bay Area and across the New York-Boston-Washington, DC corridor (Florida and King, 2018[332]) (Florida and Mellander, 2017[333]) (Florida and King, 2016[334]). While the contributions of smaller and more peripheral regions should not be discounted, superstar cities are the engines of growth (OECD, 2009[335]).

The divide between geographic winners and losers (Muro and Whiton, 2018[336]) can also been seen within countries. Consider the United States, for example. Between 2014 and 2016, the 53 largest American metros accounted for 72% of economic growth and 74% of job growth. By contrast, small cities saw their share of economic output shrink by 6.5% between 2010 and 2016, while rural places experienced population decline, as well as a decline in employment growth.

Furthermore, the world not only revolves around these powerful individual cities and metros; instead, its real economic axis turns on 40 mega-regions (Florida, Gulden and Mellander, 2008[337]) – even broader clusters of economic activity. Along with my colleagues, Tim Gulden and Charlotta Mellander, I identified these mega-regions by using satellite images of the world at night to observe actual clusters of activity, which are expressed by the light signatures of these regions (Florida, Gulden and Mellander, 2008[337]). These are economic aggregates with more than 5 million people which produce in excess of USD 100 billion in economic output. They are places like the New York-Boston-Washington, DC corridor; Greater London; Greater Tokyo; the region spanning Rome, Milan and Turin; the region spanning Amsterdam, Brussels and Antwerp; and the

area from Barcelona to Lyon. Taken together, these 40 mega-regions produce two-thirds of the economic output worldwide, and a full 90% of global innovation, while housing only 18% (Florida, 2016[338]) of the world's population.

Figure 7.2. Employment growth by city size in the United States (2010-2016)



Source: Muro, M. and J. Whiton (2018[336])(2018), "Geographic gaps are widening while US economic growth increases", https://www.brookings.edu/blog/the-avenue/2018/01/22/uneven-growth.

And these divides are fractal, there are winners and losers at every scale. Some big cities prosper, while others decline; some smaller and medium-sized cities thrive, while others decay; some suburbs do well, while others see their economies deteriorate; and while many rural areas are challenged, those that are close to large metros are home to universities, or have an abundance of amenities like coastlines or mountains do very well. And these divides are also compounded within all of these kinds of places. Cities of all sizes, suburbs and rural areas all have small areas of concentrated advantaged surrounded by much larger spans of disadvantaged. In this patchwork configuration, the middle class and middle-class neighbourhoods which have powered upward mobility and been beacons of political stability have fallen away. The rising populist tide in countries around the world is an outgrowth of such increasing spatial inequality.

Indeed, even the winners of winner-take-all urbanism are caught up in a troubling dynamic. Their economies are increasingly bifurcated, consisting of high-income, high-skill knowledge jobs on the one hand, and low-skill, low-pay service class jobs on the other. As the affluent and advantaged sort themselves into the most central and desirable cities and neighbourhoods, the less-advantaged are relegated to neighbourhoods with fewer amenities and opportunities. I call this crisis of success "The New Urban Crisis" (Florida, 2017[323]). Even in the winner cities, the vast majority of people are functionally shut off from the tremendous economic opportunities offered in the world's global cities.

Left unchecked, today's clustered urban economy generates a small group of winners and a much larger group of losers, across cities as well as within them. While the clustering of talent and economic activity transforms cities into hubs of innovation that power economic growth, it also etches deep divides into society. Furthermore, cities, and not the factory floor, have become the primary arenas of class conflict. Ultimately winner-take-all cities,

spatial inequality and the new urban crisis are not just a crisis of cities; taken together, they form the fundamental contradiction of modern knowledge-driven, place-based capitalism.

Many would suggest that the way to overcome such spatial inequality is for higher levels of governments – states or provinces, national governments or even cross-national bodies – to introduce policies aimed at spatial equalisation, say for example, by investing in lagging regions or more effectively by building infrastructure to connect lagging disconnected places to more thriving, more connected places. The so-called smart specialisation strategies, which emphasise building up the underlying capabilities of lagging places, have much to recommend (McCann and Ortega-Argilés, 2016[339]) (Dijkstra, Garcilazo and McCann, 2013[340]) (McCann and Ortega-Argilés, 2015[341]). There is little doubt that national and state or provincial strategies can play a role in helping to address the challenges faced by lagging places.

But, the reality is that nation-states have proven ill-equipped to effectively deal with growing spatial inequality. Many are so divided they cannot get things done. The ineffectiveness and dysfunction of nation-states at coping with the divides and challenges of the urbanised knowledge economy is in large measure what has created the very problem. Many nation-states are captured by anti-urban interests with little interest in addressing these problems. Not just today in a rising populist environment, this anti-urban stance is a problem going back more than a century. Much the same is true with states and provinces. A growing number of them are captured by populist or anti-urban interests (Florida, 2017[342]). Across a growing number of countries there is a lack of alignment between national, state and provincial and local levels. Like it or not, today's reality is that cities are increasingly out on their own.

The basic dilemma is this. Even though cities are economic power centres, across the globe, they remain beholden to nation-states and provinces, which often undermine their interests and cause additional economic damage, siphoning off their tax revenues, underinvesting in their infrastructure, undercutting their investments in universities and innovation, and pre-empting their abilities to attract immigrants and remain culturally open and tolerant.

All of this begs a deeper question and issue. The real key challenge of our time is to create a new governance system for the 21st century's knowledge-driven, place-based economy by massively devolving power from the increasingly dysfunctional nation-state to cities, localities and neighbourhoods.

There are clear economic benefits to empowering states and localities. More than two decades ago, the economist Alice Rivlin made a powerful case for devolving education, housing, transportation, social services and economic development programmes from the national government to the states, whose leaders, she said, are closest to the conditions on the ground (Rivlin, 1993[343]). This is supported by a massive amount of research from the OECD, which shows that decentralised local government is more powerful and efficient than centralised control (OECD, 2016[268]) (OECD, 2015[344])(see also McCann and Ortega-Argilés (2015[341]) and (2013[345])). As large corporations realised long ago, permitting work groups on factory floors to take their own decisions results in huge productivity gains (Hayes and Abernathy,(n.d.)[346]) (Womack, Jones and Roos,(n.d.)[347]) (Jaikumar, 1986[348]).

There is also less partisan or ideological division and conflict within cities and communities. Local governments tend to be less ideological and more focused on problem solving, and they know intimately which problems actually need to be solved. They are more accountable to the people they represent, because they interact with them

every day. When I travel across the world, I have trouble determining whether the mayors and local leaders I meet are conservative, liberal or moderate.

While top-down national governance tends to impose one set of choices on all of us, localism respects our differences and allows people to choose the kinds of communities that reflect their values. It is also more democratic, according to detailed studies from political scientist Jenna Bednar (2011[349]) (2014[350]), a political theorist at the University of Michigan whose research focuses on the political effectiveness of more decentralised. The empowerment of local communities thus represents an alternative solution to an impasse over the efficacy of place-based policies (Glaeser, 2011[351]) (Barca, McCann and Rodríguez-Pose, 2012[352]). The devolution of not only funding responsibilities, but revenue-generating tools, is a way out of this impasse.

Still, some will argue that devolution could worsen our existing urban divides by prompting large employers to relocate to larger cities with more economic assets and larger pools of talent. But, this criticism misses the mark. Even though some companies have gravitated to large cities, devolution can help smaller and medium-sized cities marshal their assets and build up their talent bases and economies. Rather than reflecting and contributing to the spatial inequality, devolution can actually encourage competition for talent and investment as cities endeavour to build stronger local economies (Greve, 2015[353]).

To a certain extent, the disparate priorities of large, medium-sized and small cities, urban and suburban and rural areas can even serve to complement one another. On the one hand, large, dense, cities tend to have higher wages, productivity and innovation rates alongside higher housing costs and steeper taxes. Meanwhile, smaller cities and rural areas have just the opposite: lower wages and productivity alongside lower housing costs and increased home ownership. By combining their resources, larger and smaller places have the potential to generate more widespread inclusivity, thereby eliminating the uneven geography of today's innovation and economic growth.

At a time when trust in national governments have reached historic lows and backlash politics and populism are on the rise, more robust local government has emerged as a grounding political force. For example, in the United States today, between two-thirds and three-quarters of Americans express trust in their local government compared to 55-65% for state governments and around a fifth to a third for the federal government according to recent surveys (Gallup, 2016[354]) (Pew Research Center, 2015[355]).[2] Because people pick where they live by "voting with their feet," constituents tend to share the same values as their leaders. For these reasons, local governments are uniquely poised to help us overcome or at least cope with our deepening political divides.

Of course, some issues are simply too large to be solved by municipal governments alone. In the case of transit and transportation, which span entire regions, cities and suburbs can join together to form a larger network, while groups of metropolitan areas can combine to form mega-regions. Similarly, housing investments can be publicly funded or made possible through public-private partnerships that cater to local demand.

In her final book, the late great urbanist Jane Jacobs[3] surmised that we will face a deepening "Dark Age Ahead"[4] and that the last great hope for democratic life lay in our cities and communities (Sassen, 2016[356]) (Jacobs, 2004[357]). This will require a shift in political and fiscal power commensurate to the shift in economic power from the nation-state to our cities and urban areas. At the end of the day, it is the local level – not the nation-state – that continues to serve as our most powerful source of innovation, economic growth and social progress.

Restoring growth, spurring innovation and igniting the economic engine that is our cities will not happen on its own. Left unchecked, our current urban moment will create an even more uneven, concentrated and clustered winner-take-all urbanism. The key here is not to renege on urbanism, but to make urbanism work for every member of society, rather than against them. To do so will require moving from winner-take-all urbanism to a new model of more inclusive urbanism for all, in which all communities and all classes can participate and benefit.

Notes

1. See Florida, R. (2017), *The New Urban Crisis: How Our Cities Are Increasing Inequality, Deepening Segregation, and Failing the Middle Class and What We Can Do About It*, Basic Books.
2. Confidence in the national government varies: Canada is relatively high at 62%, the United Kingdom at 41%, Japan at 36%; the United States and Spain at 30%, and France at 28% (OECD, 2017[247]).
3. See: https://www.theguardian.com/cities/2016/may/04/jane-jacobs-100th-birthday-saskia-sassen.
4. https://www.penguinrandomhouse.ca/books/86052/dark-age-ahead-by-jane-jacobs/9780679313106.

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Chapter 8. "It's too late for pessimism"

By
Anne Hidalgo,
Mayor of Paris

The Universal Declaration of Human Rights recently celebrated its 70th anniversary, but the road is still long. Poverty may be receding, but it has not yet been eradicated; and social inequalities remain and may even be becoming more apparent. Universal access to education is still not guaranteed across the globe. Populism is gaining ground, driven by ideologies diametrically opposed to basic universal principles, and geopolitical tensions endure. Climate change is now a given, and talk is no longer of global warming, but of climate change adaptation. The international community needs to take some bold political decisions because protecting natural resources and limiting global warming have become key challenges.

Towns and cities have a key role to play in addressing this global challenge by acting as trailblazers and advocates who can take action at the local level. City diplomacy is now the only way forward, especially given the current frailties of multilateralism.

As cities concentrate the most diverse populations, produce a significant proportion of wealth and are at the front line of today's challenges, it is up to cities to generate the impetus needed to overcome the major challenges of the 21st century and shape a better future.

Towards a necessary global ecological and social transition

Irrefutable evidence requiring a major shift

At the Johannesburg Earth Summit 17 years ago, environmental actors, governments, researchers, non-governmental organisations and citizens came face to face with the harsh reality of the first noticeable repercussions of global warming. We derided environmental thinking, considering it to be marginal and too cataclysmic to be taken seriously.

Today, the consequences of human activities on the planet are irreversible. The latest Intergovernmental Panel on Climate Change report in 2018 is clear: climate change has a face, that of millions of climate migrants fleeing drought and its consequences, rising sea levels or recurring cyclones. Countries which had been previously spared, especially in Europe, are now paying the price of global warming. Between now and 2050, it is estimated that the impacts of these natural disasters could force over 140 million people to leave their countries for a better life elsewhere, resulting in strong migratory pressures, notably in Europe.

National policies struggling to rise to the challenge

At the end of 2018, the international community met in Katowice, Poland to discuss, share experiences and take action within the framework of COP24, but the final agreement fails to address the issues at stake. The collective involvement of states is, however, essential, and elected representatives must become accountable to populations who are increasingly sensitive to these issues and the need to act.

International summits offer a platform for adopting global decisions. The Paris Agreement is a perfect example. Adopted on 12 December 2015 by 195 delegations after a hard fight, it represents a serious common foundation for working towards a carbon-free economy. Despite embodying everyone's hopes when it was signed, the vital task of translating it into concrete and tangible measures remains.

It is against this very backdrop, and in the face of threats against multilateralism, that we, mayors of towns and cities around the world, have used international networks of local authorities to create a multilateralism that is robust in that it is based on a commitment to serve citizens. This collective commitment needs to be strengthened.

This will take place through administrations and institutions that are more and more transparent, more participatory and more responsible. Together, we are fighting for this "new multilateralism", which combines economic progress, ecological transition and social justice.

Urban areas on the front line of change

Cities are powerful drivers of support for the necessary technological and demographic changes

By 2050, 70% of the world's population will be living in cities and metropolitan centres. This demographic increase must be taken into consideration and we must adapt our actions to accommodate these populations, all the while taking an in-depth look at our lifestyle, be it in terms of the built environment, and in particular the impacts of urban sprawl on urban areas and their outskirts, or the cost of rent, access to education and healthcare, culture and leisure activities, as well as in terms of policies in support of increasing the supply of public transport, intermodality and alternative modes of transport (carpooling, self-service bicycles, etc.) and even potential new forms of work.

At the same time, innovation has become a central notion in urban development policies. It is part of an interconnected digital world in which there are no artificial frontiers restricting information flows. Digital innovation has radically changed the way we live and, when used in the general interest (especially for making data available), can prove to be a genuine ally in addressing global challenges.

Intergovernmental co-operation must rely on local actors

It has emerged from the numerous discussions on energy and social transition that towns and cities are ahead of, and sometimes opposed to, the policies of states ruled by openly climate-sceptic governments. That is why intergovernmental co-operation must also turn to them for support.

And what if 2019 marked the beginning of a paradigm shift?

For this to happen, all the local actors – the public sector, the private sector, associations and citizens – must be mobilised in a dynamic process of sharing and co-construction. Only such a level of cohesion, between actors who place social and environmental responsibility at the centre of their concerns, will bring about genuine changes in behaviour. Cities have an important role to play, and can rely on international networks to share, pool experience and launch global initiatives: the C40, the Urban 20 and the OECD's Champion Mayors for Inclusive Growth initiative.

Article 28 of the Universal Declaration of Human Rights states that, "Everyone is entitled to a social and international order in which the rights and freedoms set forth in this Declaration can be fully realized". The right to live in a healthy environment is also an integral part of this world order and public policies must therefore take adequate action to ensure that it is enforced.

It therefore seems necessary to strengthen rights and obligations in order to ensure a decent life and living conditions for our children. It is our duty to protect future generations.

To address these common challenges, in 2015 Corinne Lepage, the former French Minister of the Environment, was given the daunting task of drawing up a Universal Declaration of the Rights of Humankind. The text is a reminder of how the future of nature is in major danger.

Article 8 of the declaration stipulates that, "Humankind is entitled to the preservation of public goods, especially air, water and land, and universal and effective access to vital resources. Future generations are entitled to the transmission thereof".

Human rights, the rights of peoples, the rights of humankind and the rights of nature are all interlinked.

Policies to serve citizens

Think "global village"

Paris lies in a natural basin that is rightly known for its rich diversity: the Paris area is not restricted to the capital, but also extends to the surrounding urban and rural areas. Energy transition offers a perfect opportunity to strengthen solidarity and reciprocity between those living in cities and those in the countryside, which is why it is important to examine the possibility of broader governance. And that is exactly what we are doing in Paris, a city that is keen to connect its regions.

A paradigm shift for more inclusive cities

The main priority at the moment is to reduce greenhouse gases, and the economy holds the key. Steps must be taken towards creating a more resilient city, one which is carbon-free and environmentally friendly. The objective is therefore to move towards "greener" policies: public transport, soft mobility, pedestrianised areas, eco-neighbourhoods, recycling! The solutions are plentiful.

Wastefulness, substandard materials, overconsumption and overuse of resources, programmed obsolescence, are all factors which gave rise to global warming. It is therefore necessary to look to the development of circular economy networks. This promising economic model, which targets the sustainable production of goods and services, reduces the impact on the environment by limiting the transport of goods, respecting seasonality and making use of short supply chains.

Moreover, under Principle 8 of the 1972 Stockholm Declaration, economic and social development is essential for ensuring a favourable living and working environment for man and for creating the conditions on Earth needed to improve quality of life. This inevitably includes social inclusion, a shift in the balance of the relationship between individuals and their environment, and a significant reduction in global inequalities.

Towards a new global social contract?

It is not too late to act. Social movements, climate marches and fights for human rights have shown populations that they have a voice which can be heard. States and cities must now work together to address the challenges before us. Tomorrow is a reflection of today's decisions, and it is up to us to prepare the future, by taking care of … the present.

Chapter 9. The triumph of urbanity and spatial justice

By
Jacques Lévy,
Professor of Geography and Urbanism at École polytechnique fédérale de Lausanne and Reims University

From the 1950s to the 1990s, certain observers predicted the death of the city as a result of the declining comparative advantage of spatial concentration in comparison with alternative configurations based on mobility (Webber, 1964[328]) or telecommunications (Mitchell, 1995[329]).

The kind of urban areas the industrial age had produced was, in a way, something like a dual misunderstanding. On the one hand, the "industrial district" (Marshall, 1919[330]), later enlarged as a "new economic geography" rationale (Krugman, 1991[331]), generated massive cluster areas, but weak diversity, especially when related to extractive activities. On the other hand, as a marketplace – labour pools and catchment areas – cities were strong if and only if manufacturing activities were immersed in a versatile, multidimensional productive system (Ohmae, 1995[332]) (Veltz, 1996[333]). At the same time, industrial systems have destroyed pre-existing urban synergies without creating new ones. Actually, the legacy of the industrial footprint includes gigantic and often unredeemable brownfields, deeply polluted areas and desperately homogeneous working-class neighbourhoods. Today, places that have missed the industrial era appear to have been lucky.

Urbanisation has continued in spite of, and also thanks to, the development of its two "co-opetitors": mobility and telecommunications. The power of place, that is the vertical accumulation of social realities in the same location, is not threatened but rather enhanced by the growth of material or immaterial motion. Tourists go to cities, and urbanites manage even better the comparative advantage of co-presence by smartly taking advantage of the digital communication assets.

Today the victory of the urban spatial choice is overwhelming, but this triumph raises novel, major political issues.

Urbanity as a new urban age

However, if the North-American Rustbelt, the English Midlands or many European former coalfields are still far from recovering, the urban world can look at the industrial age as a henceforth closed interlude. In the process that has often been called "metropolisation" or "global cities", the reinforcement of urban hierarchies and the emergence of megalopolises of more than 10 million or even 50 million inhabitants (such as the three major urban deltas in the People's Republic of China) is the consequence of a more general trend that could be named "urban renaissance" or "emergence of urbanity". Contemporary productive systems and, even further, contemporary societies, are giving cities new momentum. It can be argued, as well, that urbanity is giving productive systems and societies new momentum. This is the consequence of the growing part of creativity, that is the non-programmable component of production in social dynamics.

Two major consequences of this change can be noticed. First, the size effect has gained a new significance. It used to be a direct function of mass: more inhabitants meant more workers and more consumers. It has now become exponential because of the critical value of links: 1 million people can generate 1 trillion potential human interactions.[1] In innovating sectors, this point turns out to be crucial: 69% of all British scale-up companies localise in London, 72% of the French ones in Paris, 61% of the Swedish ones in Stockholm, and even in such a multipolar country like Germany, 54% in Berlin.[2] The 5 596 European scale-ups are located in 476 cities, but 67% of them concentrate in 48 cities only, which are, with few exceptions, the largest urban areas on the continent. In 27 countries out of 42, one city concentrates more than 70% of these mature start-ups. Promising

economy-oriented activities tend to show the same geographical pattern as cultural creativity (science, design, art, media).

Second, the classic, early 20th century Park and Burgess (1925[334]) concentric model is experiencing a new lease of life. Suburban or peri-urban dwellers clearly remain part of the urban area, but even inside an urban system, locations matter. Whatever measurement we choose, either by their residential location (Richard Florida's "creative class", (2002[335])) or by their workplace, the centripetal tropism of creativity-based activity is obvious.

This *overproductivity* of big cities encompasses every single aspect of social life, including, for instance, innovation in personal ways of life, as well as in tourism attractiveness and aesthetic or scientific avant-gardes. Formerly, cities were visible on the map, but they were in competition with farming, mining or manufacturing locations, which contributed altogether to a higher proportion of a country's gross domestic product (GDP). Never in history was a geographic configuration that correlated to both present and tendential productive logics.

To sum up this new emergence, the term *urbanity* has become an all-embracing concept that federates and metabolises what economists called "economies of agglomeration", sociologists "urban sociality", geographers "polarity" and urban planners "centrality". Urbanity can be defined as a combination of density (of people, objects, ideas, agency) and diversity (of people, objects, ideas, agency). This simple approach makes possible to identify a series of urbanity gradients that encompass both the size of an urban space and the position of a determined place inside this space. What can be observed then is that, within a national or continental territory, places that share the same gradient turn out to be economically, sociologically and politically similar. Old regional identities have given way to archipelagos whose "islands" are connected through reticular rather than by territorial metrics.

This approach allows for a multi-scalar classification of urban styles. The "Amsterdam model" can be defined by the acceptance of urbanity as a consistent way of maximising density and diversity, especially by the cohabitation in fixed and mobile spaces of all components of the urban society. In the "Johannesburg model", the advantage of concentration is challenged by a powerful drive towards fragmentation and privatisation of space. The geographic distribution of these models (Table 9.1) is significant in terms of creativity. Even more than Internet browsing, urban exposure to any kind of otherness is a decisive asset to serendipitous processes, which turns out to be a powerful engine in the emergence of any kind of innovation or invention. European, Asian and a few North American metropolitan cores possess an unequivocal comparative advantage on this point. Table 9.1 also shows the "hesitating" spaces (middle column) where the widest evolution margins could be found.

Table 9.1. A multi-scalar classification of urbanity models

Urbanity model / Predominance	"Amsterdam" gathered city	"Amsterdam" and/or "Johannesburg"	"Johannesburg" fragmented urban space
…by continent	Europe; east, south and south east Asia	Latin America, Arab world	North America, sub-Saharan Africa
…by size of urban area	Metropolises	Medium-sized cities	Small towns
…by urban gradient	Centres	Inner cities	Suburbia, peri-urban, ex-urban

Finally, urbanity proved to be what is at stake in urban planning… whose name is progressively shifting to urbanism. What is expected now from urbanists? That they help produce urbanity. This production is less a technical, analytical expertise and more a multi-dimensional, political mediation. Urban changes ended up changing urban sciences.

Arbitrage on inhabiting models

In major city centres, *bobos* (bourgeois bohemians) cohabit with migrants and "*pobos*" – poor bohemians, that is, people with much cultural capital and little economic capital and who are ready to spend a lot to live in central neighbourhoods of large cities. At the same time, *bobos* and *pobos* have confirmed their attachment to urban life. At the same time, many medium-income dwellers have chosen to leave the centres to accomplish the (bungalow + property ownership + car + garden) dream. This "urban flight' began in the early 20th century in North America and is mostly a post-World War II process in Europe. Another difference derives from the better resistance in Europe to the destruction of historical districts by "Modern Movement"-inspired urban projects. However, recent inflexions are more synchronous across the Atlantic as the tilting point of the renewed interest for the city can be placed everywhere in the west in the mid-1970s or the early 1980s. Since then, there is something like a two-way crossover of those activities/people who need a high-intensity urban environment and those who don't, either because they do not absolutely need it or because they simply reject it.

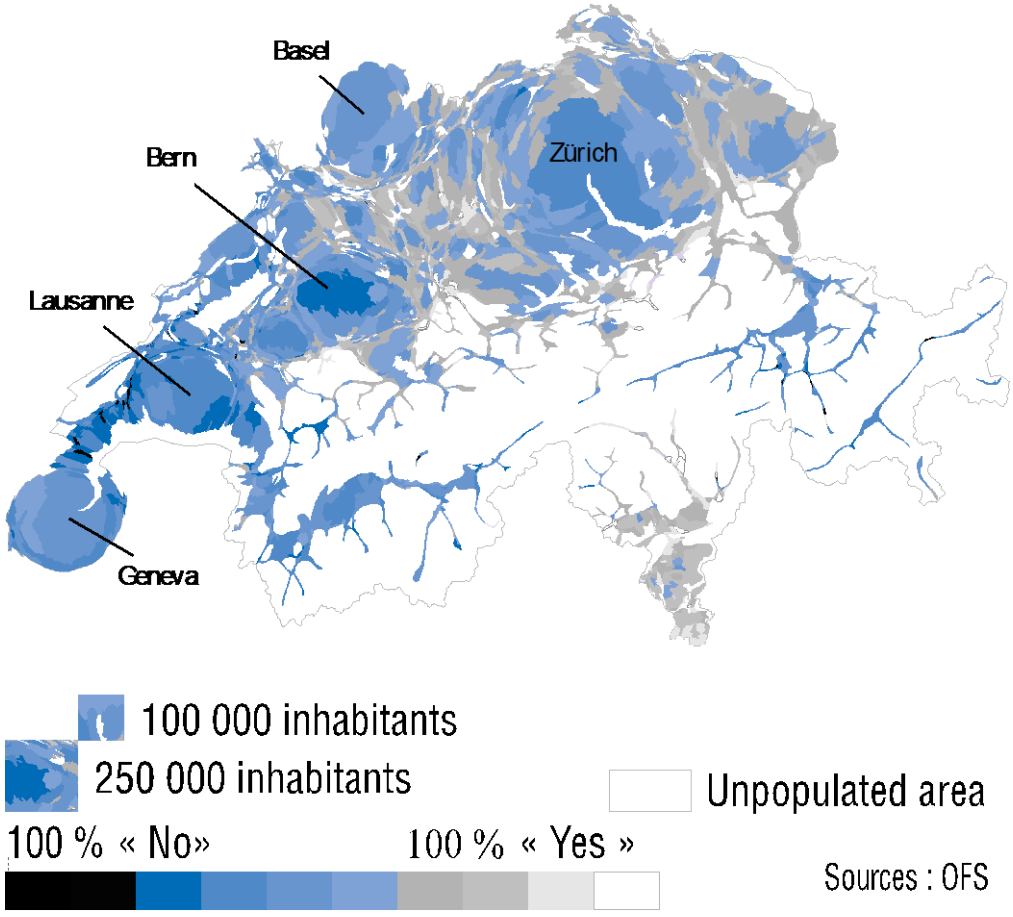
This convergence has, of course, strong effects on the desirability of urban space. Urban cores can be extended to neighbouring areas (such as West Brooklyn or West New Jersey in New York), but the pressure on real estate prices in central areas is dramatic. However, at odds with an abundant literature about "gentrification", the social mix has either increased (due to the decline of inner-city ghettos) or has been maintained in some other neighbourhoods by the arbitration, as expansive it can be, in favour of a city-centre dwelling. In European cities, public social housing policies have also partially compensated the growth of land prices by supporting medium- and low-income inhabitants and preserve both sociological and functional diversity. As a result, central areas of cities, and all the more in big ones, are undoubtedly more mixed than any other gradient of urbanity.

These alternatives create a new geography. Significant inequalities in the opportunity to choose one's inhabiting model do persist. However, it is undeniable that the actual map of population distribution is gradually overlaying this population's desires. Said differently, fewer people are forced to live in a "spatial style" that is in an urbanity gradient they don't like. It is therefore not by chance that such a strategic choice, the way of inhabiting (where and how I would like to live) meets another strategic choice: political orientation (what values and horizons I would like for society).

A gaping spatial-political divide

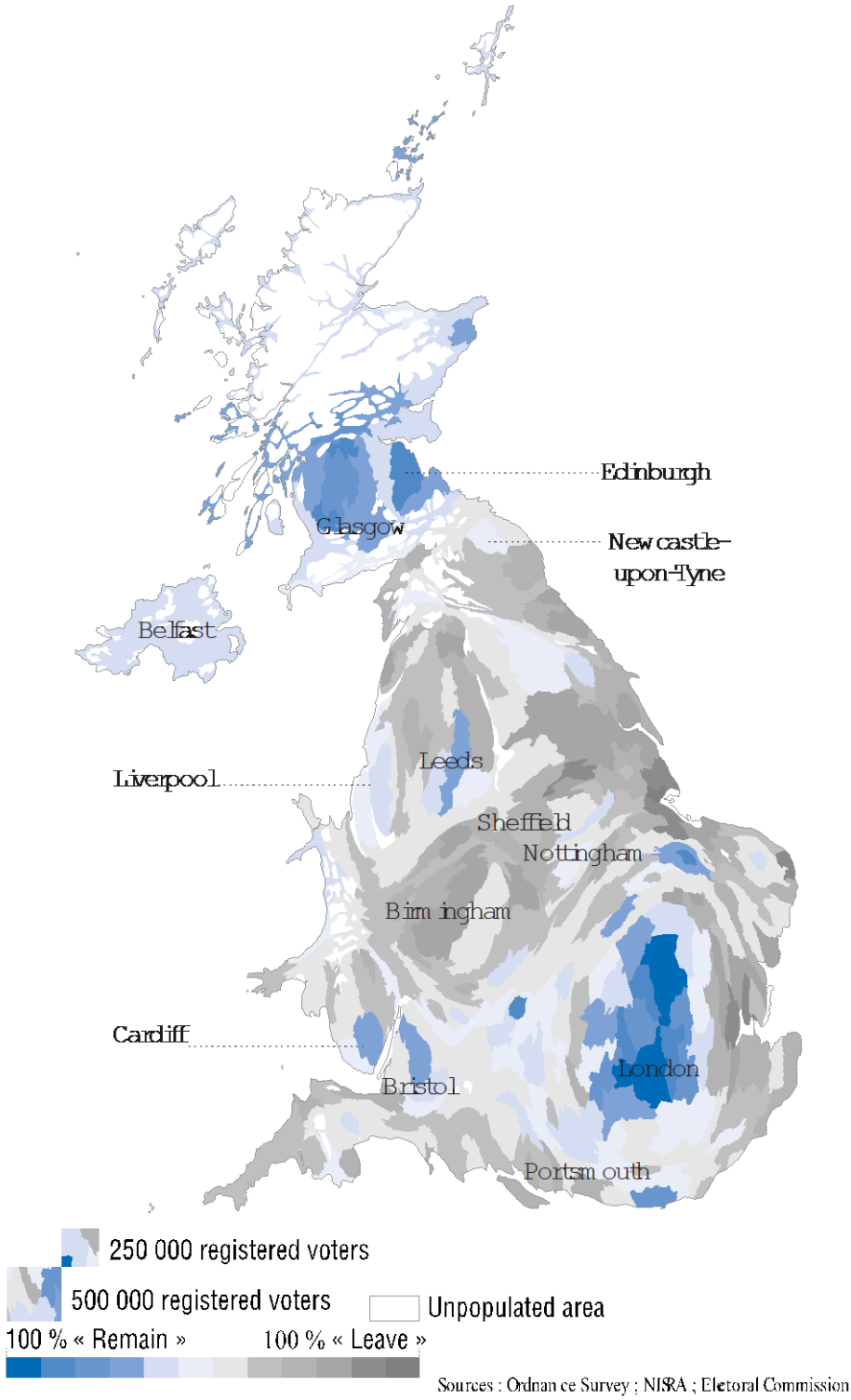
The following maps show recent electoral geographies in France, Switzerland and the United Kingdom.

Figure 9.1. February 2014 "Against Mass Immigration" referendum in Switzerland



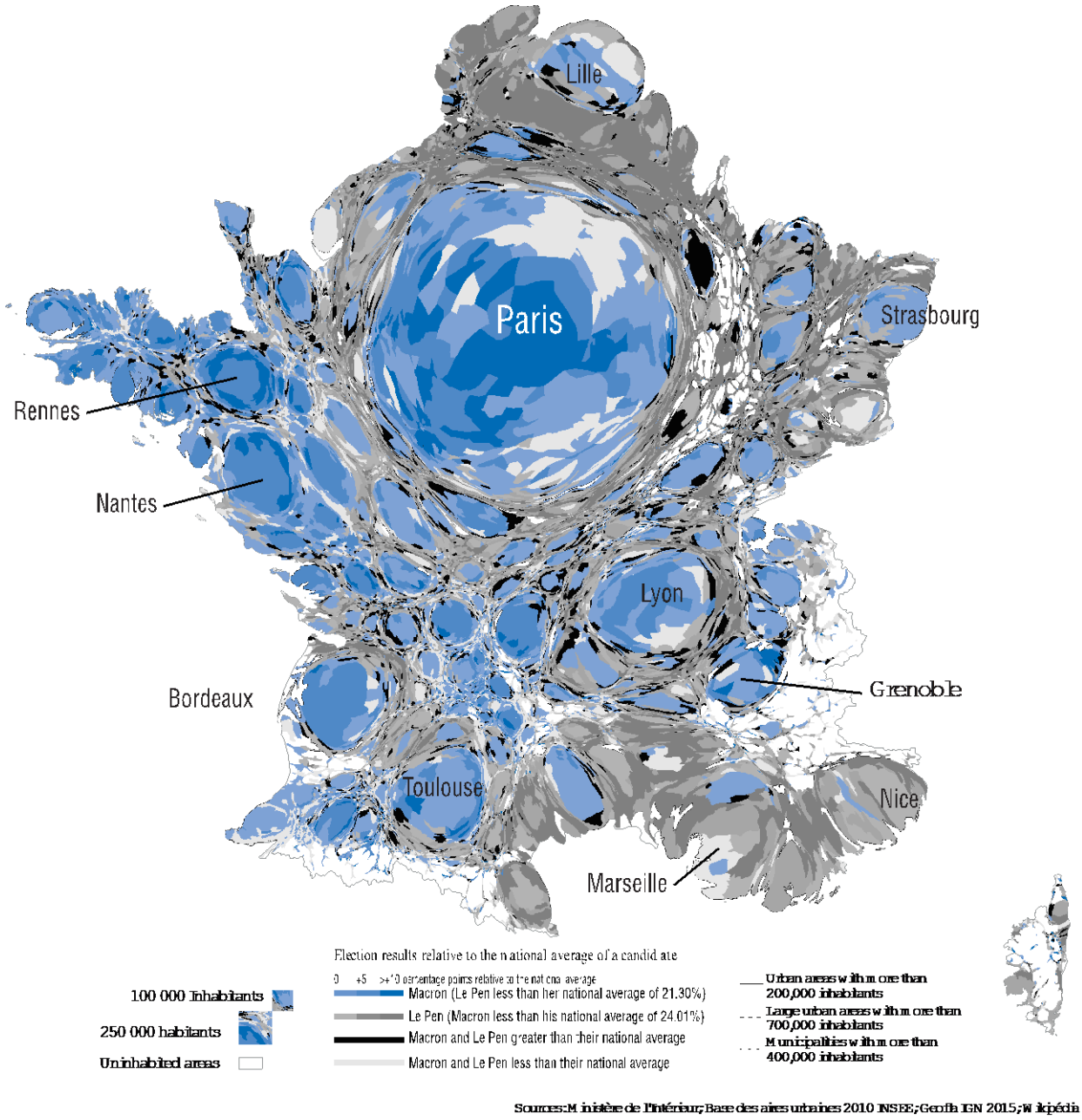
Source: Lévy, J. (ed.) (2017[336]), *Atlas politique de la France*, Autrement, Paris.

Figure 9.2. June 2016 "Brexit" referendum in the United Kingdom



Source: Lévy, J. (ed.) (2017[336]), *Atlas politique de la France*, Autrement, Paris.

Figure 9.3. April 2017 French presidential elections (round 1)



Source: Lévy, J. (ed.) (2017[336]), *Atlas politique de la France*, Autrement, Paris.

The phenomenon is massive and pervasive in the west (Lévy, 2017[336]). Across western OECD countries, almost every country is concerned. The pattern is the same: in city centres, and the most in metropolises, voters choose openness to public space, public goods, European construction and globalisation as, in certain suburban or peri-urban gradients, nationalism and rejection of any kind of otherness prevail.

Novel issues for spatial justice

Many "populist" voters nostalgically refer to a golden age of good wages and pervasive public utilities. Are voters less dotted in social amenities than the others? Have the places they inhabit been "abandoned" by public policies? It is far from evident.

By and large, the inhabitants of urban fringes in American suburbia or European peri-urban areas are wealthier than those of the city centres. However, many citizens living off built-up areas express a feeling of being left behind and fuel "populist" or nationalist-xenophobe movements.

First of all, new geographical freedoms have largely diffused throughout a large part of developed societies. Mobility has become faster and housing is, in relative terms, cheaper than it used to be in the first half of the 20th century. This dual solvability has changed the context of individual spatial strategies, enlarging the range of alternatives. In large cities, there is a certain economic neutrality in the housing + mobility budget envelope between inner and outer locations: in the centre, property costs much more but mobility costs less, thanks to the public transport system; the opposite prevails as you move away from core areas. Other parameters such as apartment/house, ownership/tenancy and, more and more, family style options have appeared on individual dashboards. There is a large "middle group" that must and can operate these arbitrages, an "upper group" for which it is not necessary and a "lower group" for which it is not possible.

The relative freedom to choose one's favourite inhabiting model is underpinned by the equalising power of public policies. In France,[3] a certain emotion was palpable in the media when it was revealed that approximately 1.5% of French women of childbearing age live more than 45 minutes from a maternity ward. The fact that 98.5% of the population is properly covered by a dense network of midwives and maternity clinics is so self-evident that everybody focuses on the yet minimal neglected population.

Among developed countries, this phenomenon is more visible in Europe and partially results from the history of the welfare state in this continent: in 1870, Otto von Bismarck was both the bold geopolitical player who created the second German *Reich* and the inventor of the *Sozialstaat*, quickly copied by the United Kingdom and France. Democracy and redistribution were the counterpart of the blood gift required by the mass wars that bloodied the continent until 1945. In Europe, taxation generally exceeds 40% of GDP, with a maximum in Nordic countries and France.

As Table 9.2 shows, in France, a powerful redistribution mechanism almost totally annihilates the productivity gaps between cities and regions. The personal median income is almost the same everywhere in the country. Moreover, if we take account of spatial contrasts in the costs of living, which is very unfavourable in large cities because of real-estate prices, metropolises prove to be the victims of this system. Residents in Île-de-France (Paris urban area), who represent less than 19% (column 2) of the population and produce 30.5% of national GDP – over twice the productivity of the rest of France (column 5) – receive, at the end of the day, less than their compatriots (column 7). In the case of a deprived neighbourhood (such as the Seine-Saint-Denis suburbs), a hardly reversible negative spiral of educational failure, violence, crime, drug trade, despair and even terrorism exists.

In short, no monetary incentive is given to the most productive part of the population. On the contrary, they bear the burden of less-productive regions. Conversely, almost all of the

non-metropolitan regions receive a lot in spite of the fact that their productivity is stagnating below the average of European regions.

This situation can be summed up by the following phrase: “The poor from the rich regions pay for the rich of the poor regions”. The triumph of urbanity turns out to be a malediction for the majority of those who make it possible.

An element of the solution resides in a federal approach. Even participating in a substantial solidarity mechanism towards less productive areas, a democratically elected Paris metropolitan council and government could thus retrieve a significant part of the EUR 668.8 billion they produce (row 3). But this is not a sufficient guarantee. In many metropolises throughout the world, local governments are seriously undersized and, as a result, many municipalities each govern a minor, homogeneous part of the urban area’s population, which does not contribute to social cohesion, but, on the contrary, to fragmentation and segregation. In France, subnational governments get 12% of the GDP, but the spatially relevant government in Paris, in the Île-de-France region, only has EUR 5 billion, which is less than 0.75% of its GDP. All the remaining resources are seized by municipalities and *départements*, whose policies structurally tend to deepen intra-metropolitan spatial divides.

Table 9.2. From productivity to income in France, 2014-15

	1. Population (million)	2. Share of national population (%)	3. GDP (billion EUR)	4. Share of national GDP (%)	5. GDP per capita ('000 EUR)	6. Median net income per capita ('000 EUR)	7. Median net income per capita, including cost of living impact ('000 EUR) [deviation from average]
Paris (Île-de-France)	12.4	18.7	668.8	30.5	55. 2	22.6	18.1 [0.80]
Lyon (Métropole de Lyon, 2012-15)	1.3	2.0	74.6	3.4	43.4	21.3	19.2 [0.90]
Lille (MEL 2012)	1.2	1.8	41.8	1.9	34.8	19.5	17.5 [0.90]
Marseille (Bouches-du-Rhône)	2.0	3.0	68.4	3.1	34.2	20.2	18.3 [0.90]
Toulouse (Haute-Garonne)	1.3	2.0	51.2	2.3	39.4	21.5	19.3 [0.90]
Bordeaux (Gironde)	1.5	2.3	48.5	2.2	32.3	21.1	19.0 [0.90]
Strasbourg (Bas-Rhin)	1.1	1.7	36.0	1.6	32.7	21.5	20.4 [0.90]
Nice (Alpes-Maritimes)	1.1	1.7	36.6	1.7	33.3	20.0	18.9 [0.90]
Nantes (Loire-Atlantique)	1.3	2.0	43.6	2.0	33.5	21.3	20.2 [0.95]
Rennes (Ille-et-Vilaine)	1.0	1.5	32.2	1.5	32.2	20.9	19.9 [0.95]
Ten metropolises	24.2	36.5	1101.7	50.2	45.5	21.7	18.6 [0.86]
Rest of mainland France	39.9	60.1	1050.8	47.9	26.3	19.9	24.5 [1.20]
Mainland France	64.1	96.6	2 152.5	98.1	33.6	20.4	20.4 [1.00]
Overseas territories	2.2	3.4	41.7	1.9	21.9	14.6	13.1 [0.9]
France	66.4	100	2 194.2	100	33.0	20.2	20.2 [1.00]

Sources: Insee. Métropole de Lyon. MEL. 2014-15 © Jacques Lévy 2019.

Could the "Yellow Vests" reconcile with urbanity?

If we go back to the geography of the "populist" movements, it must be recognised that it is completely different from the geography of spatial injustice. An "anti-system" movement such as the *Gilets jaunes* ("Yellow Vests") cannot be simply identified as a low-income protest: throughout the OECD, the income distribution in the concerned population appears to be highly comparable to that of the overall country. It is not a lack-of-welfare protest either: no evidence can be found of a particularly "left-behind" population or territory. Instead, the hypothesis of a paradoxical low-productivity protest movement could be put forward: persons detaining little cultural capital and living off the cities have eventually realised they are being progressively excluded (and, partially, are excluding themselves) from the dynamic sectors of society. The sensation of being "left behind" is probably related to this point. This means that the only way to strike up a conversation with these

citizens is not to offer them more generous redistribution policies, but to help them increase their own capabilities (Sen, 2010[337]) in order to co-produce (and co-consume) public goods such as education, health and urbanity (Lévy, Fauchille and Póvoas, 2018[338]). Justice then becomes a combination of societal development and self-development. It implies the recognition by the potential beneficiary that his/her personal change is part of the solution, but the rejection of this approach is the very bedrock of their discontent. Let's admit that creating conditions for this new political conversation will be far from trivial.

Notes

1. The number of potential links in both directions between *n* operators is given by the formula: *n* x (*n*-1), which is close to n^2.
2. A "scale-up" is a start-up company that has raised at least USD 1 million. See the Mind the Bridge Foundation survey of 5 596 companies in 42 European countries, https://mindthebridge.com/startupcity-hubs-in-europe.
3. French Ministry of Health and Solidarity, 24 January 2019, https://drees.solidarites-sante.gouv.fr/etudes-et-statistiques/publicationsetudes-et-resultats/article/infirmiers-masseurs-kinesitherapeutes-et-sages-femmes-l-accessibilite-s.

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