
Economic Commission for Europe

Committee on Urban Development, Housing and Land Management

Eighty-first session

Geneva, 6-8 October 2020

Item 8(b) of the provisional agenda

The Economic Commission for Europe nexus on “Sustainable smart cities for all ages”

Cross-sectoral cooperation

Flagship Publication “People-Smart Sustainable Cities: A Policy Nexus for Prosperous, Green and Liveable Future”

Note by the Secretariat of the Committee

In 2019 UNECE commenced the project “Improving knowledge of UNECE member States to design and implement integrated policies in support of the 2030 Agenda for Sustainable Development at regional and national levels”.

One of project deliverables was to prepare a flagship publication under nexus on “Sustainable and smart cities in the UNECE region”.

This document includes executive summary and a full version of the publication. An executive summary with the summary of recommendations is available as an official document of the eighty-first session of the Committee (ECE/HBP/2020/12).

The Committee is invited to take note of the publication.

Acknowledgements

The publication “People-Smart Sustainable Cities: A Policy Nexus for Prosperous, Green and Liveable Future” was developed by the United Nations Economic Commission for Europe as a part of the work of its nexus on “Sustainable and smart cities in the UNECE region”.

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People-Smart Sustainable Cities: A Policy Nexus for Prosperous, Green and Liveable Future

Contents

Executive Summary.....	5
1. A cities-based approach to sustainability	10
1.1. A policy nexus for sustainable development	10
1.2. Defining people-smart sustainable cities.....	12
2. Trends and challenges for urban futures	15
2.1. Urbanization and globalization	15
2.2. Geographical disparities.....	16
2.3. Crises, pandemics and uncertainties	20
2.4. Digital revolution.....	21
2.5. Population ageing	23
2.6. Climate and environmental challenges.....	26
2.7. Natural and technological hazards	28
3. How cities foster sustainability and liveability	30
3.1. Every city matters	30
3.2. Is there city after COVID-19?	33
3.3. Living in digital worlds.....	36
3.4. Cities that make life comfortable for all	41
3.5. Climate neutral cities	46
3.6. Eco-friendly and healthy cities.....	50
3.7. Value out of waste	53
3.8. When disaster strikes.....	56
4. How cities harness their potential and capabilities.....	59
4.1. Create, innovate, reflect	59
4.2. Know what works and what does not.....	61
4.3. Mobilise finance for a good cause	63
4.4. Work with people and for people.....	65
4.5. Make the most out of spatial planning	68
4.6. Cooperate across borders	70
5. Summary points.....	73
Publications	75
Web articles.....	81

Executive Summary

A cities-based approach to sustainable development

The 2030 Agenda for Sustainable Development provides an ambitious and comprehensive plan of action with its 17 Sustainable Development Goals (SDGs). To advance the 2030 Agenda, the United Nations Economic Commission for Europe (UNECE) (see box 1) has adopted a “nexus” approach in its work, focusing on high-impact nexus areas where multiple SDGs converge. This flagship publication is related to one of those high impact nexus areas: “Sustainable and smart cities for all ages”.

This publication advocates a “cities-based” approach to sustainable development. This approach recognises the central and integrating role that cities and urban living play in developing sustainability. As a dominant form of spatial organization within society today, cities are the centrepiece of economic, social, and cultural life. Without localising SDGs at the urban level, few can be effectively addressed at all. By their nature, cities represent a complex arrangement of many interrelated systems, both social and technical, so that they are best placed to address multiple sustainability goals at once. Cities also offer more rapid, practice-informed and grounded responses to sustainability challenges.

Box 1. What is UNECE and the UNECE region?

The United Nations Economic Commission for Europe (UNECE) was set up in 1947 as one of five regional commissions of the United Nations with a major aim to promote pan-European policy cooperation. UNECE includes 56 member States – which is collectively referred to in this publication as the UNECE region. The region includes all the countries of Europe, as well as countries in North America (Canada and United States), Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan) and Western Asia (Israel).

The UNECE region is essentially the global north, broadly the wealthiest region of the world. However, the region also includes countries at the middle or lower middle-income levels of economic development, including those emerging from the dissolution of the Soviet Union. This diversity represents a challenge for UNECE, as the organization must respond to the expectations of its different members. However, it is also an advantage, as it encourages the sharing of diverse experience and knowledge, as well as financial and technical aid for countries in need.

As a multilateral platform, UNECE facilitates greater economic integration and cooperation among its member States and promotes their sustainable development and economic prosperity through policy dialogue; knowledge sharing and the exchange of experiences, best practices and technical expertise; negotiation of international legal instruments; development of regulations and norms; and technical cooperation for countries with economies in transition. The UNECE also contributes to enhancing the effectiveness of the United Nations through the regional implementation of outcomes of global United Nations conferences, summits and agreements.

Liveability and sustainability for all

Cities possess colossal resources, talent and creativity and serve as hubs for innovation, knowledge sharing and experimentation, facilitating the process of generating new ideas, embedding them locally and scaling-up what works best. Cities, however, are not abstract sustainability machines; they are where real people live, work, study and fulfil themselves. Cities are made of people, by people and for people. Sustainable measures therefore must make sense for inhabitants of cities, making their life more liveable. Furthermore, it is people who drive sustainability and are its ultimate source and beneficiaries. This vision underpins the notion of “people-smart sustainable cities”, introduced in this publication.

“People-smart sustainable cities” engage with sustainability in an inclusive, collaborative and equitable way. While fostering sustainability across their environmental, economic, social and cultural dimensions, these cities provide the necessary conditions and infrastructure to enhance the capabilities of their citizens to contribute to, and enjoy the benefits of, a more liveable, resilient and sustainable urban development. These cities enable the meaningful participation of citizens in fulfilling their right to the city; they focus on making cities more prosperous, equitable, comfortable and innovative; they address social needs and make sure housing and urban services are high-quality and affordable; they cater for the needs of the vulnerable and those with disabilities; and they are also gender-sensitive and age-responsive, acknowledging the different and changing needs of residents at different stages of their life.

Societal trends and challenges

The fundamental role of cities in driving sustainable development interplays with big societal trends and challenges to which all cities must adapt, but which also produce new opportunities.

- (a) Globalization and urbanization. These two processes support each other: globalization causes people move to cities - with their benefits of agglomeration, while urbanization fosters economic and cultural interdependence of the world and creates a planetary-wide ecological footprint.
- (b) Geographic disparities. Besides the persistence of social inequalities, which produce issues with spatial segregation, unequal standards of living and a lack of housing affordability within cities, large economic inequalities exist between larger metropolitan areas and smaller, peripheral and old industrial cities, resulting in an uneven quality of life and different life opportunities for their residents.
- (c) Crises and pandemics. The financial crisis of 2008 and the outbreak of COVID-19 have contributed to new global instabilities, intensifying underlying the economic and social problems of cities.
- (d) Digital transitions. Information and communications technologies (ICTs) and the fourth industrial revolution offer new opportunities for managing cities more efficiently and holistically and for enhancing wellbeing of people, and introduce new challenges to privacy and democracy.
- (e) Population ageing. Ageing produces specific demands on urban infrastructure, health and social care system, housing and public space, and expands the “silver economy”, which already makes up a considerable share of urban economies.
- (f) Climatic and environmental challenges. As well as facing global transformations associated with climate change and their inferences for energy transitions, cities are also faced with localized environmental pressures, such as air, water and noise pollution, which influence public health.
- (g) Natural and technological hazards. Urbanization decreases distances between population centres, industrial areas, flood plains, seashores and other areas prone to the impacts of natural hazards and increases the exposure of the population to technological hazards.

What do cities do to foster sustainability and liveability in an integrated manner?

The UNECE region is a home to cities that are leading the way to becoming sustainable themselves and contributing to overall world sustainability. UNECE strategic policy instruments, experiences, good practices and lessons learned support policymaking for people-smart and sustainable cities – both at the level of national governments and cities. This publication discusses a few important cross-sectoral areas, in which the potential of cities is directed towards addressing the big societal trends and challenges in an integrated manner, while fostering sustainability and liveability.

Every city matters

Persistent geographical disparities call for an inclusive, coordinated, multi-level and multilateral approach to a sustainable city. The wellbeing and prosperity of each and every city matters for sustainable development. No nation can claim to be sustainable if many of its cities are not. Advanced nations allocate considerable budgets to territorial balancing programmes, mitigating economic inequalities and supporting areas which may be lagging behind. Yet, many countries, including those with economies in transition, focus on large-scale urban projects, particularly in larger and capital cities. More inclusive policies seek to externalise/share the benefits of larger metropolitan agglomerations to benefit the whole urban system – whether through a redistributive hand of the state, territorial planning and integration, a polycentric model of regional development or better connectivity and enabling infrastructure.

Dealing with pandemics

Like the financial crisis of 2008, COVID-19 has highlighted the fact that different cities have different capacities to cope with crises. Weaker cities have interconnected underlying problems which cumulatively undermine their capacity to cope. Both the disease itself and the economic plight caused by lockdown measures have disproportionately affected the most vulnerable groups in society and those who are in more precarious housing conditions. The pandemic has demonstrated how fundamental housing is to public health, thus emphasising the importance of implementing the principles of the *Geneva UN Charter on Sustainable Housing*. The outbreak of COVID-19 has also demonstrated that cities need first to develop innovative methods of controlling infectious diseases without relying on drastic top-down measures, and to re-consider some accepted principles of urban design. Access to public spaces, green spaces (parks, forests) as well as blue spaces (water bodies) has proved important for physical and mental wellbeing.

Engaging with digital transitions

Digital technology is increasingly integrated into urban design and management. Cities deploy ICT infrastructure and “smart” solutions to support the integration and coordination of urban systems and processes and to enable them to offer citizen-centric services. While these technologies are not a panacea and need to be tailored to the real needs of cities, they do promise greater efficiency and expediency. City operating systems are deployed alongside digital twins to create more holistic and optimized ways of managing municipal services and transport infrastructure. Cities experiment with robotics and autonomous systems (e.g. connected self-driving cars, robotic healthcare, automation in buildings for energy efficiency). New online sharing platforms unlock underused capacities of urban systems and create new markets (e.g. car, bike, home sharing). Increasingly cities are becoming aware of the ethical and social challenges which come with digitization. People-smart cities seek to be digitally inclusive, to enhance capabilities, and ensure value and benefits to all citizens.

Cities that make life comfortable for all

Cities that aspire towards a more liveable and sustainable environment provide fusions of housing, urban and social infrastructure. These are part of the so-called foundational economy – the everyday anchors of the urban life, which are critical for making cities liveable. People-smart cities aspire to widen access to decent, adequate, affordable and healthy housing for all: housing that supports not

just basic needs but allows full participation of people as well in urban life and to connect to lifestyle preferences, everyday infrastructure and public spaces. This process is part of creating more appealing urban environments for all social groups and ages. In the context of ageing, for example, cities support wellness and provide conditions for older people to have a pleasant environment to age in place. In these cities, housing, social infrastructure and transport accommodate the needs of older people and persons with disabilities. People-smart cities also pursue an integrated approach to sustainable mobility, adopting the cross-sectoral principles of the UNECE Transport, Health and Environment Pan-European Programme (THE PEP).

Climate-neutral cities

Thousands of cities have already incorporated climate and energy targets into their strategies and plans. These plans create a sense of direction, even if these targets are more aspirational than binding. Trends are occurring almost everywhere towards strengthening energy efficiency standards for new-built buildings and homes, providing energy regeneration for existing buildings, and sharing expertise between cities (as, for example, facilitated by the UNECE International Centres of Excellence on High-Performance Buildings). Cities are changing energy supply sources to cleaner modes and modernising their energy infrastructure. Cities also have the power to do much through a focus on transport, which remains predominantly based on fossil fuels. Municipal procurement for clean energy and green technologies for public services and transport is an effective lever, alongside city planning and incentivizing shifts in modes of travel of citizens.

Ecological stewardship and health

The negative environmental impacts of human activities return to society in the form of health impacts and deteriorating living environments. These impacts are often socially uneven as poor residents are more exposed due to discriminatory siting of polluters, low quality, unhealthy housing or the need to sacrifice health for the sake of employment. Similarly, vulnerable groups struggle with affording access to clean and safe water, energy or good quality food. Sustainable cities foster inclusive solutions such as adopting the equitable principles of *the UNECE Protocol on Water and Health*. Green and nature-based solutions are already commonly used in many cities. Smart technologies help better monitor environmental conditions, including by providing information through mobile phone applications and informing residents.

Value out of waste and circular cities

Sustainability-minded cities look to close the open loop metabolism where natural resources are brought into cities, but their remainders are dumped as waste. A circular economy approach makes value out of “waste”, so that it becomes an input resource for further processing. Proper incentives are important to stimulate the shift to a circular approach, while digital platforms can facilitate the creation of new supply-demand chains, such as for converting food waste into energy. While traditional urban management for the food, water, energy, and waste sectors is operated in silos, the realisation of the benefits which would be generated by interconnections between these systems becomes an aspiration for uniting them as an energy-food-water-waste-land nexus. The nexus approach has also proven effective in regenerating brownfields for new sustainable communities.

Tackling hazards

Natural, technological and hybrid hazards require preventive solutions as well as preparedness and response measures. Due to the concentration of people, housing and capital stock, cities are particularly vulnerable to the impacts of disasters. Following *the Sendai Framework for Disaster Risk Reduction*, key aspects for reducing negative impacts are policy integration, improved adaptation and resilience. To achieve resilient urban environments, concerted efforts by multiple stakeholders are required: to boost the internal capabilities of urban systems to prevent disasters, to minimize their negative impacts if they do happen, and to make sure any post-disaster recovery activities are

coordinated, effective, people-centred, inclusive and focus on enhancing wellbeing and further resilience of cities (the “building back better” principle). The UNECE Industrial Accidents Convention and the UNECE Water Convention, promote the identification of technological and natural hazards and risk mitigation through the adoption of policies for prevention, preparedness and response.

How do cities activate capabilities for becoming people-smart and sustainable?

National and municipal governments activate the capabilities of cities to implement sustainable solutions by promoting a culture of innovation and deliberation which systematically explores new opportunities, identifies what works and what does not, unlocks untapped potential and generates new values by overcoming fragmentation and inefficiency.

A strong innovation-enabling environment

Experimentation and exploration are important for finding new and innovative solutions. A smart policy intervention is a continuous and exploratory process rather than a prescribed set of strategies with expected results. To fully utilize their innovative potential, cities develop an open culture of agile governance that facilitates reflective learning, adaptation, creativity, innovation and co-creation, and that supports innovative business models. This involves exploratory multi-level management mechanisms to facilitate collaboration across different sectors, collect evidence, generate confidence and designs, and then pilot, modify, and scale up ideas.

Steering and prioritising workable solutions

To be forward-looking, cities develop a culture which avoids making new major investment decisions based merely on previous practices, existing infrastructure or entrenched interests. Retaining old habits often reproduces inefficiencies. Leading cities enable a system of critical assessment, identifying what works, what does not and ensuring the ability to stop what does not work, avoiding costly lock-ins and status quos. An evidence-informed “what works” approach helps understand and evaluate solutions in practice.

Public procurement directed at sustainability

Procurement has a crucial importance in channelling priorities and driving demand for innovative solutions. To facilitate innovation-enhancing procurement, cities enter into competitive dialogues with potential bidders in order to understand the current state of technology and the potential for superior solutions. They also use pre-commercial procurement methods such as grants to innovative companies and local start-ups. Local fiscal and payment regimes can play a stimulating role in encouraging sustainable activities, projects or lifestyles and discouraging those which are unsustainable. Innovative and flexible tools for mobilising the “right finance” are available to cities, such as the UNECE people-first public private partnerships (PPPs) mechanism that emphasises SDG compliance with an emphasis on “people” as the main beneficiaries of infrastructure and public services.

Public participation and co-production

The ability to engage systematically and meaningfully with citizens, private sector actors and other stakeholders is what distinguishes people-smart sustainable cities. Participatory planning and budgeting are some of the tools used by people-smart cities. The UNECE Aarhus Convention promotes effective access to information and informed participation at all levels. New technologies and digitalization, open data, open government and e-government initiatives help authorities to make information more accessible and allow the public to more easily participate in decision-making. The key question for progressive participation is to what extent residents are capable of initiating change and collectively shaping cities to their aspirations.

Making the most out of spatial and land use planning

Spatial planning is crucial for the integration of different urban sectors into a coherent and consolidated spatial strategy. Urban design, sustainable and affordable housing provision, public transit and integrated infrastructural systems are some of the planning considerations that have long been acknowledged among the principal instruments for sustainable cities. Innovative cities ensure adequate land supply and create supportive planning and zoning conditions for encouraging investment, for example, in cleaner energy or quality affordable and sustainable housing. Land use planning is important to prevent cities being locked into unsustainable or hazard-prone conditions. The *UNECE Protocol on Strategic Environmental Assessment* (SEA) alongside several other strategic UNECE transboundary agreements provide frameworks for understanding and working on environmental impacts and risk management of proposed projects.

1. A cities-based approach to sustainability

1.1. A policy nexus for sustainable development

The imperative need for sustainable development remains a key planetary consensus. Sustainable development provides a long-term vision that unites peoples and nations in addressing important questions: how do we want the world around us to function and develop? What are the key priorities? How do we balance and reconcile different priorities? What future do we want?

Sustainability calls for development that meets the needs of the present without compromising the ability of future generations to also meet their needs. It calls for the integration of economic development, social equity, and environmental protection. It is the kind of development that puts people at the centre and that is just, equitable and inclusive (UN DESA and UNDP, 2012).

The United Nations *2030 Agenda for Sustainable Development* provides an ambitious and comprehensive plan of action. At the heart of it are 17 Sustainable Development Goals (SDGs), which represent a blueprint for policymaking and international cooperation. SDGs recognize that a sustainable future depends on how successfully multiple global challenges will be addressed at once: ending poverty and other deprivations, improving health, education and wellbeing, reducing inequality and spurring economic growth, preserving the environment, and tackling climate change. The integrated character of the 2030 Agenda draws attention to linkages and complementarities among many traditionally dispersed policy areas.

This publication takes the 2030 Agenda forward in a “cities-based approach” to sustainable development. This approach aims to recognise the central and integrating role that cities play in addressing, initiating and governing sustainability. As the dominant form of the spatial organization of society, cities are driving economic, social, and environmental transformations. Consequently, cities can be, and already are, engines for directing these transformations towards greater sustainability.

The key to successful sustainability transition is “innovation” (see box 2). Cities bring together industries, entrepreneurs, research and education institutions, human capital, efficient infrastructure, a large diversity of consumer demand and preferences, investors, accountable and reactive policy makers and public officials, culture and, importantly, different kinds of talent. The concentration of all these elements in one place serves as fertile ground for innovative ideas to create opportunities and ultimately resolve the sustainable development issues facing the world today, including traffic congestion, energy and resource depletion, pollution, human health, waste management and affordable housing. Cities function as hubs and testbeds in this respect, absorbing ideas, demonstrating their viability and ensuring their transmission to the rest of the society. By

systematically trying out different ideas and subsequently scaling them up or diffusing them to the rest of society, cities drive the whole of society to a more sustainable future.

Box 2. Defining innovation

Innovation does not necessarily mean something that has been unknown or untested beforehand. It includes implementing approaches that have been developed in other contexts. It is important to note that innovations in this context include not only technology, but also, more broadly, mechanisms to apply knowledge, ideas, practices, and new and better ways of doing things in addressing contemporary dilemmas and challenges. The Organisation for Economic Co-operation and Development (OECD) defines innovation as “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations” (OECD, 2005: para.146). Innovation includes the generation and application of new knowledge that contributes in a novel way to creating pathways to a more sustainable future. Apart from new technology or new product, innovation may involve new governance and organizational practices, new ways of structuring partnerships, or new ways of managing social relationships. In short, the concept of innovation goes far beyond scientific research, high-tech start-ups, and even profit-oriented, private sector activities as a whole. It is about trying out and finding better ways for human beings to interact and to thrive.

Source: OECD (2005).

There are indications that without a close involvement of cities, few of the SDGs can be achieved at all. The 2030 Agenda particularly refers to cities within SDG 11: “Make cities and human settlements inclusive, safe, resilient and sustainable”. This goal covers areas such as housing and basic services, transport, urban planning and management, national and regional development planning, cultural and natural heritage, urban resilience and environmental impact of cities. However, cities can also act as catalysers for addressing the majority of other SDGs. This perspective, where the role of cities is understood more broadly as bonding together different sustainability goals, is also central to the *New Urban Agenda*, which was adopted by Habitat III in 2016 (see box 3).

At the heart of the enormous potential of cities for sustainability are people – collectively and individually, living today and those who will live tomorrow. Society certainly bears responsibility for the many challenges that our planet is experiencing, but it is people who drive sustainability and are its ultimate source and beneficiaries. Recognising the centrality of people in sustainable cities, this publication coins the vision for “people-smart sustainable cities”. People-smart sustainable cities are those that engage with sustainability transitions in a people-first, inclusive, collaborative and equitable way. This vision underscores the people-centred and integrated (cross-sectoral) approach of UNECE to addressing the SDGs.

The innovative and transformational potential of cities should not be taken for granted, however. It is necessary that this role for cities is explicitly recognised and promoted at all levels of government and that necessary mandates are given to these different levels. The enabling of innovation involves a range of disparate factors, all of which must be in place for a vibrant eco-system to emerge. This publication invites a sharp focus on cities and advocates considering urban-based policies as a platform for integrating sustainability policies both across sectors and across different levels of cooperation, from local to international.

Box 3. The New Urban Agenda and its implementation in the UNECE region



Urbanization as a new central force in broader civilizational development was outlined by the *New Urban Agenda* adopted by Habitat III in 2016. This is a landmark document that sets out a global vision for the development of cities in the next two decades, prior to the next Habitat conference. UNECE has contributed to the development of the *New Urban Agenda* in a number of important ways, including by preparing a Habitat III Regional Report for the UNECE region. The key recommendations of the report were put directly into policy action by the *Geneva Ministerial Declaration on Sustainable Housing and Urban Development* adopted by the heads of delegations of UNECE member States in 2017.

Source: Habitat III (2016).

1.2. Defining people-smart sustainable cities

People-smart sustainable cities engage with sustainability in an inclusive, collaborative and equitable way. While fostering sustainability across its environmental, economic, social and cultural dimensions, these cities provide necessary conditions and infrastructure to enhance the capabilities of their citizens to contribute to, and enjoy the benefits of, a more liveable, resilient and sustainable urban development. These cities enable the meaningful participation of citizens in fulfilling their right to the city; focus on making their cities more prosperous, equitable, comfortable and innovative; address social needs and make sure housing and urban services are high-quality and affordable; cater for the needs of the vulnerable and those with disabilities; and are gender-sensitive and age-responsive, acknowledging the different and changing needs of residents at different stages of their life.

This is a necessarily inclusive and equitable perspective that directly and clearly links sustainable development with the development of human capital, while also affirming the imperative of enhancing life opportunities and the quality of life for all. Citizens are seen as both the source and beneficiaries of sustainable development. The foundation for these ideas lies with the concepts of “sustainable cities” and “smart cities” (reviewed below). But the notion of people-smart sustainable cities also focuses more sharply on human needs, capabilities and capacity building, while still inviting stakeholders to engage in collaborative, inclusive and yet pragmatic politics for achieving sustainable development.

The creation of “sustainable cities” has been a main vision for urban development since the establishment of sustainable development as a societal paradigm in the early 1990s. It is comprehensively defined as a policy commitment within the *New Urban Agenda*. The sustainable city is considered to be the one that enhances and balances social, economic and environmental dimensions. Different aspects and goals of urban sustainability are further stressed within the *New Urban Agenda*: “just, safe, healthy, accessible, affordable, resilient and sustainable cities”. Sustainable cities often interplay with a host of related normative visions for urban development. For example, cities should be at the same time economically sound (productive cities, competitive cities, creative cities), socially responsive (inclusive cities, liveable cities, just cities, age-friendly cities) and ecologically responsible (resource-efficient cities, green eco-cities, resilient cities).

Ongoing digital transitions and the rise of smart technologies have made their impact on the conceptualization of sustainable cities, bringing the “smart” dimension as a new claim to normativity for a technology-enhanced society. Over the past two decades, “smart cities” and “intelligent cities” have proliferated as a way to build more efficient and liveable urban environments. These

acknowledge the role of ICT in making urban infrastructure and decision-making and management systems more efficient, more environmentally friendly and more economically sensible. Smart cities promise integration, efficiency, sustainability and people-centricity. In order to be smart, a city not only needs a comprehensive commitment to using technology well, but also to transform governance, citizen interaction, and value creation across the board. The success of smart city projects is not determined by technology or technical capital alone; success is dependent on leadership, inter-organizational coordination and citizen engagement. The active involvement of stakeholders – including citizens – in the co-creation and implementation of smart city solutions is important for improving transparency and incentivizing society towards more sustainable practices and behaviours.

A concept that has emerged in association with the vision of “smart cities” is that of a “smart sustainable city”. The International Telecommunication Union (ITU) and UNECE worked together to define a smart sustainable city as “an innovative city that uses information and communication technologies and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects”. According to this, smart sustainable cities use technology to build strong relationships between citizens and city governments so that all citizens can benefit from, and even co-create public services (World Bank, 2015a) (see box 4).

Box 4. United for Smart Sustainable Cities

United for Smart Sustainable Cities (U4SSC) is a United Nations initiative coordinated by ITU, UNECE and UN-Habitat. The initiative is centred on SDG 11: “Make cities and human settlements inclusive, safe, resilient and sustainable”. U4SSC serves as the global platform for exploring the use of ICTs to facilitate the transition to smart sustainable cities. U4SSC has developed a set of key performance indicators (KPIs) for smart sustainable cities (SSC) which can be used as criteria to evaluate contributions of ICT in making cities smarter and more sustainable, and to provide cities with the means for self-assessments in their progress in achieving the SDGs. Over 100 cities worldwide are already implementing these KPIs. The U4SSC Implementation Programme (U4SSC-IP) supports the projects and builds partnerships for smarter and more sustainable cities worldwide.

Source: UNECE and ITU (2016).

The International Organization for Standardization (ISO) has developed a number of protocols for smart and sustainable cities. For example, ISO 37106:2018 “Sustainable cities and communities — Guidance on establishing smart city operating models for sustainable communities” gives guidance for leaders in smart cities and communities on how to develop an open, collaborative, citizen-centric and digitally-enabled operating model for their city that puts its vision for a sustainable future into operation. The document does not describe a one size fits all model for the future of cities. Rather, the focus is on the enabling processes by which innovative use of technology and data, coupled with organizational change, can help each city deliver its own specific vision for a sustainable future in more efficient, effective and agile ways.

The technology-centred “smart city” vision is not without its problems and dilemmas, however. The concept has been critiqued for its tendency to glorify technology, where urban citizens become subordinate to, rather than placed at the heart of, a sustainable city project. A systematic review of literature on the subject notes:

Complexities involved in developing truly smart cities are pushing policymakers to opt for short-term wins implementing Black Box technology solutions promoted by technology companies... While in theory smart is seen as inclusive of the sustainability goals, in practice, the smart and sustainable notions have often been used merely as window-dressing or reduced to ancillary aspect... In smart city projects, rather than producing new visions for the “good city”, the focus has shifted to mainly generating technocentric solutions for cities (Yigitcanlar, T. et al., 2019: pp. 359-360).

The concept of the “smart city” has morphed over time: it has experienced a notable shift from what some call now Smart City 1.0 (characterised by a top-down framework, with a focus on ICT infrastructure and deploying solutions promoted by technological companies) to Smart City 2.0 (a people-focused, users-friendly framework) to Smart City 3.0 (a framework for inclusive and participatory urban governance, even if still technology-enhanced). In terms of technologies, instead of uncritical deployment and copying what other cities are doing, there is now a search for “actually-smart” city solutions that are tailored to the very specific needs of individual cities and their communities with specific characteristics, aspirations, and challenges. This approach is also coordinated with the concept of adaptive governance discussed in Chapter 4.

Smartness is certainly one of the enabling conditions for improving sustainable development, but at its core must be people, citizens, and communities. In this present publication, under the notion of people-smart sustainable cities, smartness is taken as a decisively “humanistic” vision: inclusive of, but not limited to, and stretching far beyond, ICT or technology. Rather, the notion of people-smart sustainable city advocates a broader understanding of smartness in city development as a set of capabilities-enhancing conditions directed at sustainability and focused on generating a harmonious society and improving quality of life. This means reducing gaps in capacity and efficiency, meeting social needs, and making cities more conducive to innovation and more attractive to people and businesses.

This approach will drive through the rest of this publication, which will focus on how to create those enabling conditions that make cities people-smart and create pathways towards more sustainable and liveable futures. This is also to demonstrate that cities are key forces for implementing and innovating towards sustainable futures.

2. Trends and challenges for urban futures

2.1. Urbanization and globalization

The world has been rapidly urbanizing over the past century, a trend that is likely to continue throughout the 21st century. The World Economic Forum notes: “Humanity faces the mammoth task of adding over two billion people to the urban population before 2050, the equivalent of creating a city the size of London every month for the next two decades” (Charles, 2015). Some countries and world regions are already highly urbanized, and others are less so, but the latter are experiencing a rapid urbanization today. Rapid urbanization trends are: “translating into a growing and urgent demand for new or improved infrastructure, services and institutions capable of meeting the three-fold challenge of: 1) providing larger urban populations with access to basic services and vital resources, 2) sustaining continuous economic development, and 3) managing resources within our planetary limitations while addressing the challenges of climate change adaptation and mitigation” (GIZ and ICLEI, 2014: p.4).

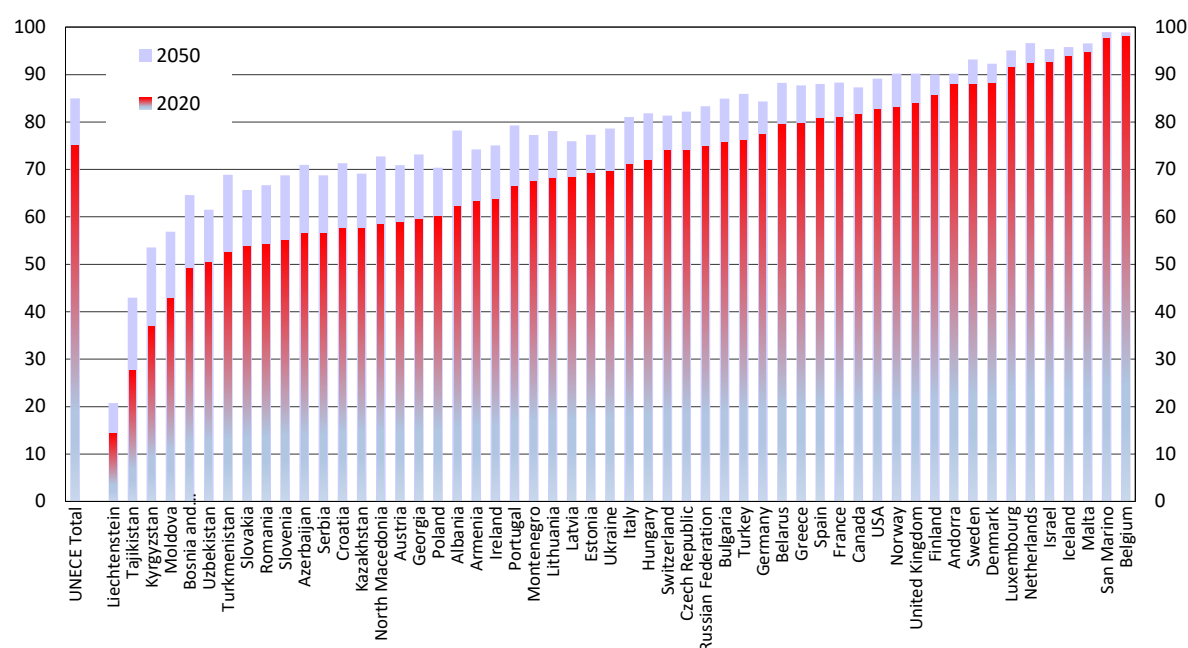
Cities already represent the core social and economic assets and engines in all countries (including in those where the population is still predominantly non-urban). This is due in large part to economic and cultural globalization. Globalization is driven by advancements in telecommunication, digital technologies, transport systems as well as trade liberalization. These advancements “shrink” the world, making it “smaller” in terms of the speed of information and material flows across the globe. But simultaneously globalization creates its own demand for an increased speed of social and economic interactions, making people move to cities, particularly larger cities, with their benefits of proximity, accessibility and remarkable productivity. Productivity of cities is driven by agglomeration benefits, economies of scale, knowledge sharing, business synergies, access to jobs, finance, entertainment, media, arts and other services. Competitive and attractive cities drive job growth, incomes and productivity, even if there is a huge variation in performance (World Bank, 2015b).

Globalization thus remakes geography, both global and local, strengthening the urban hierarchy with the larger metropolitan areas benefiting as hubs of globalization - although all cities in the urban hierarchy play their part in the architecture of the new economic geography. As will be discussed in section 2.2, this process widens the gap between strong and weak cities and increases geographically uneven development. The other side to this process, however, is that larger and more globally integrated cities are also those that are at the forefront of shocks related to negative impacts of globalization, as demonstrated by the COVID-19 pandemic.

The key regional focus of this publication is the UNECE region, which is already highly urbanized. The UNECE region is home to 17 per cent of the world population. With over 75 per cent of the population of the region already living in urban areas (as officially defined by the member States), this is where the social, intellectual and economic power of the region is concentrated (see figure 1). The UNECE region is also a leader in sustainable urbanism and is home to many cities that are leading the way in becoming smart and sustainable and making significant contributions to sustainable development overall.

The fundamental role of cities in driving societal development must be contextualised within the broader mega-social trends and challenges that cities must adapt to as these trends and challenges produce new opportunities. These societal trends lead to the creation of new functions for cities in society. The key challenges are introduced below.

Figure 1. Percentage of the population residing in urban areas: United Nations forecast for 2020 and 2050



Source: Based on the database of the United Nations Department of Economic and Social Affairs (UN DESA, 2018).

Note: The definition of urban areas is from national classifications.

2.2. Geographical disparities

There is a great diversity of economic conditions across the world and across the UNECE region, defined by different legacies of previous development and investment, different circumstances and different development pathways. An important dimension of the UNECE region is a large group of countries that have experienced a transition from a form of state socialism to capitalist economies. Regional economic data illustrates that the majority of Central, Eastern and South-Eastern Europe cities still lag behind the EU-28 average in term of productivity and innovation (Kollar, Bubbico and Arsalides, 2018). However, these countries vary greatly between themselves, including with respect to the levels of economic development (see figure 2).

Within nations, diversions in socio-economic development are wide and persistent too; each country has its own “core-periphery divide”. Globalization, alongside the processes of welfare state restructuring and a shift towards a much more open economic model since the end of the 1970s, has increased the socio-economic gap between cities in different locations, functions and size. Large cities that offer agglomeration and network advantages (larger markets, demand and labour pool) enjoy substantial privileges over smaller cities. This uneven development is further underpinned by factors such as deindustrialisation in Europe and North America and is manifested in the increased dominance of larger and capital cities and the decline of many of the smaller “old industrial” cities (see box 5).

Despite this, in the majority of cases it is these smaller and old industrial places that contain the majority of the national population. Figure 3 demonstrates, using the example of the 12 largest UNECE countries in terms of population, that urban population is not necessarily concentrated in a few large metropolitan areas, but is distributed across multiple smaller cities. Smaller cities are thus equally, if not more, important for sustainable development than the largest ones.

Relative economic performance, jobs opportunities and salary are some of the indicators often revealing inter-urban inequalities and the consequences of this often spiral in their effects. For example, a continuing economic underperformance of a city and a lack of economic opportunities lead to a drain of talent, skills and jobs to other places. This reduces the ability of public and private sectors to support the fiscal health of the locality, as well as its service provision and infrastructure. This, consequentially, leads to lower levels of business development and innovation. Over time, the qualitative and quantitative differentiation between places only increases, bringing in uneven quality of life.

While some ideological propositions may consider this in naturalistic terms as “the survival of the fittest” and that people “vote with their feet”, the consequence is that those overwhelming majorities of citizens that vote to stay rather than go are deprived of their capabilities to realise their potential and wellbeing in comparison with their peers in “successful” cities. This can be seen as “spatial” or “territorial injustice”, contradicting the ethos of sustainability, whereby core places are systematically advantaged – economically, culturally and/or politically – compared to peripheries.

Related to this is the phenomenon of shrinking cities. These are cities that are experiencing a long-term loss of population. This is a relative process; shrinkage has different intensities for different cities and happens alongside growth in other cities that are attracting population. “Urban shrinkage” is the result of an interplay of national demographic trends and subnational uneven development; it is more likely to happen in countries with a declining population overall. Among the countries of the world that are already shrinking or are projected to lose substantial parts of their population in the coming 20 years, almost all are situated in the UNECE region, mostly in Eastern Europe. Over 60 per cent of cities analysed by a World Bank study in Eastern Europe and Central Asia have declined in population in the period of 2000-2010 (Restrepo Cadavid et al., 2017). This occurs mainly in smaller cities, although even larger cities may be affected depending on their economic structure and location. Impacts of urban shrinkage include declining tax revenues, rising unemployment, outward migration of the working-age population, surplus land and buildings, and an oversized physical infrastructure (UNECE and HABITAT III, 2016: p.19). All this is happening against the continuing growth and expansion of “stronger” cities (see box 6 and section 3.1).

Box 5. Urban deindustrialization and monotowns

In the context of deindustrialisation and industrial restructuring, many urban economies have found themselves stuck in decline. This situation may be particularly grim in overspecialized cities whose economy has relied on one industry or a cluster of interrelated industries that have experienced shrinking demand. Thousands of old industrial cities and towns in Western Europe and North America have suffered a great decline because of delocalisation of industry since the 1960s-1970s, often alongside corresponding population shrinkage (famously exemplified by Detroit). While some old industrial cities have managed to diversify their economies and find new economic “raison d'être”, many still struggle in the new economy and remain susceptible in the face of economic shocks and crises.

A feature of Eastern Europe, Russia and Central Asia is a large number of so-called monotowns (from Russian “*monogorod*”). The economic performance and employment of these cities are heavily dominated by a few inter-connected industries, which have also supported a substantial part of the budget and urban social infrastructure of the city. Such inflexible urban economic structures have proliferated in capitalist economies too (e.g. Stoke-on-Trent or Port Talbot in the United Kingdom). But the mono-functional city approach was deliberately used under the centrally planned (state-

socialist) economies as an instrument for a more equitable regional development, with a combined goal of industrialisation and economic equalisation.

Many monotowns were newly built, often in remote locations. The establishment of such towns was heavily funded alongside major industrial programmes, frequently in areas of energy generation and resource extraction. According to the paradigm of “territorial industrial complexes”, monotowns worked closely together as part of a united yet spatially distributed “factory”. Their highly specialized economies complemented each other with the support of large-scale infrastructure and intensive transport flows.

Following the dismantling of the planned economy, exposure to the international markets, privatization of economic assets, disintegration of industrial supply chains and increased transport costs, monotowns have followed divergent trajectories. While centres of export-oriented industry (e.g. oil or metals) or state-funded economy (e.g. science towns or nuclear plant towns) continue to flourish, others, especially smaller and remote cities, have experienced economic decline and shrinkage similar to old industrial cities in Western Europe and North America. Such towns constitute, for instance, 25-30 per cent of the total number of cities in countries like Russia and Ukraine.

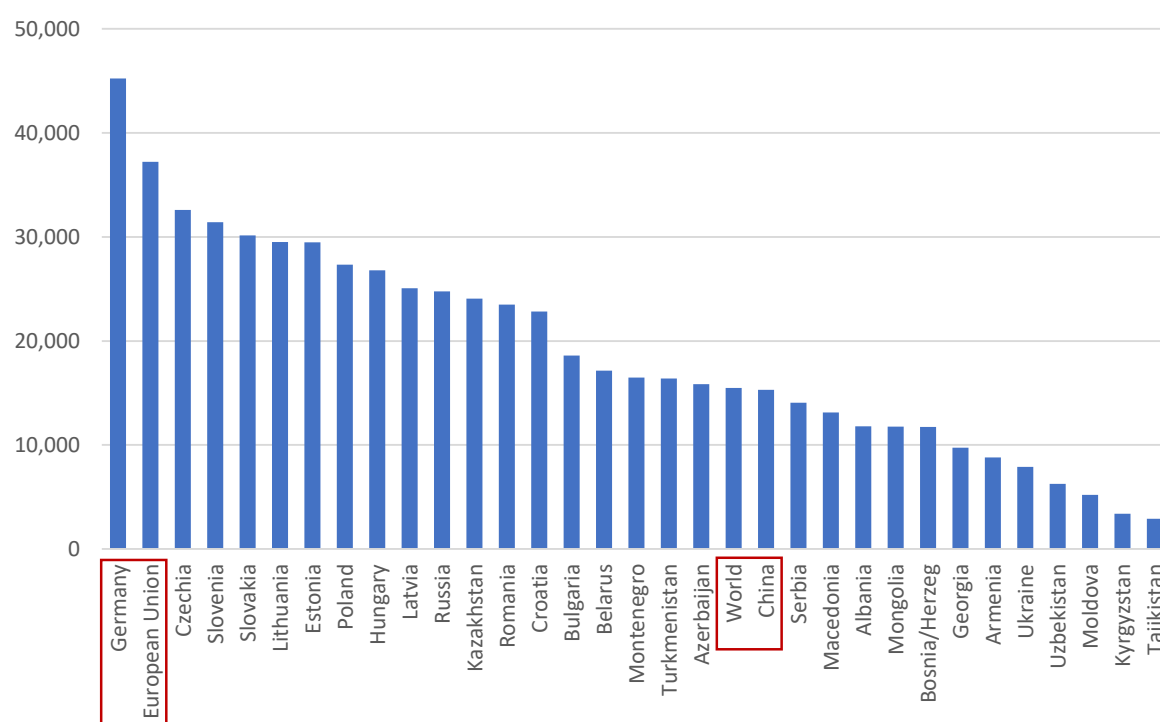
Sources: Golubchikov et al. (2015); Restrepo Cadavid et al. (2017).

Box 6. The Geneva Ministerial Declaration on Sustainable Housing and Urban Development

The *Geneva Ministerial Declaration on Sustainable Housing and Urban Development* adopted by the heads of delegations of UNECE member States in 2017, followed the publication of the Habitat III Regional Report for the UNECE region. The Ministerial Declaration serves as a high-level mechanism to mobilise governments and stakeholders to address key urban development and housing challenges across the UNECE region. The Declaration builds on the key principles of the Habitat III Regional Report and develops a number of new policy articulations with regard to overcoming geographical disparities in the region. For example, the Declaration asserts the importance of addressing social and spatial inequality within and among the cities of the UNECE region, reducing the economic polarization in growing cities that results from housing market imbalances and promoting inclusive cities by addressing the multiple integrated aspects of housing, urban poverty and exclusion. It also recognises specific challenges faced in the eastern part of the region, including the need for reforms in the spheres of large housing estates, energy efficiency, and company towns (monotowns). UNECE works towards the implementation of the Declaration through everyday activities on policy development and strengthening the capacity of national and local governments.

Source: UNECE (2017b).

Figure 2. GDP PPP^a per capita in ex-socialist countries compared to the world, EU^b and China, 2017

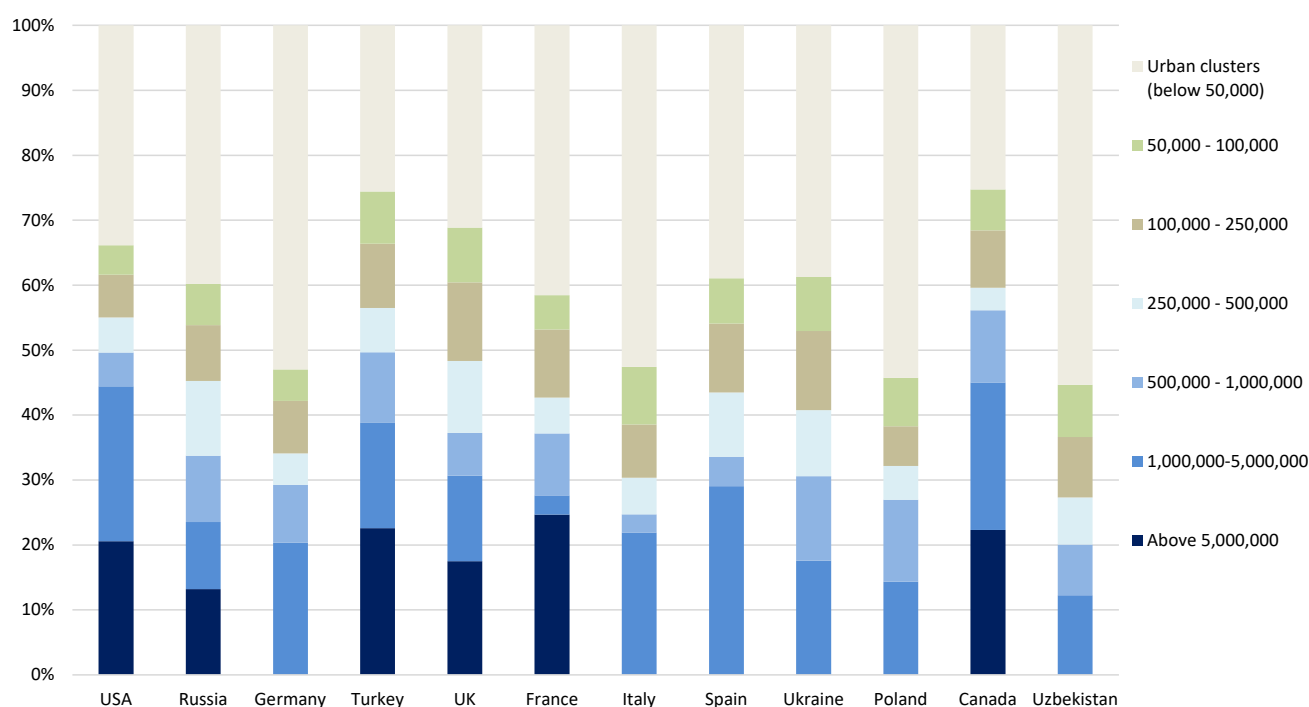


Source: World Bank Development Indicators (World Bank, 2019).

^a GDP PPP is gross domestic product measured in purchasing power parity, in the real value of US dollars, recalculated to their 2011 value.

^b European Union.

Figure 3. Distribution of urban* population by settlement size, 2015



Source: Joint Research Centre (JRC) degree of urbanization database (JRC, 2015).

Notes: Countries included are UNECE member States with over 30 million inhabitants, in increasing order of total population size. Data were calculated based on JRC internationally harmonized “degree of urbanization” data for functional “urban centres” (cities with over 50,000 inhabitants) and “urban clusters” (mostly towns and suburbs). An urban centre consists of contiguous grid cells of one km² with a density of at least 1,500 inhabitants per km² and a minimum total population of 50,000. An urban cluster consists of contiguous grid cells of one km² with a density of at least 300 inhabitants per km and a minimum total population of 5,000. This methodology is different from national statistics for administrative units.

2.3. Crises, pandemics and uncertainties

While globalization has lifted billions out of poverty, it also generates negative impacts linked to the interconnectedness of the world. This is demonstrated by the outbreak of COVID-19 caused by a novel coronavirus in 2020 – an example of black swans or rare and unpredictable events of extreme impact and profound consequences. Of course, black swans are often more associated with highly unusual, catastrophic events; COVID-19 is not one of those. But it should serve as a reminder that the world might well face something more catastrophic and needs to prepare for it. Rapid urbanization over the past few decades has increased the potential exposure to such diseases. The outbreak of the virus, as well as lockdown measures to contain its spread, have consequently led to serious economic impact, the scope and long-term effects of which are still difficult to predict.

Like the financial crisis of 2008, COVID-19 has demonstrated the importance for cities to be more flexible and to develop “resilience”, that is, the ability to withstand different kinds of shocks, of different nature and to adapt and recover from them in a way that doesn’t threaten the functioning, wellbeing and prosperity of the city, at least in the medium term. However, both crises have also highlighted the conditions of structurally uneven resilience (when different cities have different capacities to cope with the crisis). Crises are never the same across multiple places.

The financial crisis of 2008 produced particularly strong and long-lasting negative implications in already economically weaker cities, which found themselves less resilient, suffering from decreased public budgets, caps on public spending, and growing social and economic inequalities. Are the consequences of the crisis associated with COVID-19 different, that is, more “inclusive” of larger and stronger metropolises?

On the one hand, the COVID-19 pandemic infiltrated different nations through mega and large cities; their airports serve as gateways to the world and they have larger pools of interconnected population through which a virus can spread. The other key determinants of high rates of infection – density, percentage of foreign residents, age, presence of global supply chains, and reliance on tourism and hospitality (DeVol, 2020) – are all combined and peak in mega cities. The economic impact of the lockdown on these larger cities has also been more obvious because of their sheer share of the total economic pie. Cities like New York, Milano, Madrid, London, Paris and Moscow were all at the national epicentre of the coronavirus from the onset. They witnessed thousands of deaths, thousands of businesses closed and tens of thousands have lost their jobs. New York City alone stands to lose up to USD 6 billion in tax revenue (Harris, 2020).

Not only are the economic consequences of COVID-19 lockdown likely to far exceed those of the financial crisis of 2008, but also likely to affect the poorest much more. This is because lockdown measures have seriously affected those with precarious, temporary employment or those relying on informal activities in the domestic, low value added, already financially fragile service sector directly affected by lockdown restrictions. Cities have to deal with large social problems that will require substantial transfers to mitigate the harm, especially in poorer countries with severe fiscal constraints.

COVID-19 is also to have a more lasting economic impact on economically weaker cities. While the recovery of larger centres is more imminent, weaker cities have interconnected underlying problems which cumulatively undermine their capacities to cope with a crisis, exacerbating the impact of each new shock.

Overall, the spread of coronavirus and the effects of containment measures have exacerbated pre-existing social, spatial and economic inequality. Both the disease itself and the economic plight caused by lockdown measures have disproportionately affected the most vulnerable groups of the society: senior citizens, low-income families, homeless people, people living in overcrowded apartments, large families with children, people with disabilities, immigrants, refugees and minority groups. These groups suffer from limited access to healthcare, fuel poverty or inflation of the prices of essential goods and services.

The impacts on vulnerable groups have been particularly strong in those societies which are also traditionally spatially segregated. For example, government statistics in the United Kingdom (UK) identified that amidst the peak of the COVID-19 outbreak in March 2020 people living in more deprived areas had experienced mortality rates (i.e. deaths involving COVID-19 per 100,000 people) more than double those living in less deprived areas (Office of National Statistics UK, 2020). Similarly, data from the US highlighted a strong spatial-racial divide. If measured relative to the total population of the race group, African Americans were twice as likely to die from the disease as their Caucasian, Latino and Asian American compatriots. In some States, including Washington D.C., the death rate exceeded six times higher for African Americans than Caucasian (Pilkington, 2020; APM Research Lab Staff, 2020). Out of the 10 ZIP codes with the highest death rates in New York City, eight had populations that were predominantly African Americans or Latino (Schwartz, 2020). The most affected groups of the population are more likely to have lower levels of overall health and underlying health conditions (such as diabetes, hypertension and obesity); are disadvantaged in terms of access to diagnostic testing and high-quality health care; and are more likely to rely on precarious employment in lockdown-affected sectors.

2.4. Digital revolution

The rapid expansion of digital technologies – including digital communication, infrastructure and other frontier technology – has restructured many domains of social life, including production and consumption, how people interact with each other and how people work and behave. Again, the lockdown measures necessitated by COVID-19 and the temporary transition to remote working have demonstrated how far digital transformation has extended within society. The features of the so-called “gig economy” that decouples job and location have suddenly become prevalent for far more people, even for those who would not normally conduct their work away from the traditional workplace.

The deep sense of this transformation is captured in the notion of the “fourth industrial revolution”, which some claim is already changing the way in which economies and societies are organized and operate. This is underpinned by technological elements such as big data, the internet of things (IoT), artificial intelligence, machine learning, robotics, autonomous vehicles, dematerialization and others.

Most of these trends are more pronounced in cities due to the concentration of demand in these contexts. Technical innovation and ICTs offer new opportunities for managing cities more effectively and holistically and transitioning towards “smart cities”. Technologies such as high-speed internet, 5G mobile networks, IoT and big data play an increasingly important role in sustainability innovation.

Cities have a broad range of applications at their disposal that they can tailor to support initiatives. These include smart buildings, smart water management, intelligent transport systems, and new ideas to enhance efficiency in energy consumption and waste management. These initiatives further promote interaction of governments and service providers with the public, public participation in decision-making, awareness-raising and transparency. Smart cities can use technology to build strong relationships between citizens and city governments that all citizens can benefit from and facilitating citizens to even co-create public services. Citizens commonly have access to a large variety of services just in their pockets, that is, through electronic devices (see figure 5 and section 3.3).

There are certainly many risks and unknowns on these pathways to digitalization, some of which will be discussed later in this publication. These include privacy concerns, risks to traditional businesses and exploitative tendencies of sharing economy platform monopolists. Concerns about mass surveillance have become pronounced during the COVID-19 outbreak (see box 7). The gig economy itself is a symptom of a broader change in a direction that opens up many opportunities, but also subjects people to new risks including more precarious and uncertain jobs. This, in turn, requires policymakers to experiment with new ways of formulating social policy in order to mitigate negative effects and channel effective investment into human capital. Cities may prove to be perfect venues for doing this in a novel and creative way.

Box 7. Smartphone applications for city users

Since their introduction in the 2000s smartphones have become an everyday device for the majority of the population in the UNECE region (GSM Association, 2020: p.8). Taking advantage of the technological features of smartphones – location tracking, camera, internet connectivity and other wireless technologies – thousands of mobile applications (apps) allow users access to various services and resources. Apps transform engagement of users with urban spaces and services, including the way people get information, interact, transact with one another, move around, access places and participate in social and political activities. Among many others, the functions of city-related apps include:

- **Urban mobility.** Smartphone apps take advantage of built-in location for navigation, adapted to different transportation modes. Many public transit services provide real-time schedules, traffic information, the option to buy tickets online and tracking progress towards reaching bus or train stops through geographic location. Parking apps help people find unoccupied parking spaces and pay for parking directly from the app. Bike-sharing apps allow users to reserve a bicycle. Navigation apps offer walkers and cyclists the choice of the best routes based on length, safety and difficulty.
- **Car sharing.** Other apps offer access to car sharing services by allowing the user to locate available cars and rent on an hourly basis or access carpooling services. Cab-hailing services make it easier to order a taxi, locate it in real-time, and pay for the ride online from the app.
- **Shopping and delivery.** Retail and supermarket chains provide apps which give access to their products, allow placing an order for delivery, and help to locate nearby branches. It is also possible to order food and get it delivered through access to restaurant menus and independent deliverers.
- **Financial services.** This includes apps for everyday mobile banking and paying online with a phone at shops or for services, replacing a credit or debit card. These apps also make it easier for anyone without a card machine to make small personal cash transfers.
- **Short-term rents.** Finding hotel rooms, comparing prices, reserving a room and managing the booking can be done as easily from a smartphone as from a desktop computer. With the growth of sharing economy (see section 3.3), this is not limited to hotel rooms, but also to house sharing services.

- **E-governance.** Receiving government services directly from smartphones is becoming common. Many local governments provide apps which make it easier for citizens to inform government and participate in government decisions. These include reporting flaws in infrastructure through georeferenced image captures and short descriptions which are fed to relevant public services. Other apps provide information about upcoming elections, informal votes or other social initiatives and legislative motions.
- **Health services.** Apps also change approaches to health services, some of which have proved useful during the COVID-19 outbreak.

Box 8. A surveillance feast in time of pandemics: a glimpse of the dystopian future?

Human rights groups have raised concerns about the ethical implications of the state surveillance apparatus mass-tested and deployed during the COVID-19 pandemic in cities across the world.

Dozens of countries deployed mobile tracking applications as well as hidden surveillance techniques to trace the movements and contacts of residents. China, Israel, Singapore and South Korea were some of the first to mobilise their mass surveillance ecosystems to monitor quarantined people, using a combination of location data, video cameras and credit card information to track COVID-19 (Kharpal, 2020). Poland required those who were ordered into quarantine to periodically submit geolocated selfies through an ad-hoc app. Cities like Moscow have publicised the effectiveness of their facial-recognition systems for tracing people suspected of quarantine avoidance. Electronic permits were also introduced in Moscow to restrict and monitor out-of-home mobility.

While these systems were justified by the state of emergency, the Amnesty International noted: “In the name of combatting the disease, some governments are rushing to expand their use of surveillance technologies to track individuals and even entire populations. If left unchecked and unchallenged, these measures have the potential to fundamentally alter the future of privacy and other human rights.” (Amnesty International, 2020). UNICEF similarly alerted against creating a “new normal” in which children’s privacy is under constant threat (Vosloo, Penagos and Raftree, 2020).

These experiences concern not only a new wave of institutionalisation for the mass violation of privacy, but also potentially the more ominous possibilities of the growing capabilities of surveillance systems to be used to profile and suppress political dissidents and other “unwanted elements”, thus opening the way for a possible “digital totalitarianism” of the future. Rights-based principles need to be applied to health-related data tracking so that these measures are temporary, necessary, proportionate and transparent, including instigating the active participation of privacy groups.

2.5. Population ageing

Urban systems both reflect and form one of the factors in generating societal changes, including demographic transitions. Urbanized countries, such as the majority in the UNECE region, are developed and attract in-migration, but also many possess an ageing population.

While the 56 UNECE countries collectively account for 17 per cent of world population, they host 31 per cent of the population aged 65 years or older. At the turn of the 21st century, 14 per cent of the urban population in Europe were 65 years old and above, the share had grown to 17 per cent by 2015; in North America, the proportion increased from 12 per cent to 14 per cent (UNECE, 2020a). This trend has both challenges and potential. An ageing population is generated by a combination of low fertility

and increased life expectancy and denotes a shift in the composition of the age of population towards the older generation. The trends are pronounced in cities.

The spread of COVID-19 has shown the effects of an ageing population to be a growing vulnerability for cities in the UNECE region. Older people have found themselves at higher risk of developing health complications, as such countries and cities with ageing populations have been particularly badly affected by the outbreak – as exemplified by Italy where the factor of population ageing has been coupled with active intergenerational exchange and densely populated urban centres.

Indeed, the most "aged" subregion is EU15 countries (i.e. the EU member States prior to the accession of ten new countries in 2004), in particular, Germany and Italy. However, many others are catching up fast. The fastest rates of population ageing are occurring in Eastern Europe and the Western Balkans where populations are declining due to high out-migration flows coupled with low fertility. In contrast, countries in Central Asia, such as Azerbaijan and Kazakhstan, demonstrate a divergent pattern. They have higher fertility rates and a relatively young population. However, even these countries experience tendencies towards population ageing as life expectancy of their population increases.

Population ageing has a direct impact on cities by changing their demographic makeup, as well as potentially impacting the share of population that is working age, with further impacts therefore generated on employment-related tax revenues. Population ageing also produces specific demands on urban infrastructure, health and social care systems, housing and public spaces. It is not only that the total demand on housing increases as people live longer, but housing conditions and urban design must develop to meet the specific needs of the older generation, particularly with regard to the provision of adult services such as assisted living, as well as more general issues of mobility, accessibility and assistance.

However, all of this also opens up opportunities to cities. Firstly, ageing does not necessarily need to diminish the urban tax base; later retirement age and post-retirement participation in labour market are both picking up in many countries. VAT/sales tax (that makes up a substantial part of the revenue of the city) is charged the same for the older people and in many countries, pensions are not exempt from income tax either.

Secondly, the older population also ensures demand and room for new businesses, leading to what has become known as the "silver economy". This economy plays a vital role in a diverse range of sectors. Some estimates suggest that the silver economy, involving those who are 50 years old or older, contributes about 30 per cent of EU GVA (gross value added) (Varnai et al, 2018). The main portion of spending by the silver economy is on housing and utilities, which is well concentrated in urban areas. In fact, many urban services, industries and jobs – both public and private – rely heavily on the silver economy. For example, food, health, pharmacies, insurance, banking, transport and leisure among others. The *New Urban Agenda*, for example, recognises the imperative of "harnessing the ageing factor as an opportunity for new decent jobs and sustained, inclusive and sustainable economic growth, while improving the quality of life of the urban population".

Thirdly, as will be further demonstrated throughout this publication, a search for new solutions to cater for the heterogeneous needs and wants of older population opens new opportunities and innovation for "smart ageing" (see box 9). For example, an important aspect of this is enhancing the opportunities of "ageing in place". This is the ability of older people to continue living in their own home and community - securely, safely, independently, and comfortably - without the need to change their place of residence (for example, to move to a care home) due to illness or inability to manage own life independently (UNECE, 2020d). There is a strong evidence that older people prefer to stay in

their existing home where they feel having more autonomy, dignity and security, while staying close to their local community gives them a sense of identity, connection and familiarity. Technology, telemedicine and assisted homes can radically reformat the relationships between elderly care and places of residence, giving older people the chance to stay in their own home and community as much as possible, rather than to moving into care or nursing homes (see sections 3.3 and 3.4).

The outbreak of COVID-19 has further reasserted the importance of rethinking the arrangement of care for the most vulnerable groups within the older population. In the rich countries by mid-2020:

Nearly half of all deaths from COVID-19 have happened in care and nursing homes, even though less than 1 per cent of people live in them. In Canada 80 per cent of all the deaths from COVID-19 have happened in [such] places... In Britain the pathogen has killed an estimated 5 per cent of all people living in such institutions. The problem is not only that the residents' age makes them particularly vulnerable, but also that their living arrangements created opportunities for the virus to spread. Countries with fewer care homes have had fewer COVID-19 deaths, all else being equal (The Economist, 2020a).

Besides ageing, demographic shifts also include regional trends with respect to migration, population diversification (including ethnical diversity but also lifestyle choices) and changing family structures (smaller families with more people living in a single single-person household, particularly older women and younger generation). These shifts put further pressure on housing in cities, as well as increasing the importance of catering to different lifestyles and social and cultural diversity.

Box 9. Smart ageing for sustainable cities

Age-friendly sustainable urban environments can be designed with the help of new technologies to meet the needs of all generations and all levels of ability, overcome the digital divide, foster inter-generational solidarity and ensure that older people are not left behind. Focusing on three realms of urban life – housing, green and public spaces and transport - UNECE provides the following key recommendations to policymakers:

- Mainstream ageing, gender, disability and human rights considerations into urban planning to ensure that the design of housing, public and green spaces and transport systems in cities is responsive to the needs of all generations and all levels of ability.
- Involve all generations and stakeholders for people-centred local development planning. This involves engaging, consulting and designing with and for city residents of all ages and abilities. Doing this facilitates learning about the different needs, preferences and habits of citizens and ensures that no one is left behind due to technological developments and urban design that do not cater to their needs.
- Cooperate across sectors to connect the dots between different realms of city life and find a synergy between the environmental, economic and social considerations to be taken into account in sustainable urban planning. This could be done by facilitating the development of projects such as smart housing developments that are energy efficient, connected to public transport, barrier-free and adaptable to changing needs of people over their lifespan. This would also have the effect of facilitate intergenerational contact and relations. Success will depend on effective cooperation across all sectors, at regional, national and local levels.

Source: UNECE (2020d)

2.6. Climate and environmental challenges

Cities are key actors in environmental management and require innovative approaches to resolve issues around air pollution, energy and water conservation, waste management, and ecological protection. Globally, despite occupying a small portion of landmass, cities are responsible for over 70-80 per cent of natural resource and energy consumption and a roughly equivalent share of greenhouse gas (GHG) emissions. In relative terms however, cities are still more environmentally efficient than rural areas, especially if similar levels of development (GDP per capital) are achieved in both (rural areas are usually less wealthy than cities and consume less resources). For example, owing to their density and productivity, cities consume less energy per person or per a unit of GDP as people live closer together; each person therefore uses less energy for heating and is much more likely to have access to convenient public transportation. Overall cities are still the primary carriers of the bulk of environmental transformations. They are equally at greatest risk of facing the negative impacts associated with those environmental transformations, such as climate change or pollution and their socially uneven implications.

“Climate change” refers to rising global temperatures and the extreme environmental impacts caused by this, as well as the global consensus on the anthropogenic origin of this phenomenon – i.e. as a result of the intensified emissions of GHG. *The Paris Agreement* under the United Nations Framework Convention on Climate Change (UNFCCC) is currently the major framework regulating international efforts to combat climate change through creating a pathway towards low greenhouse gas emissions and climate-resilient development (see box 10). EU countries, for example, have committed to cut net GHG emissions to net-zero by 2050. This policy landscape puts serious pressure and expectations on cities. Cities need to be future-proofed for climate change, directly for the impacts of climate change and extreme events associated with it, but also indirectly for more demanding requirements with regard to climate policy coming as part of national and international regulation packages.

For most cities, the combustion of fossil fuels remains a major source of energy and the main source of GHG too. Cities use energy for heating, cooling, lighting and for the operation of machines (including transport) and appliances. Cities also consume energy embedded in the manufacturing of consumer goods, foodstuff and building materials. Apart from carbon dioxide (CO₂), another principal GHG is methane, which is particularly emitted from waste decomposition and treatment, as well as food production. Cities are involved in combating climate change – “climate change mitigation” - through policies such as the deployment of clean energy systems, reduced use of fossil fuel, sustainable mobility, improved energy efficiency and sustainable methods of waste utilization and recycling (for further details see section 3.5).

However, urban communities are also themselves vulnerable to climate change and its negative effects. These include extreme weather events (floods, heatwaves), rising sea levels, melting permafrost (affecting cities in northern areas), wildfires and droughts. Urban areas, concentrating people and infrastructure and often in hazard-prone areas, experience some of the largest impacts from both gradual climatic changes and abrupt natural occurrences. Within cities, moreover, it is often poor and more disadvantaged people who suffer the most. Cities, therefore, embrace socially oriented policies for climate adaptation and resilience as part of their sustainability policy packages (see sections 3.5 and 3.8).

Besides global transformations associated with climate change, cities are dealing with local and regionalised environmental issues, such as air, water and noise pollution, which are important factors influencing the quality of life and public health in cities (see section 3.6). Through urban sprawl and land-use change, cities also contribute to the loss of biodiversity and soil degradation.

Today, most cities take clean drinking water for granted. Yet, in the pan-European region alone, in both cities and rural areas, about 19 million people still do not have access to clean and reliable water sources and 67 million people lack access to improved sanitation facilities. About 100 million people do not have access to sanitation facilities at home, which makes them vulnerable to water-related diseases, such as cholera, bacillary dysentery, coli infections, viral hepatitis A and typhoid (UNECE, 2020f).

Air pollution causes severe health problems throughout the UNECE region. Exposure to air pollution is biggest in cities due to the concentration of traffic and industry. Exposure to poor air quality is especially high along busy roads, near industrial sources or when many houses are heated with solid fuels (UNECE, 2018a). Transport is thus one of the key sources of air and noise pollution in cities influencing health. The UNECE *Transport, Health and Environment Pan-European Programme (THE PEP)* is an important framework mechanism to mitigate the negative impacts of transport on health and environmental pollution (see box 11).

Waste is another significant concern for cities because it creates huge environmental, financial and social problems. One component of this is food waste. Cities multiply the food loss problem because of their size, the constant need for food availability and relatively low cost of food, a low understanding of food production systems and their environmental impacts among the population, and, in developing countries, the lack of refrigerated storage. Already now, food waste makes up a considerable portion of waste produced in urban areas and creates a huge environmental, financial and social problem for cities. At the same time, as will be demonstrated later, cities are a formidable playground for innovative solutions to addressing the food waste problem, as they also are with respect to many other types of “waste” and idle capacities, converting them into efficiency and values (see section 3.7).

Box 10. The Paris Agreement

The Paris Agreement came into force in 2016 as an international agreement building on the UNFCCC. Its central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C. Additionally, the agreement aims to strengthen the ability of countries to deal with the impacts of climate change. Appropriate financial flows, a new technology framework and an enhanced capacity-building framework have been put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives. The Agreement also provides for enhanced transparency of action and support through a transparency framework. Unlike its predecessor, the *Kyoto Protocol*, which set commitment targets that had legal force, *The Paris Agreement* emphasises consensus-building and allows for voluntary and nationally determined targets. *The Paris Agreement* requires all parties to put forward their best efforts through nationally determined contributions (NDCs).

Source: United Nations Paris Agreement (United Nations, 2015).

Box 11. Transport, Health and Environment Pan-European Programme (THE PEP)

The Transport, Health and Environment Pan-European Programme (THE PEP) is an example of an effective cross-sectoral and people-smart approach. The Programme, which was established in 2002, encourages governments, at national and local levels, to pursue an integrated approach to sustainable mobility. Through THE PEP, the transport, health and environment sectors work together to find solutions to make cities more healthy, liveable and prosperous. THE PEP has five priority goals:

- (a) To contribute to sustainable economic development and stimulate job creation through investment in environment- and health-friendly transport;
- (b) To manage sustainable mobility and promote a more efficient transport system;
- (c) To reduce emissions of transport-related greenhouse gases, air pollutants and noise;
- (d) To promote policies and actions conducive to healthy and safe modes of transport;
- (e) To integrate transport, health and environmental objectives into urban and spatial planning policies.

THE PEP covers, among other things, activities related to sustainable urban transport, health impacts of transport, mobility management, cycling and walking as feasible non-motorised transport modes for urban areas, and consideration of institutional arrangements for policy integration. The *Paris Declaration - City in Motion: People First*, adopted at the fourth high-level meeting of THE PEP, further underlines the importance of placing citizens at the centre of decisions on transport and mobility. The emphasis is on people-centred policies designed to make safe, healthy and green transport choices accessible and affordable to all.

One of the recent flagship publications of THE PEP is *A Handbook on Sustainable Urban Mobility and Spatial Planning - Promoting Active Mobility* (2020). It advocates integrating transport, health, quality of life and environmental objectives into urban and spatial planning policies and puts forward a methodology for sustainable urban transport planning. It provides references to case studies, good practices and examples from cities across the Euro-Asian region (and beyond) covering a wide array of thematic areas. These include spatial planning in function of sustainable urban mobility and accessibility; public transport planning; active mobility and how it promotes health and the environment; and the potential of intelligent transport systems in an urban context.

Source: WHO Europe (2019).

2.7. Natural and technological hazards

Disaster risks posed to cities have multiple dimensions beyond those linked with climate change or environmental pollutions. Urbanization decreases the distances between population centres, industrial areas, flood plains, seashores and other areas prone to the impacts of natural hazards and increases both the exposure and vulnerability of the population to disaster risk. There are also further risks associated with terrorism. All of these may significantly undermine sustainable development.

In the disaster risk reduction (DRR) terminology, a “disaster” is described as a hazardous event (triggered by a natural or technological hazard) interacting with the social conditions of exposure, vulnerability and capacity (see figure 4). “Hazards” may include natural hazards such as, for example, earthquakes or landslides, as well as technological hazards such as industrial accidents. Even if referred to as a “natural” hazard or disaster, the latter is a mix of natural factors and social vulnerabilities. “Vulnerability” influences capacity of people to anticipate and cope with the negative impacts of hazards. Vulnerability of a city is a product of social, economic and political processes that influence how hazards affect people in varying ways and with different intensities. Vulnerability reflects, for example, social differentiation across class, gender, ethnicity, age groups, disability, immigration status, as well as locational characteristics.

Thus, the adverse impacts of hazards are often more significant for vulnerable groups, who are more exposed to hazards due to their limited access to material resources and safe living conditions and/or due to their limited capacity to cope with the crisis. There is often a political reluctance to deal with these most important social and economic factors behind a disaster because they are hardest to address. For example, “policies might include land reform, enforcement of building codes and land-

use restrictions, greater investment in public health, provision of a clean water supply and improved transportation to isolated and poor regions of a country” (Wisner et al., 2004, p.9).

While regulation and new standards have driven significant progress in industrial safety, major technological disasters such as industrial/chemical accidents still occur as countries face new challenges and emerging risks. For example, from October 2016 to September 2017 alone, Asia, Europe and North America witnessed 620 accidents reported on the media, associated with 552 deaths, mostly in Asia (UNDRR, 2019).

In recent years, many extreme weather-related events triggered industrial accidents with severe environmental and economic consequences, such as Hurricane Harvey in the US. These events, known as “NaTech” (natural hazards triggering technological disasters), are increasing in frequency and intensity due to climate change. Such natural, technological and hybrid hazards require special prevention and protection as well as preparedness and response measures at the city scale that concentrate on population and infrastructure, both of which can be put at risk (see section 3.8).

Figure 4. The causation of disaster risk



Source: OCHAOPT (2017: p. 44).

The discussion above demonstrate some key challenges and opportunities that shape cities and society today. This discussion brings with it some important questions: How can cities systematically address sustainability challenges? How can cities utilize their “integrating” potential for sustainability transitions? How can urban innovation be shared to benefit the broader society in line with the vision for people-smart sustainable cities?

The next chapter reviews selected policy areas and illustrates the role of cities in providing integrated policy solutions. It will outline what solutions are being implemented in cities to address the challenges or embrace the opportunities that are being generated by the trends discussed here.

3. How cities foster sustainability and liveability

3.1. Every city matters

Cities are an integral part of the dynamic flows of social and material relationships. They are both nodal points in the organization of the national social, economic and political system and the consequences of that system. Each and every city represents its nation. A country cannot claim to succeed in making itself more sustainable where only some of its cities thrive as “sustainable” while many other cities, the indispensable elements of the national social fabric, suffer from serious social, economic or environmental problems. In other words, the sustainability of each particular city and place is not simply a matter of that city alone. It is a matter of the sustainability of the whole urban system and the nation as a whole. The health and prosperity of each city matters in the national and international efforts for sustainable development.

The previous chapter demonstrates that economic inequalities, concentration and polarisation between cities are persistent and represent a challenge for sustainability. This should be understood in the context of SDG 10: “Reduce inequality within and among countries”. Geographical disparities exist not only between nations or at the urban/rural divide, but also between metropolitan areas and more peripheral and old industrial cities. Territorial inequalities have implications for social justice, since wellbeing of people is greatly dependent on the area in which they live. This remains a limiting factor both for economic and social development and for innovation.

The “growth pole” theory stresses the multiple positive effects from the more successful and fast-growing metropolitan areas for regional and national economies and, most notably, suggests that the economic successes of these areas will eventually “trickle down” to the rest of the national economy, including to “catching-up” places. However, in the absence of coherent government policies to that end, larger cities internalise much of their agglomeration benefits and externalise many negative effects for the rest of their nation; these effects include skills drain and environmental footprint. The territorial effects of development and under-development often become self-perpetuating and spiral, meaning that successful “growth poles” reap all the benefits and continue to prosper, while many other areas become associated with failure and deprivation and are pushed further to the periphery. There are also costs of agglomeration in terms of congestion or issues with housing affordability and quality of life for low-income groups.

There is compelling evidence that greater levels of equality create stronger overall returns in terms of innovation, wellbeing and prosperity. Many regional development policy models stress the importance of the state and other actors in ensuring enabling conditions and capabilities for less “successful” cities and places to become more prosperous and competitive (ESPON, 2012).

Economically advanced nations, including the EU as a bloc, spend considerable budgets on territorial balancing programmes, mitigating economic differences. This is also important in light of SDG 8: “Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all”. The EU structural funds are a key source of regional development in the new EU members States in Eastern Europe. However, these still tend to focus on larger cities and more populous areas where benefits of individual measures are considered to have a greater impact in terms of coverage. This addresses the problems of some areas but intensifies their socio-economic distance from other places.

And yet many countries, including those with economies in transition, have less developed mechanisms for wealth redistribution and feature greater levels of territorial inequalities, as they also do with social inequalities. This is due to the serious limiting of the redistributive scope of the state

during their transition to capitalism. Cities in these post-socialist countries commonly share many similar challenges: increased polarisation between cities of different size and specialisation with resultant sharp depopulation of many peripheral regions and cities (see box 12); fragmented system of spatial planning; problems with the management and maintenance of large-scale housing estates; lack of housing affordability and energy efficiency; and growing urban sprawl and ecological footprint (Golubchikov and Badyina, 2016). Efforts in urban regeneration across the region so far have focused on large-scale “signature” projects such as housing renovation in capital cities, mega-events or spectacular urbanism (Golubchikov, 2017; Salukvadze and Golubchikov, 2016). This benefits only a handful of places; geographically selective investments of this kind are insufficient to address multiple challenges across the whole region and achieve broader social and spatial cohesion.

Sustainable urbanism is a relational category: individual cities are not self-contained entities that can be “islands of sustainability” in the sea of decline. Thinking of cities as self-contained and independent entities does not work for sustainable development. What is important is to see each city as part of the whole national socio-economic systems as well as broader ecological systems and shared sustainable development commitments. Bridging the development gap requires sharing and diffusion, both horizontally (across space/the urban system) and vertically (between different levels) and in a way that does not impede healthy competitiveness, entrepreneurialism and productivity. Instead initiatives should activate the capabilities of each and every citizen irrespective of their place of living. This requires a change from the “cities-centric approach” that privileges particular cities (especially those which are large and successful) to a “cities-based approach” which involves a fair-sharing of the benefits of the more advanced cities with wider society. It is important to externalise the benefits of larger urban agglomerations to benefit lagging behind places, whether through the redistributive hand of the state (including with respect to guaranteeing the quality of key societal functions such as education and healthcare), better spatial planning and a polycentric model of regional development or through better connectivity.

In the context of the post COVID-19 world, more attention will be given to the “foundational” economies, where cities play the key role. Cities, regions and municipalities have the local knowledge and the proximity to local citizens to design and deliver public services and development strategies and these foundational assets need to be nurtured and nourished if the pandemic is to be a portal to a better world (see box 13).

Each city is unique. The diffusion and transfer of best practice, models, knowledge and expertise are only good as long as it can accommodate and take into account the diversity of urban contexts. Cities “are the communities, spaces and political arenas through which change is invented, implemented, enacted and experienced in always specific and different ways” (Rutherford and Coutard, 2014: p.1371). From this perspective sustainability transitions need to be plural and heterogeneous; there is not one size fits all solution. Every city matters and every city is unique. Local actors and local residents are best at understanding the particular needs of a city. Running through all that are imperative for success in generating smart sustainable growth should be the thread of local collaborations between citizens, business, academia and governments. (see box 13).

Box 12. How Murmansk plans to reverse its population decline

Murmansk, a port city in the Russian Arctic, has experienced some of the largest rates of population decline in the world for a city of its size. From the peak of 468,000 people in 1989, the city population has shrunk by 38 per cent to an estimated 288,000 in 2020. The new regional government, however, aims to capitalise on the growing support to the Arctic areas offered from the federal government and use this to revive the city and its wider region. The plan addresses the causes of depopulation (out-migration and short life expectancy) through policies such as providing incentives for in-migration and healthy lifestyles. The former includes tax incentives and employer support, meaning that salaries in

Murmansk will be 30 per cent higher than the average in bigger cities of Russia. The latter includes a limitation on alcohol and tobacco consumption, increased support for sports clubs and the rehabilitation of outdoor public spaces to make them more attractive. Support for larger families, building schools and kindergartens and creating employment programmes for working mothers are among new measures. Importantly, the plan of the governor also includes regenerating urban social infrastructure including via capital repairs of housing and buildings, renovation of public spaces, road construction and repair, as well as modernization of public transport. To take advantage of marketing itself as the Arctic capital of Russia, a new polar research and education centre is planned alongside creating infrastructure for prototyping and testing in Arctic conditions.

Source: Nilsen (2019).

Box 13. The foundational economy – a spatial strategy for everyone everywhere

The foundational economy (FE) refers to the social and material infrastructure that supports everyday life; and public and collective goods and services that provide mundane essentials such as housing services, physical infrastructure, retail banking, schools, food supply and health services.

Conventional ways of theorizing and measuring the competitive economy render the FE invisible and overlook its contribution to development. Orthodox thinking is fixated on the contribution of hi-tech industries and property-led regeneration to boost GDP. But growth in GDP is not translating into improvements in living standards for many households and provides only a narrow and desiccated index of progress. The conventional debate also leaves unanswered questions about the fate of the vast majority of people and places that do not feature in the narrow world of innovation policy.

It is in this space that the FE concept makes its most important contribution because, far from being socially and spatially exclusive, it has something to offer everyone everywhere, that is, to all citizens irrespective of their income and location (Foundational Economy Collective, 2018). The FE includes “material infrastructure” – pipes and cables and utility distribution systems for water, electricity, retail banking – and “providential services” – education, health, food provisioning, dignified elder-care and income maintenance. It is the foundational economy that supplies goods and services critical to rising living standards and social wellbeing, and that make a difference to quality of life of people (Heslop, Morgan and Tomaney, 2019).

The COVID-19 pandemic has demonstrated the importance of the foundational economy as the part of the economy which cannot be shut down. The list of essential workers in each national economy provides a practical definition of what counts as foundational (Foundational Economy Collective, 2020).

Wales in the UK became the first nation in the world to officially embrace the FE to deliver the sustainability goals of its Wellbeing of Future Generations Act. To promote this agenda, Wales joined the Wellbeing Economy Governments (WEGo) alliance with Scotland, Iceland and New Zealand. The rationale for this small nation alliance is to implement the SDGs and to champion the idea that national success should be defined by the quality of life of citizens rather than the growth rate of GDP of a country.

Promoting the FE in the post-pandemic world requires nothing less than a process of societal innovation for foundational renewal in which two things are necessary: (a) citizens and consumers continue to view and value activity that has social value; and (b) national and supra-national authorities work in concert with cities and regions in a spirit of co-production rather than the top-down manner of the pre-pandemic era.

Box 14. The Intelligent Cities Challenge

The Intelligent Cities Challenge (ICC) is a European Commission initiative bringing together 126 cities to achieve intelligent, socially responsible and sustainable growth through advanced technologies.

The 2.5-year programme builds on the success and lessons learned of the Digital Cities Challenge (DCC), which helped 41 EU cities develop a strategic vision and roadmap for their digital transformations. The DCC initiative fostered complementarities and synergies between existing policies involving digital priorities (e.g. smart specialization, digital city, e-government) and new actions supporting digital transformation. Activities within the DCC particularly focused on the needs of mid-sized cities, enabling them to become more competitive in a global economy. They develop activities in sectors that are relevant for the local economy and in those areas related to fostering entrepreneurship, improving the local digital skillset, and making use of open data platforms. Key lessons offered by DCC included the following:

- **Citizens at the centre.** Visionary leadership and collaboration between citizens, business, academia and local governments is the secret of success as cities and ecosystems together design future strategies for smart sustainable growth
- **Data is the big topic governing smart policymaking and sustainable growth.** This is a clear message to city ecosystems to keep control of their data and unleash their full potential.
- **Skills and attracting talents are key** for those cities developing innovative and disruptive education and training schemes to prepare their citizens for a bright future
- **Cities are vibrant market creators** as they increasingly base their decisions on data analytics and are procuring cutting-edge technology solutions and services

These lessons learned were used in ICC to support cities to become the engines for the recovery of the economy and building sustainability and resilience through the uptake of advanced technologies, re-skilling and upskilling of the workforce.

Source: European Commission (2019).

3.2. Is there city after COVID-19?

The outbreak of COVID-19 has shaken many “linear” assumptions about the evolution of sustainable cities, particularly with regard to planning for environmental sustainability and resource efficiency. As was well noted in one newspaper: “one of the most pressing questions that urban planners will face is the apparent tension between densification – the push towards cities becoming more concentrated, which is seen as essential to improving environmental sustainability – and disaggregation, the separating out of populations, which is one of the key tools currently being used to hold back infection transmission” (Shenker, 2020).

This is not for the first time that cities become the epicentres of communicable diseases; the Spanish flu killed tens of millions of people almost exactly a century before COVID-19. Since then there have been a number of other large disease outbreaks, although of smaller severity. Population density, as this and many other pandemics throughout history have shown, makes transmission much easier. Historically, many argue, this has been the main impediment to growth for the world as a whole. In the case of the Black Death, the disease killed 30-60 per cent of population. Nothing of this scale has yet been seen with COVID-19 or other pandemics, but it does raise the question of what can be done to balance the trade-offs.

Social distancing and other measures introduced by governments to restrict the spread of the virus question the very essence of what urban life is about. Does this mean that we can see the beginning of the end of “the city” as we know it? Does this mean at least the end of the sustainable city? Should urban sprawl - where the population is dispersed across a larger area around urban cores and thus relies on cars for commuting to jobs and services – change its so far highly negative connotation in sustainability discourses?

There are certainly multi-dimensional considerations related to future forms and functions of cities which come out of the experience of the pandemic and concerns on how to minimize the spread of infection. For example, how premises such as offices, houses and shops could be better designed; how public spaces, mobility and transportation systems within cities could be better laid out; how cities should rethink their development, high streets and other locational priorities; and whether the benefits of urban agglomeration could be replaced by distributed clusters where physically dispersed activities are combined in digital space as “virtual agglomerations” (akin to virtual power plants that aggregate the capacities of multiple energy producers with the help of smart grids).

Reaction of society to COVID-19, especially the rapid spread of teleworking, may change urbanization patterns. Companies may see less reason to pay the huge premium for downtown offices and high salaries to compensate workers for the cost of living. Real estate prices may even move backwards, or at least stagnate; and it will take some time for these shifts to unfurl. From a city government perspective, this might mean also a rapid fall in tax revenue, as more and more people may choose to live further away if they only have to come to an office a few days per week. That means they will have to do more with less, and better use of technology and experimentation with ideas is not only a good approach overall, but an imperative to keep cities liveable and functioning during these developments.

Yet, none of those previous pandemic outbreaks has “killed off” the city. On the contrary, urbanization has thrived. People have an innate desire to socialise and cluster together to realise their creativity and productivity, for which the modern city presents the best platform. While the pandemics certainly provide food for reflections and practical action towards how cities should be future-proofed, it doesn’t necessarily change the direction of sustainable cities. On the contrary, it has only stressed their importance as one of the “nexuses” or cross-sectoral areas for policy action.

Good quality, healthy housing remains at the centre of urban liveability and sustainability. The pandemic has brought a new perspective to the housing question by demonstrating how fundamental housing is to public health. People living in inferior and crowded housing have been hit particularly hard. Moreover, access to green public spaces (parks, forests) as well as blue spaces (water bodies) has proven to be important for physical exercise but also mental rehabilitation during the pandemic.

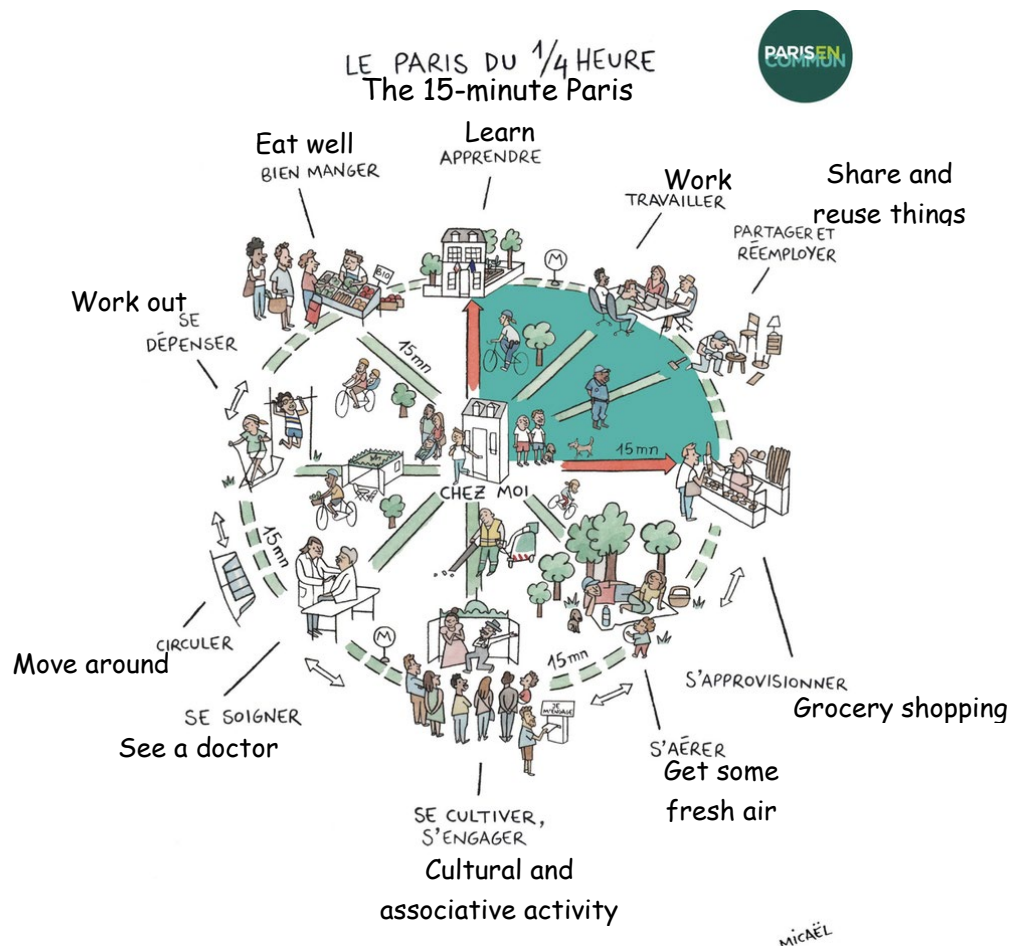
Furthermore, after the pandemic, creating the resilient and adaptive city – as important dimensions of the sustainable city more broadly – is firmly back on the policy agenda. Resilience here means not simply being able to cope with the dangerous situation, but also learning from what has happened and using this as an opportunity to make positive and transformative changes (in line with the United Nations-advocated “building back better” principle – see section 3.8), rather than to return to the status quo (OECD, 2020). Indeed, resilience should be seen as “a metaphor for change, not against change” (DeVerteuil and Golubchikov, 2016).

The outbreak of COVID-19 has also demonstrated that cities “need to develop efficient and innovative methods of confronting emerging infectious disease without relying on drastic top-down state measures that can be globally disruptive and often ineffective” (Connolly, Keil and Ali, 2020). Cities can learn from each other how to best prepare and respond to such disasters, including finding new

approaches to urban practices, urban and housing design, and the design and organization of collective infrastructure and public spaces (see box 15). Economically, cities must “assess the industries and clusters that are most vulnerable in their territory, evaluate the impacts future pandemics will have for their labour markets and communities, and plan to make their economies more resilient and robust.” (Florida and Pedigo, 2020: para 8) (see box 16).

Box 15. The “hyper-proximity” plan of Paris

The *La Ville Du Quart d’Heure* (the 15-minute city) programme proposed by the Paris Mayor envisages remaking the city as a set of self-sufficient communities with amenities nearby, in which nobody takes longer than 15 minutes to get to work or take their children to school. This is to “reinvent” the idea of urban proximity and make it work to fulfil the needs of city dwellers, reduce traffic and stress, and to make the city cleaner and more pedestrian friendly. The idea has gained new light in the context of the COVID-19 lockdown, as it can make the city more resilient in situations which may hamper the use of transportation infrastructure.



Sources: Martinez Eukliadas (2020) and Willsher (2020).

Box 16. Urban transport statistics and COVID-19

Since the COVID-19 outbreak and the accompanying lockdowns of varying degrees in different counties, there is a great deal of interest in how this has affected mobility. Large reductions in road traffic have been observed during the lockdowns, with even larger reductions in public transport use. In many cities, large increases in walking and cycling have taken place. However, with an explosion in

private car use in the aftermath of the pandemic, monitoring transport systems with reliable data, in a timely way, is more important than ever, especially due to implications for road safety, environmental impacts and health impacts. Since the start of the crisis, UNECE has been collating all available short-term transport data sources onto a dedicated wiki page (UNECE, 2020h), allowing policymakers to see available data when it is published. For example, the road safety data for cities like New York and London demonstrated modest reductions in fatalities during lockdowns against the much larger decreases in traffic volumes. This indicates that less cars on the road is encouraging some drivers to speed and drive more recklessly. The Lisbon metro in April 2020, meanwhile, had just 18 per cent of the passenger numbers of April 2019, agreeing with similar public transport reductions in other cities and countries. This short-term data complements the tram and metro statistics (split by city) (UNECE, 2020g). All of this data allows better understanding of the sustainability of urban transport and provides insights into its future developments.

3.3. Living in digital worlds

Digital revolution equips cities and citizens with new tools to find opportunities, address challenges and create pathways towards more sustainable and liveable futures for all. This particularly relates to the rise of industry 4.0, automation and robotization, which could change the way in which businesses operate and the way social life is organized. The rise of industry 4.0 is also impacting on job markets.

“Platform urbanism” and smart cities are some of the trends associated with cities. They acknowledge cities as suitable agglomerative space for the deployment of smart technologies, including in their experimental “testbed” modes. Various “platforms” introduce new services and markets into urban life that allow things to be done more efficiently and cost-effectively, offering new opportunities for service providers and more convenient and cost-effective services. The pioneering online “marketplace” giants such as Amazon or eBay were followed by the emergence of the whole new world of the so-called “sharing” or platform economy.

The sharing economy involves consumer-to-consumer based activities providing or sharing access to goods and services between buyers and sellers, usually with the support of online platforms. The model allows new markets to be created where users can make money from underused or idle assets, such as cars or properties. Airbnb, Uber and their regional alternatives like Yandex Taxi and other Yandex services and similar platforms have rapidly become part of everyday life. Carpooling services like Oszkár in Central Europe, car sharing platform and bike sharing platform have proliferated. Similarly, co-working and freelancing platforms help match demand and supply better in a more flexible job market. Platforms get better as they get bigger due to the network effect and the economy of the scale.

The sharing economy unlocks a tremendous potential for improved resource efficiency, while opening new markets and boosting economic gains, especially in the high-density urban context. For example, data suggests that private vehicles go unused for 95 per cent of their lifetime (Yaraghi and Ravi, 2017). Car sharing increases vehicle use without increasing a number of cars on the streets. A more efficient organization of taxi rides via online services reduces the amount of traffic. Both tourists and homeowners benefit from the lodging sharing services like Airbnb as homeowners make use of their spare bedrooms.

However, the sharing economy has its dark sides. This includes, for example, when considerable parts of urban areas become magnets for Airbnb-based commercial operators leading to housing markets “switch” where traditional housing markets are converted into short-stay lets (Henley, 2019). This brings with it housing shortages, higher housing prices and even displacement of the local population. Serious concerns have been raised about the regulatory deficit, as online platforms can avoid more

stringent regulations that normally characterise business sectors, getting away with unfair advantages but also leading to various potential forms of abuse. For these reasons, top tourist destination cities such as Amsterdam, Berlin, Barcelona, Paris, New York or Los Angeles have introduced permission-based and restrictive regimes on short-term rentals.

These downsides, however, should not constitute a reason to cloud the enormous potential of the platform economy overall. Cities are well advised to enable experimentation rather than constrain it, while monitoring trade-offs carefully and intervening and regulating where the harm may exceed the benefits created (see box 17).

Cities are otherwise getting “smarter” as they explore and scale up ideas for using technology better when they plan, design, run, and monitor urban systems and platforms. For example, electronic and contactless smart cards and other digital solutions give rise to the concept of “mobility as a service” (MaaS). This is a user-centric platform that integrates different mobility services and provides trip planning and one-stop fare purchase through a single platform (see box 18). As people are relying more on technology for routine communications in their daily lives, cities are also adopting new technology through sensors deployed to monitor and gather information about people and their environment for reasons of ease-of-use and resource efficiency, entailing doing things better for less or more for less. Increasing automation and efficiency have led to big data collection that is used for reporting and informing urban government and loops back to inform planning and design.

A new form of sustainable urbanism puts innovation and technology front and centre. The initial driver was to work towards service and resource use efficiency at a smaller scale (e.g. energy or water efficiency in buildings), but the concept of the smart city has grown from this original ambition to one that applies to entire cities and urban areas, no longer just transportation system or buildings. Modern applications involve increasingly levels of connectivity or integration, with the involvement of multiple stakeholders and city components (Thornbush and Golubchikov, 2020). High-speed internet and ubiquitous connectivity, including with the assistance of 5G mobile networks, can become the backbone infrastructure for a digitally smart city.

City operating systems are deployed alongside “digital twins” to create more integrated ways to manage public infrastructure and maximise its efficiency, reliability and returns. Digital twins are:

A digital representation of its entire infrastructure on a secure, enterprise-wide software platform. A state-of-the-art digital twin is essentially an integrated, centralised platform (or “nerve centre”), where diverse information about assets and associated services is combined, monitored, analysed and acted upon. It can be a critical facilitator of transformation – delivering benefits across all phases of the lifecycle of designing, running and maintaining/improving local infrastructure, whether within a single organisation or across an entire city (Tabbitt, 2020) (see box 19).

Big data and the rapidly falling cost of computing and connectivity have enabled the explosion of artificial intelligence (AI). This is technology that is able to learn from experience how to complete increasingly complex tasks and assist in various aspect of life. AI applications are now common in healthcare (diagnosing disease, assisted living for an ageing population, see section 3.4), transportation (traffic control, advanced driver assistance systems), public safety and surveillance (facial recognition), manufacturing (process control) and online retail (Vander Ark, 2018). Cities have become testbeds for automation and experimenting with robots in managing urban services and public spaces. Automated traffic control systems and automated supermarket tills (“self-checkout”) are already common, while the introduction of autonomous vehicles – self-driving cars and autonomous delivery drones - is impending. These “robotics and autonomous systems” (RAS), as they

are known in engineering, extend considerably the initial smart city applications. While “smart” technologies embody a computational logic whereby computers are programmed to perform tasks, the RAS technologies employ AI and machine learning to make decisions and adapt processes to circumstances without direct human agency (Macrorie, Marvin and While, 2019) (see figure 5).

These transformations raise new critical questions. These include whether “smart cities” could become too technocratic in actual operation, and also, with regard to citizen involvement, their effective access to information and meaningful participation in decision-making on matters impacting their life in such a technologically automated environment. Increasingly cities also address the challenge of a “digital divide”, based on differences in access to broadband and devices (e.g. due to socio-economic factors) and the lack of capacity or confidence to use for some group (e.g. due to age or disability). People-smart cities need to be digitally inclusive, to enhance capabilities, ensure access and benefits to all citizens. A digital inclusion strategy needs to be part of the digital transition at city-level to “leave no-one behind”.

One further important dimension is a search for new ethical principles for ICT-based “smart city”. Problems that are associated with cybersecurity and big data, including personal privacy and ultimately democracy need to be addressed (Thornbush and Golubchikov, 2020). But smart and digital systems penetrate increasingly deeper into the intimate spheres of personal life, which allows technology giants to aggregate, analyse, and trade personal data, so that right of an individual to privacy becomes increasingly elusive (Zuboff, 2019). Regulatory frameworks such as the *EU General Data Protection Regulations* are important in this context to govern the processing of personal data, including in digital circulations. Similar ethical concerns exist for robotics and autonomous systems (RAS). Beyond privacy issues, these concerns, according to UKRAS (Winfield et al., 2019), include, for example: bias (e.g. potential bias against minority or low-income groups as well as needs of women), employment (e.g. displacement of certain classes of workers), safety (e.g. production of new risks due to the deployment of RAS such as autonomous vehicles or weapons), and oversight (e.g. the ability of operators to manage the behaviour of systems). There are calls to introduce “responsible urban robotics” (Nagenbord, 2018), while the ethical artificial intelligence movement demands technology companies develop and commercialize AI that prevents harm and advances humanity, increases societal and environmental wellbeing and respects human rights. This includes, but is not limited to, voluntary ethical codes, ethics-by-design principles in software development, new governance structures and employee training programmes (Telenor Group, 2020).

Here, too, flexibility is important. Overly restrictive or misguided regulatory approaches can hinder important innovation and radically reduce the potential benefit of, for instance, data aggregation. Several technical solutions, such as distributed ledgers, can help enable more liberal use and trade of valuable data while ensuring reasonable privacy and anonymity, and government has an important part to play to align standards and set clear, transparent, and flexible rules of the game.

Figure 5: Contribution of robotics and autonomous systems to solving urban challenges

Urban challenge	The potential of the robotics and autonomous systems
Congested transport infrastructure in growing cities	AVs allow more efficient use of transport infrastructure and can radically reduce the demand for parking in central areas and free up valuable space for housing and recreation; Automated traffic control systems making use of AI and real-life sensor information. UAVs exploit underused urban airspace.
Low carbon energy networks and ecological management	Automation enables buildings and infrastructure to respond to climate change (e.g. regulating energy use and comfort, air quality). Sensors and AI can underpin the development and management of green infrastructure.
Assisted living for an ageing population and inclusion.	Automated and robotic health and social care support assisted living. Scope to extend age- friendly urban environments. AVs extend personal mobility.
Infrastructure maintenance and repair	More efficient monitoring, repair and control through robotics, especially in contexts where human accessibility is difficult or unpleasant.
Controlled internal environments for leisure and food	Automation and AI provide the climate control needed to manage advances in controlled internal environments for food growing and leisure.
Urban security and policing	UAVs and automated robotic policing help extend policing and surveillance.

Source: Adapted from UK-RAS (Marvin et al., 2018: p.10).

Abbreviations: AV, automatic autonomous vehicle; AI, artificial intelligence; UAV, unmanned aerial vehicle.

Box 17. The benefits of platform economy

SDG 12 on sustainable production and consumption – or the ambition to move towards an increasingly circular economy – calls for an economy that uses resources well, enabling economic growth in particular among low and middle-income countries while protecting the environment, making better use of waste, and preventing the threat of resource depletion.

If cities are to continue to grow and lift people out of poverty, this requires a substantial rethink of how we produce and consume. This also creates an opportunity; people only want goods when they actually use them. Many do not actually want to drive alone to work or buy a high-end power drill to drill a few holes and then let it gather dust in a basement or buy a carpet cleaner to clean a carpet one a time. In fact, most physical products we buy lie around unused most of the time. What we want is not to own them, but to be able to use their functions. What if we could turn these goods into a stream of services that give consumers what they need, when they need them? All of this for a fee that is much lower than what is paid for driving to work or buying a carpet cleaner.

The reason this has not happened is what economists refer to as “transactions costs”. Short of canvassing the neighbourhood to find people going your way or that have the power tool you need; the only reasonable option has been purchasing goods. Over the past 20 years, however, we have seen the rise of what some call the platform economy – digital platforms that triangulate supply and demand and allow people to interact and transact directly. Some of these, such as Facebook market place, Airbnb, and Blah Blah car, have gained substantial traction, but we are far from exploiting the full potential of turning physical goods into services in our daily lives in the effort to allow us to

consume sufficiently while using less resources. This is equally important from the perspective of social inclusion. Platforms make expensive equipment significantly more affordable.

Several factors stand in the way. One is the need for a critical mass of supply and demand for a growing range of products; people need to be able to find what they want at the right time and within a limited physical distance. Another is the need for the platforms themselves, that is, entrepreneurs that try ideas out. The constraining effect of legacy regulation often unintentionally precludes innovation and protect entrenched interests. Yet another factor is the need for efficient physical transportation at low costs, one which technology is already able to resolve through inventions such as sensors, AI, and autonomous delivery vehicles.

Smart and sustainable cities are best placed to overcome these impediments. Population density and diversity of demand allows for the accumulation of the critical mass of supply and demand needed for platforms to work. Responsive and innovation-friendly public authorities are more able to experiment with regulatory solutions that enable the innovation that needs to take place.

There will, of course, be problems along the way. Most instances of innovation fail. It is the ones that work that make the difference. It is impossible to predict what will work, how our habits will change, and what is sustainable. Some solutions may have unintended trade-offs, as some examples, such as, say, Venice and AirBnB, have shown. The challenge for policymakers is how to enable and guide the development of the sharing economy while addressing short-term negative consequences. Most importantly policymakers should err on the side of permissiveness and move in to regulate and correct only when the negative trade-offs created exceed the value added to society.

Contributor: Lars Anders Joensson, UNECE.

Box 18. Mobility as a service

Electronic and contactless smart cards and increasingly digital solutions in conjunction with smart phones enable new applications for mobility systems. This gives rise to the concept of mobility as a service (MaaS), with a number of cities experiencing the development of comprehensive data-based multi-mode mobility systems. MaaS is a digital platform for route planning, booking, electronic ticketing and payment services involving all means of transport including public or private. The concept is based on a user-centric model that puts the demand first (UNECE, 2020e). In cities, MaaS creates a wide range of services for users and thus offers an alternative to owning a car. The service can include, for example, public transport, ride- car- or bike-sharing, taxi, car rental or lease. By providing a single payment channel instead of numerous ticket and payment operations, this approach makes it possible to transform an existing inflexible transport system into a more versatile structure.

Helsinki is one of the forerunners in deploying a MaaS platform. The city already has an efficient and diverse public transport system, but its ambition is to go further and reduce the use of personal cars. The city called on a start-up, Maas Global, which signed agreements with transport operators and created the Whim app. The app offers its users a single integrated mobility app through which the users can access different means of transport by purchasing a subscription. Users can choose between several subscription options, with the most expensive and comprehensive covering an unlimited use of all vehicles including public transport, taxi, car sharing and shared bikes. The company benefits from the local transport authority providing its open data as interface services and data packages. This case shows that an openly shared API (Application Programming Interface) is an important success factor to initiate the process in a city. Another driver that MaaS Global has benefited from is the cooperation between private and public transportation companies.

Box 19: Smart city experiments in Toronto and Barcelona

Two city experiments that are now emblematic - in Toronto and Barcelona - provide emerging lessons, including controversies, related to alternative versions of smart cities.

The approach of Toronto has been to develop a 12-acre waterfront district known as Quayside, in cooperation with Google. The Master Innovation and Development Plan of Sidewalk Labs envisages innovative design and the latest digital technologies to create a radically new urban community. The mass adoption of sensors and connected devices managed within a superfast 5G networks enables real-time data flows that optimise the “central nervous system” of a city. This is promising big improvements in transport, logistics, services, the environment and land use. However, the plan has triggered a strong opposition from activists and civil society, who fear that Google may infringe privacy and data rights of citizens, “privatize” the functions of municipal government and subvert democracy.

Barcelona, in contrast, uses new technologies to enhance and improve existing institutions. Barcelona aims to assert “digital sovereignty” of its citizens by emphasising civic participation, social impact and public return. The city has effectively inverted the paradigm used by Sidewalk Toronto. Rather than designing the technological infrastructure first and then adapting it, Barcelona uses existing technologies to solving everyday problems affecting residents, including pollution, affordable housing and transport. Central to vision of Barcelona is Decidim, an online platform that enables citizens to participate in decision-making. Some 40,000 people use it to initiate and shape policy. The data of the city remains the property of the citizens themselves. By opening up data sets in a secure way, Barcelona aims to stimulate local businesses and civic initiatives.

Source: Thornhill (2019).

3.4. Cities that make life comfortable for all

While robots and ICT can help facilitate sustainability transitions, the central aspect of urban living remains quality of life. This contains many aspects, such as social cohesion and inclusiveness, that will never be delegated to AI alone, making a city really liveable and comfortable for all people, of all ages, and for women as well as for men. To that end, people-smart sustainable cities seek to provide a high-quality fusion between housing, mobility and social infrastructure. These are part of the so-called foundational economy (see box 13 in section 3.1) around which life rotates in every city, irrespective of size or economic functions, and which are critical for making cities comfortable and liveable or otherwise. And it is these aspects of urban life – being comfortable and liveable – that, in our increasingly mobile and postmodern world, define the attractiveness of a city as a place to live in, to realise one’s talent and aspirations, to generate and expose to others new ideas and create values.

Housing is placed right at the centre of urban life. As will be further discussed in Section 4.5, various supply-side constraints, such as zoning restrictions or opposition of residents, prevent the expansion of housing supply, and, as a result, concentrating that supply on high-income housing. Finding solutions for the provision of affordable housing remains a key responsibility for city governments. However, sustainability also calls for going beyond the “building buildings” way of thinking. People-smart cities aspire to widen access to adequate and affordable housing that supports more than basic needs, but allows full participation of people in urban life, connects to lifestyle preferences, everyday infrastructure and public spaces. If housing, even if fairly “green” and affordable, is not located in the right place, is not integrated with the social infrastructure and public transport network, and is not socially- and age- inclusive as well as aesthetically attractive, it is hardly contributing to the

multidimensional vision of urban sustainability. The *Geneva UN Charter on Sustainable Housing* (United Nations, 2017) insists on “access to decent, adequate, affordable and healthy housing for all” by promoting its four principles: environmental protection; economic effectiveness; social inclusion and participation; and cultural adequacy. These varied considerations for sustainable affordable housing should be dealt with at multiple levels and require a close dialogue between multiple governmental functions (see table X1).

Part of this vision is the integration of housing into urban life more generally, a search for more appealing urban environments with positive “vibes” and vibrancy – not only for the younger population, but for all ages. There are many dimensions here, but one of the key ones is a high quality of urban “social infrastructure”. This can be broadly defined as “the construction and maintenance of facilities that support social services. Types of social infrastructure include healthcare (hospitals), education (schools and universities), public facilities (community housing and prisons) and transportation (railways and roads). All of these structures serve as the backbone for communities and societies.” (Cohen, 2017) (see table X2).

Apart from providing key services for the proper functioning of cities as cities, urban social infrastructure, including public and green spaces, glues urban civic life together and caters to the needs of different urban social groups. As such, if used strategically, it can help fight key pressing challenges for cities such as inequalities, social disintegration and promoting physical and mental health (Klinenberg, 2018).

By clustering collective social infrastructure cities provide not only for the needs of their own citizens, but they share their benefits with broader areas.; for example, by concentrating higher education, hospitals, or government functions. The “centrality” of a city within national and international socio-economic flows is not simply defined by the size of the city in the urban hierarchy, but by the existence of superior and unique social infrastructure functions of national and international significance. This includes cities being seats of central, provincial or international branches of governments or hosting universities. Developing such functions of centrality, whether in a bottom-up (by cities) or top-down (by central government) manner, is important, for example, for redressing geographical disparities.

People-smart cities also pursue an integrated approach to sustainable mobility. Cities like Moscow have made substantial progress in making urban life more comfortable by boosting the quality of social infrastructure alongside the rapid expansion of public rail transit, as well as pedestrian and cycling lanes (see box 20).

Non-conventional forms of public transit can help connect peripheral places to urban cores more efficiently, with less pollution. Electricity-powered cable cars, for example, modify their tourist connotation when they are designed to provide better connectivity for disadvantaged communities, as they do in the Latin American cities of Medellin, La Paz or Rio de Janeiro. The 3.7 km Volga Aerial Tramway of Nizhny Novgorod was built in 2012 as the first regular public transit cable car route of Russia. In just over 10 minutes it connects the centre of the regional capital with the less well-off city of Bor on the other bank of the Volga River, otherwise only accessible by an often congested 20 km drive via a motorway.

Re-adjusting urban roads and streets for public transport can make difference without heavy infrastructural investment. Almaty in Kazakhstan has developed bus rapid transit (BRT) in 2013 as a strategy of sustainable transport. This includes the development of high-speed corridors for buses and trolleybuses as well as infrastructure for non-motorised traffic. A green corridor combines the unconditional priority of public transport with bicycle and pedestrian infrastructure in one of the busiest streets in Almaty (UNECE, 2020b).

Urban housing, social infrastructure and mobility patterns also need to accommodate the needs of the older persons, particularly in the context of ageing populations. People-smart cities provide the necessary conditions for older people to have the ability and a pleasant environment in which to age in place (see section 2.5). Providing this necessitates considerations in urban design such as assisted living, adaptive houses, houses and buildings accessible for wheelchair users, ramps and escalators, rest areas, public toilets, street safety and accessibility, barrier-free transportation and sidewalks, and generally more innovative healthcare and technology.

The city of Ottawa in Canada promotes age-friendly adjustments of municipal infrastructure through its Older Adult Plan established in 2012 (City of Ottawa, 2020). The city also provides older adults with a comprehensive accessible guide to the city services and programmes available to them (City of Ottawa, 2016).

Rapidly expanding smart city technologies offer innovative ICT-based products, services and systems for disability and ageing, such as IT sensors, alarms and telecare, all of which can reduce emergencies and promote social inclusion. Coupled with other measures, age-friendly smart technologies and design can not only provide older people with independence and a more comfortable environment to live in but can also reduce demand for health and social services.

The Italian municipality of Bolzano gives an example of ICT-assisted living for the older persons:

The Italian municipality of Bolzano has teamed up with the private sector to install a range of sensors to help older residents stay in their homes longer. These include touch pads on which they can place their medications to be reminded to take their tablets, or if they have already taken them. Water and electricity sensors track the routine of washing up, showering, watching TV, or putting the kettle on. There are door sensors to monitor if residents are getting up and out and about. And bed pads show whether a resident is sleeping, or if they've had a fall out of bed (UNECE, 2020d: p. 8).

But even simple things such as installing an easy to use video calling platform in the homes of older citizens could radically increase the quality and efficiency of care and quality of life overall, especially in situations where older people must protect themselves from epidemics such as COVID-19. Certainly, the dignity of private life, individual choice, privacy and security remain imperative considerations in deploying ICT-based solutions.¹

Accessibility is also an important consideration more broadly for inclusive cities. The city of Lyon in France is praised for its integrated and participatory approach to sustainable mobility planning, putting users and their needs at the heart of the planning process. The city has identified accessibility as a cross-cutting issue for city liveability and invests substantially in creating a barrier-free and inclusive environment. It has been estimated that as much as a third of the public transport users of the city are affected by mobility issues; this includes people with “permanently reduced” mobility as well as “temporarily reduced” mobility (e.g. pregnant women, people with pushchairs, shopping bags or luggage). All of the vehicles used for public transport are equipped with a low floor, retractable ramps and wider entrance doors. Metro stations have various technologies to enable easy access for people with reduced mobility. A remote-control device can be used by visually impaired people to receive travel information at bus stops and at passenger information kiosks and can also be used to activate sound boxes at pedestrian crossings. Training programmes for public transport drivers make sure that the needs of people with reduced mobility are fully addressed. Its accessibility programme

¹ For case studies on age-friendly cities and communities, see also WHO (2020).

targets also public space and municipal institutions, and overall accessibility of life in the city (e.g. culture, education, employment and information) (Modijefsky, 2019).

Overcoming gender inequality is yet another consideration for people-smart sustainable cities, particularly as cities become more technologically sophisticated. Women tend to use ICT and related infrastructures and services less than men; moreover, an unbalanced division of work and family care may prevent women from fully benefitting from the value generated by smart cities (Nesti, 2019). Poorer women and single mothers are also more reliant on social housing than men, often due to be the primary carer for children (URBACT, 2019). Moreover, the uses of, and needs from, urban infrastructure for men and women are also different.

Austria is one of a few countries worldwide, which has implemented “gender budgeting” into their constitution, meaning that budgets, revenue and expenditures must encourage equality between women and men (United Nations, 2020). In Vienna gender mainstreaming has been a cross-cutting principle for city development since 2005. Vienna has a long tradition of incorporating the specific needs of women in planning urban infrastructure to make it more inclusive for women; for example, adding streetlights to increase safety at night, widening sidewalks for strollers or wheelchairs and designing social housing with flexibility for different family situation. More recently, the Smart City Wien Framework – exemplary in many respects for a people-smart sustainable city strategy – has recognised gender equality, safety and security as key ingredients in improving quality of life of the city. The Framework defines gender mainstreaming as: “a concept to denote a gender-equitable society with equal social structures, starting points and framework conditions... women and men are thus not viewed as a uniform, homogeneous group; rather, their respective social, ethnic or age-related differences are taken account of” (City of Vienna, 2014: p. 104). The city has also produced practical guides for mainstreaming gender in urban planning and urban development (City of Vienna, 2013).

More broadly, the human capital of women often remains underused, especially as they today tend to have higher levels of educational achievement. Addressing the digital divide between men and women and encouraging employers to offer more flexibility in working arrangements – for example, using teleworking and the benefits of the platform economy – can provide increased opportunities for women to participate in the economy and entrepreneurship, a move which would also help society to enhance capabilities of women.

Table 1. Multi-scale framework for sustainable housing policy

	Nation (regulation and oversight)	City (planning and implementation)	Neighbourhood (building and living)
Environmental	<ul style="list-style-type: none"> • Planning and building regulations • Climate and energy policies • Resource efficiency standards • Hazards prevention • Mainstreaming green building 	<ul style="list-style-type: none"> • Appropriate location, density • Ecosystem protection • Low-carbon infrastructure • Transport infrastructure • Waste management 	<ul style="list-style-type: none"> • Ensuring resource efficiency • Green design, greening • Preventing hazardous materials • Climate/disaster protection of buildings • Recycling provision
Social	<ul style="list-style-type: none"> • Participation laws • Right to (adequate) housing • Affordable decent homes • Social housing frameworks 	<ul style="list-style-type: none"> • Integrated communities • Urban facilities, public spaces • Integrating housing in urban areas • Slum upgrade 	<ul style="list-style-type: none"> • Health, safety, well-being • Access to social and hard infrastructure • Sense of community • Accessible/inclusive buildings
Cultural	<ul style="list-style-type: none"> • Education and information • Heritage protection • Links with cultural economies • Indigenous, local knowledge 	<ul style="list-style-type: none"> • Urban creativity, diversity • Shaping values and norms • Protecting housing heritage • Traditional building techniques 	<ul style="list-style-type: none"> • Aesthetics of the built environment • Culturally-responsive design • Helping community creativity • Assisting migrant transition
Economic	<ul style="list-style-type: none"> • Budget and fiscal capacities • National spatial planning • National infrastructure • Housing management regulations • Mortgage regulations 	<ul style="list-style-type: none"> • Infrastructure, land supply • Development control • Local building industry • Regional and urban regeneration • Integrating housing and jobs 	<ul style="list-style-type: none"> • Housing management/maintenance • Supporting domestic activities • Promoting self-help housing • Resilience and future-proofing

Source: Adapted from Golubchikov and Badyina (2012: p. 8).

Table 2. Examples of social infrastructure

Type	Description	Examples
Public institutions	Places or facilities that are provided publicly and intended for public use.	Libraries, museums, art galleries, universities, schools, memorials, squares, plazas, parks.
Commerce	Spaces that involve commercial transactions. Payment might be required for entrance or to buy goods or services in the space.	Markets, shops, laundrettes, cafes, bars, barbers, hair salons, nail bars, restaurants, hardware stores, street vendors.
Recreational activities	Places or facilities that are designed to facilitate a recreation or leisure activity.	Gyms, sports fields, basketball courts, swimming pools, allotments, cinemas, theatres, bowling alleys, skate parks.
Religion	Spaces designed for religion. Places of worship.	Churches, church halls, mosques, synagogues, gurdwaras, temples, stupas.
Transit	The spaces and infrastructures of mobility.	Buses, bus stops, bike lanes, trams, subways, sidewalks, train stations, walking trails.

Source: Adapted from Latham and Layton (2019: p.6).

Box 20. “Comfortable city” programme of Moscow

In 2013, Moscow Government introduced a vision for its development as a “city comfortable for living”. Since then Moscow has embraced a multidimensional set of activities, remaking itself as a more liveable city.

The My Street programme of Moscow included the regeneration of 22,000 local courtyards, 550 parks and green zones, and 327 streets between 2011 and 2018, with thousands of tree plantations, façade and residential building renovations. All of this was accompanied with the expansion of pedestrian spaces, cycle lanes and green areas all around the city.

The Housing Renovation programme launched in 2017 envisages resettling more than a million of residents from low-quality five-storey blocks of flats built in the 1960s to new condominiums, with modern, spacious apartments and social infrastructure (new apartments are provided free of charge; extra space is available for a subsidised purchase).

The Smart City Moscow programme has allowed the digitization of many key city services, now provided on a single platform, as well as the introduction of e-governance services.

The transportation programme of Moscow has seen the largest expansion of public transit in Europe, with the addition of new metro lines and modes of rail transportation, allowing greater accessibility within the city itself and across its wider city region, with millions more passengers per year. The city has reorganized its traffic, introduced many bus lanes, as well as a universal parking fee system with differentiated tariff zones. Outcomes include a decrease in the number of private vehicles entering the Garden ring road of the inner city by 25 per cent, an increase in the turnover of car space by a factor of four and an increase in the traffic speed by 12 per cent.

These programmes have transformed Moscow into an even more attractive metropolis. Lessons learnt from Moscow have been used by the federal government of Russia as a guide to developing similar regeneration activities in the rest of the country. However, in Moscow, these programmes have been afforded due to the wealth of the own budget of the city, as well as through generous influxes from the federal budget. Moreover, the inhabitants of Moscow represent around 12 per cent of the total population of Russia. It is far more difficult to scale this experience across the country in the absence of equally generous federal subsidies for smaller and peripheral cities. And yet, such efforts will be critically important for providing better social cohesion and instilling a sense of territorial justice among the whole Russian population.

Sources: City of Moscow (2020a; 2020b), UNECE (2020b).

3.5. Climate neutral cities

Cities are at the forefront of addressing climate emergency. As declared by a joint communique of some of the leading cities of the world: “the future of our globe will be won or lost in the cities of the world” (CitiesAct, 2009). Climate mitigation and adaptation are the two sides of an urban strategy for climate neutrality, which suggests that: (a) cities move towards reduced emissions of GHG as much as possible and develop trade-off mechanisms to offset the remaining unavoidable emissions (moving towards “net zero”); and (b) cities become climate-proof, or resilient to the negative impacts of the changing climate by improving their adaptive capacities (UNECE, 2011).

The role of cities here includes not only pioneering and leading new initiatives, but also meeting the increasingly more demanding regulatory requirements coming from the national and international level for reducing GHG emissions, as well as building local adaptive measures.

Mitigation efforts mostly focus on energy, as its contribution to the GHG emissions is estimated to be three-fourths of the total. This is mostly a result of the combustion of fossil fuels (coal, oil, gas), which are the main source of CO₂. The so-called decarbonisation of economies — i.e. reducing CO₂ emissions via limiting energy consumption and switching to non-carbon-based fuels (such as renewables) — has become a major direction of policy in the emerged consensus about the urgency of climate change. SDG 7 demands for the expansion of renewable energy as part of its call to “ensure access to affordable, reliable, sustainable and modern energy for all”, which goes alongside SDG 13 “take urgent action to combat climate change and its impacts”.

This is not something beyond own ambitions and capacities of cities; cities have long taken the challenge seriously. Vancouver as far back as in 1990 produced its Clouds of Change Report (City of Vancouver, 1990) on the municipal role in addressing climatic and atmospheric changes, which, among many other measures, included specific recommendations for CO₂ reduction in the city. Portland was the first United States (US) city to adopt a climate action plan in 1993. Following such pioneering examples, thousands of cities have incorporated climate and energy targets in their development strategies and plans (REN21, 2019). In many cases, these targets are even more ambitious than targets set by their national governments.

The mitigation ambitions range from Copenhagen - which according to its climate plan aims to be “the world’s first carbon-neutral capital city” as early as by 2025 (City of Copenhagen, 2012) - to the Fossil Fuel Free 2030 - Climate Positive 2050 plan of Uppsala (Uppsala Kommun, 2020) to Barcelona, Paris and Berlin, whose targets to become climate-neutral by 2050 are just timed with the EU corresponding goal. Some other larger cities in the UNECE region that have already pledged to become carbon neutral include: Boulder, San Francisco, Glasgow and Oslo (by 2030), Helsinki (by 2035), Stockholm (by 2040), Amsterdam, Hamburg, London, Toronto, Vancouver, Minneapolis, New York City, Portland, Seattle and Washington DC (by 2050) (Carbon Neutral Cities Alliance, 2019). REN21 (2019) also lists the following cities that have introduced city-wide net-zero/carbon-neutrality targets by 2050 or earlier: Montreal, Heidelberg, Bristol, Manchester, Nottingham, Austin, Boston, Los Angeles.²

As part of these plans or as standalone ambitions, many cities also engage with 100 per cent renewable energy targets, either for municipal operations or citywide (ICLEI, 2020). In most cases, these targets are restricted to electricity use, but occasionally cover heating and cooling, transport and other end-use sectors. In Germany alone, more than 150 districts and cities have adopted 100 per cent renewable electricity targets, including Hamburg and Munich by 2025 and Frankfurt by 2050. Hassfurt achieved 100 per cent renewable electricity in 2017 and aims to scale up renewables in other sectors, including by expanding its district heating capacity. In the US, several cities already have transitioned to 100 per cent renewable power, including Aspen (Colorado), Burlington (Vermont) and Greensburg (Kansas) (REN 21, 2019: p.53).

These plans create a sense of direction for these municipalities and regions; although contrary to national commitments, these targets are more aspirational and not legally binding and may be thus contingent on local electoral cycles. New ambitious initiatives will likely to raise the number of such cities even further in the coming years. As part of the European Green Deal Strategy to make Europe climate neutral by 2050, the Mission Board for Climate-neutral and Smart Cities of the European

² Energy and Climate Intelligence Unit provides a map of cities with net zero targets and links them to sources. See: <https://eciu.net/netzerotracker/map>

Commission promotes the idea of reaching 100 climate-neutral cities by 2030, which would be used as experimentation and innovation hubs for all cities (European Commission, 2020b).

Cities address climate neutrality in a wide range of areas, including, for example:

- (a) Changing energy infrastructure and energy supply structure: for example, decarbonizing heating systems via expanding district heating and CHP, deploying solar and other renewable energy systems and using waste-to-energy facilities (see also section 3.7);
- (b) Using procurement for clean energy and energy-efficient municipal services such as street lighting;
- (c) Increasing energy efficiency standards of new and existing buildings, including housing and public buildings;
- (d) Optimizing urban development and planning: for example, transit-oriented and mixed-use developments, walkable urban districts;
- (e) Transport sector measures: for example, modal shifts, eco-mobility, reduction in vehicle fuel consumption and emissions, and developing car sharing and pooling;
- (f) Working with industries to minimize their carbon footprint;
- (g) Encouraging climate friendly consumption and lifestyles, including through policies that encourage personal choices of citizens to achieve net-zero.

Reducing energy demand and using energy efficiency are always more cost-effective, no-regret solutions and are prioritised in the hierarchy of mitigation measures. Decreasing end-use energy demands through energy saving, efficiency measures and lifestyle change alleviates the need to generate as much energy and, thus, moderates the carbon footprint.

Buildings and houses are some of the main sectors in this regard as they consume a bulk of total energy. There are trends almost everywhere towards strengthening energy standards for new-built buildings, such as the mandatory “nearly zero-energy buildings” standards promoted in the EU (European Parliament and Council of the European Union, 2010). However, it is also important to provide energy retrofit/regeneration for existing low-efficiency buildings, since they will still constitute the majority of the built environment for many decades. A good economy of scale can be achieved when regenerating the apartment housing stock. Moscow engages in a comprehensive programme of housing stock replacement, while Freiburg and Berlin have achieved deep energy retrofits as part of their rehabilitation programmes (see box 21).

But even with efficiency measures, demands for energy will always be present, with a growing population and economic development bringing further pressures. It is necessary to decouple economies from carbon emissions by decreasing the share of fossil fuels and increasing the role of renewables. Cities are transferring their energy supply to clean energy, drawing on “distributed” sources and modes of energy: another measure that can be introduced in modernising energy infrastructure to produce and manage more sustainable energy. Within distributed energy systems, buildings can serve as “power plants” and generate more electricity than they consume. This can then in turn, for example, fuel electric cars or supply the grid. Individual households, housing associations and businesses, by producing and consuming their own energy, are effectively turned into “prosumers”: a model that gives citizens options to take part in energy transitions as active participants.

Cities can do much with a focus on transport, which remains predominantly fuelled by fossil fuels in most places. Municipal procurement for clean energy and green technologies used by public services and transport is an effective direct lever that city administrations have, alongside with city planning and incentivizing modal shifts from private cars to public transports, walking and cycling (e.g. with

congestion charges, separating traffic). As further discussed in Section 3.6, in order to combat air pollution and climate change many cities are introducing low emission zones and plan to phase out combustion engine-powered vehicles.

While climate neutrality is a strategy to be “climate-smart”, it is also a means to address other environmental, economic and social challenges. Certainly, policies such as compact city, transport planning, increased green spaces and improved energy efficiency are all elements of urban sustainability that predate the international quest for climate neutrality. Climate neutrality is, furthermore, an opportunity to promote national and local economic competitiveness, to enhance energy security, to improve quality of life and to tackle energy poverty (i.e. a condition where people cannot afford energy services sufficient to cover their basic human needs, leading to deprivation). The pursuit of these co-benefits is crucial for gaining support of stakeholders to climate-neutral policies (Thornbush and Golubchikov, 2020).

However, this is not to suggest that urban energy transitions are automatically inclusive and socially benevolent. Evidence is abundant that without redistributive policies and also without engagement with procedural/participatory justice, low carbon transitions have uneven impacts on different communities and places, with economically vulnerable social groups and deprived areas being left behind the benefits of transition, while still bearing a burden as renewable energy subsidies are translated into higher energy bills for everyone (Golubchikov and O’Sullivan, 2020). Furthermore, in the absence of compensatory mechanisms, cities that due to their specialisation are relying on high-carbon economies (e.g. heavy industry or coal-mining regions) are likely to be hit hard socially and economically in case of rapid decarbonisation requirements.

In view of this, for example, the European Commission has launched the Just Transition Mechanism (JTM) as part of its Green Deal (European Commission, 2020a). The JTM seeks to overcome the economic and social costs of the climate transition in the most vulnerable coal and carbon-intensive regions. This mechanism creates investment to help workers and communities which rely on the fossil fuel value chain. It is a tool to ensure that the transition towards a climate-neutral economy happens in a fair way, leaving no one behind.

Partly for the same reason of ensuring “energy justice” and partly to retain better control over the development and pricing policies, many cities insist on retaining municipal ownership of key municipal utilities and infrastructure, including those which are energy related. Barcelona, Munich and Nottingham retain a full municipal ownership over utilities. Some cities have even engaged in re-municipalisation of energy networks. Notable examples include German cities such as Berlin and Hamburg.

In any case, policies need to be people-smart in addition to be technologically-savvy, prioritizing, for example, low-income groups or social housing (Golubchikov and Deda, 2012). Since technology does not provide with a universal solution, it is necessary to include linked scientific and social research that does not exclude the role of the individual, culture, and society. This is especially relevant since social participation and consumption are also driving forces of social change, which could affect the acceptance and adoption of new technology. Climate-neutral cities presuppose a change from fragmented sectoral-based interventions to an interrelated matrix of comprehensive actions integrated at an urban scale.

Box 21. Addressing climate neutrality in buildings through the international centres of excellence

Cross-department work of UNECE on sustainable energy helps reduce GHG emissions and the carbon footprint of cities. As part of this work, UNECE has launched a global network of International Centres

of Excellence on High-Performance Buildings (ICE-HPB). Their mission is to advance the rapid transition to high-performance buildings, locally and around the world, in support of the SDGs and the Paris Climate Accord, while fostering a thriving building industry that creates healthy, comfortable, and sustainable buildings everywhere for everyone. The network works to disseminate and deploy the *UNECE Framework Guidelines for Energy Efficiency Standards in Buildings*.

One of the centres, the Greater Pittsburgh ICE-HPB is an extension of the Green Building Alliance (GBA) of Pittsburgh and its existing programming, technical assistance, trainings, and outreach activities. The centre has the intention to scale these efforts to realize greater impact. GBA works with stakeholders including building owners and operators, K-12 educators and facility managers, academics and researchers, architects, engineers, contractors, community members, and government officials to create healthy and vibrant places. GBA fosters networks of professionals to advance sustainability in its region, including the International Living Future Collaborative, the Emerging Professionals, and the Women+ in Green network. GBA convenes the Pittsburgh 2030 District, the largest in the world with over 700 buildings committed to reducing their energy use, water use, and transportation emissions by 50 per cent by the year 2030, while improving indoor air quality.

Sources: UNECE (2019a).

3.6. Eco-friendly and healthy cities

Growing consumption and urbanization put broader environmental pressure on ecosystems (on water, air, natural resources, land and biodiversity), while ecological stability requires that economic consumption of the products and services of nature be compatible with the rates of production and the assimilative capacity of the ecosphere (Rees, 1995). Furthermore, the environmental impacts of human activities come back to society in the form of negative health impacts and deteriorated living environments.

Environmental determinants of health (factors which directly or indirectly impact the physical, mental or social wellbeing of a population) often share causes with other environmental nuisances. For example, sources of emissions of GHGs (e.g. cars) are often also responsible for air and noise pollution, which are among the main detrimental environmental determinants of health in cities. Policies supporting public health can have a beneficial impact on environmental challenges, and vice versa.

Negative environmental impacts are often socially differentiated. Poor residents in many countries tend to be more exposed to environmental hazards due to discriminatory siting of polluters, segmentation of housing prices or the need to sacrifice health for the sake of employment. Similarly, economically vulnerable groups struggle with affording access to essential environmental services, such as clean and safe water, energy or good quality food.

Cities, as key consumers of ecological resources, play a crucial role in ensuring ecological stewardship and environmental justice. Green and nature-based solutions are already commonly used in many cities, which among other things help cities to address the challenges of climate change. Cities are also hubs for experimenting with environmentally sustainable ideas. This is, of course, part of the overall dynamics of cities bringing people, ideas, talent, demand, and public sector responsiveness together. Urban dwellers, however, also have a higher incentive to combat the problems they tangibly suffer from, such as pollution. Demand in urban areas tends to be more sophisticated and environmentally aware. Urban residents are more likely to download apps to avoid food waste or to think about their carbon footprint. This allows cities to experiment to find out what works, and then to scale up good ideas to rural areas and other cities and beyond.

The connections between water quality, sanitation and health are also concerns for cities. Ensuring equitable access to water and sanitation is important in order to respond to and prepare for water-related epidemics outbreaks, as well as for pandemics such as COVID-19. The provision of safe and sufficient water and adequate sanitation for all and in all settings is the key to promote appropriate hygiene practices and, in the absence of a vaccine or effective treatment, frequent handwashing with soap is a simple but effective intervention to limit the spread of COVID-19. Nevertheless, this may be challenging where vulnerable and/or marginalized groups face obstacles in accessing water and sanitation services or where certain sections of the population face affordability concerns. Equity gaps thus need to be appropriately mapped out and addressed to strengthen inclusive and informed responses to pandemics as well as future preparedness, while always ensuring that the most vulnerable do not suffer disproportionately in times of emergencies. The UNECE–WHO Regional Office for Europe *Protocol on Water and Health* to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes helps to address these issues systematically and to identify vulnerability and problems with equitable access to water and sanitation, including at the urban level (see box 22).

Emissions from vehicles remain a key source of air pollution in cities. Many cities are taking action to phase out combustion-engine powered vehicles in order to improve local air quality and reduce carbon footprint. This follows national targets as more countries in Europe plan to get rid of combustion-engine passenger cars. Norway is set to be the first to ban the sale of passenger cars and light vans, which are not zero-emissions, from 2025 onward while other countries have the period of 2030-2040 in their plans. Almost 30 cities have made their local plans or have pledged to prohibit combustion-engine cars from driving in city centres or entire cities. In contrast to national governments, city targets normally cover all cars and include both new and second-hand vehicles. However, rather than sales restrictions, city measures mostly concern prohibiting combustion-engine vehicles from entering or driving in certain city areas. Many localities are focusing on full bans for diesel vehicles first and then gasoline-powered cars. The International Council on Clean Transportation (Wappelhorst, 2020) has reported the following larger cities taking action: Rome, Paris, Oslo, Bergen, London, Strasbourg, Milan, Amsterdam, and Brussels. Local deadlines range from 2024 to 2035.

Congestion charges have long been introduced in many cities to reduce general traffic in certain urban zones. Some cities now operate or intend to introduce partial driving bans in designated low emission zones (LEZs) for combustion-engine vehicles. However, these restrictions are limited to certain fuel types or vehicles of certain European emissions standards. Combustion-engine vehicles are often still allowed to enter regulated city areas on a fee basis or if they belong to local residents. By 2020, LEZs were introduced in Madrid (Madrid Central zone), Krakow (Clean Transport Zone), London (Ultra-Low Emission Zone), as well as Stuttgart, Berlin, Stockholm, Bucharest (Wappelhorst, 2020).

UNECE offers a variety of platforms to address environmental issues in cities in a cross-sectoral manner, including with respect to vehicles. The UNECE *Transport, Health and Environment Pan-European Programme (THE PEP)* is an important framework mechanism to mitigate the negative impacts of transport on health and environmental pollution (see box 11). Furthermore, the World Forum for Harmonization of Vehicle Regulation (WP.29) develops standardized regulatory systems to reduce environmental impacts from vehicles, as well as to improve road vehicle safety and security (see box 23).

Smart technologies help better monitor the urban environment. Extensive networks of air pollution monitoring systems have allowed the development of smartphone applications which permit users to follow real-time information on air quality indicators such as the European Air Quality Index, as well as PM₁₀, PM_{2.5}, CO, NO₂ and SO₂ concentrations. In Gothenburg, Sweden, data on air quality is made

available for easy use by pupils on the way to school via a smartphone app. Such data also provides a better basis for policy decisions by decision-makers and for people to change their behaviour; all this contributes to improved health (Hallgren, 2017). Another example is the “AirCare” application, which was initially developed for the city of Skopje. This now covers cities in the entire Balkans region. Making air quality data easily accessible not only allows people to minimize their exposure to pollutions, but also stimulates the political will to better address environmental health challenges.

In many places, NGOs play a major role with very limited resources, taking bottom-up initiatives to monitor and inform of challenges related to urban pollution and inequities, which in turn contribute to tackling these challenges. For example, Bishkek, Kyrgyzstan, in winter, suffers from smog caused by high volumes of traffic, as well as emissions from buildings heated by coal and synthetic materials such as old car tires, plastic, and used oils. A local youth ecological movement “Move Green” has improved public information on air pollution through the installation of air monitoring devices in the city and offering an app for mobile devices for real-time monitoring, enhancing the participation of young people in efforts to reduce air pollution in Bishkek (Move Green Association, 2018).

There are many experiments with smart technology, and this is only the beginning of exploring the potential. One example of smart integration of air pollution monitoring into health and mobility is the mass deployment of interconnected air monitoring sensors. These can be linked with an air pollution-aware toll system with highly dynamic real-time pricing that can coordinate congestion charges based on levels of air pollution in urban areas, incentivising drivers to take less polluted routes thus improving public health (Rodriguez and Küpper, 2019).

Box 22. The equitable access principles of the Protocol on Water and Health

The UNECE *Protocol on Water and Health* is a legally binding instrument aimed at achieving an adequate supply of safe drinking water and sanitation for everyone and effectively protecting human health and water resources. Parties are required to establish national and/or local targets for the quality of drinking water and the quality of discharges, as well as for the performance of water supply and waste-water treatment. The Protocol stipulates that “equitable access to water, adequate in terms both of quantity and of quality, should be provided for all members of the population, especially those who suffer a disadvantage or social exclusion”. This embodies the “no-one left behind” approach, which is an integral part of the 2030 Agenda, particularly SDG 6: “Ensure availability and sustainable management of water and sanitation for all”.

The concept of “equitable access” under the Protocol is defined in terms of: (1) tackling geographical disparities, (2) addressing the needs of vulnerable and marginalized groups and (3) ensuring the affordability of services. By working along these dimensions to improve equitable access, countries progressively realize the human rights to safe drinking and sanitation (UNECE and WHO Europe, 2019: p. 41).

One of the tools developed under the Protocol is the “Equitable Access Score-card: supporting policy processes to achieve the human right to water and sanitation” (UNECE and WHO Europe, 2013). This is a self-assessment tool that allows governments to establish a baseline measure of the situation with respect to equitable access to water and sanitation.

For example, a self-assessment exercise was carried out in France in 2012-2013. It identified a number of areas for improvement, including with respect to large locational disparities in terms of prices and 140,000 homeless people who did not have access to drinking water; affordability concerns were identified as one of the main issues in the Greater Paris area. The equitable access perspective informed national measures on access to water and sanitation. Most notably, action was taken on the experimentation of social pricing by municipalities (e.g. social tariffs and other financing mechanisms), with a view to addressing affordability concerns and promoting a simple and efficient system.

Sources: UNECE and WHO Europe (2000); UNECE and WHO Europe (2019)

Box 23. The World Forum for Harmonization of Vehicle Regulations

The World Forum for Harmonization of Vehicle Regulation (WP.29) gathers countries and other stakeholders to lead discussions about the technical performance of road vehicles. The Forum develops standardized regulatory systems to reduce environmental impacts from vehicles, as well as to improve road vehicle safety and security. In addition to the introduction of several United Nations harmonized regulation agreements in this area, innovations are constantly introduced at the Forum to adapt to emergent challenges. New considerations include, for example, climate change, autonomous vehicles, cybersecurity and challenges caused by the evolution of urban spaces and how they are used by the population. Cities in countries applying the regulations that emanate from WP.29 benefit from vehicles which are safer for people inside the vehicle as well as for people who are sharing outdoor space with these vehicles and exposed to the dangers they pose, such as cyclists and pedestrians, including the most vulnerable (children, senior citizens, people with disabilities). These cities also benefit from the state-of-the-art technologies which facilitate important reductions in air pollutants and GHG emissions.

Source: UNECE (2019c)

3.7. Value out of waste

Sustainability-minded cities look to close the “open loop” metabolism where natural resources as materials and products are brought into urban areas but their remainders are dumped as waste.³ Waste, including food waste, is one of the central concerns of SDG 12: “Ensure sustainable consumption and production patterns”. Due to the concentration of production and consumption, cities have a great range of possibilities for the reclamation of materials from waste streams and their recycling. Ensuring that waste is correctly managed is essential to the sustainable management of cities. However, many cities lead a deeper paradigmatic shift in the sense that waste is no longer considered a nuisance but rather a potential, underused resource. Cities bring together several of the elements that are needed for markets to emerge that make better use of waste: sophisticated consumer demand, physical proximity, the potential for a critical mass of supply and demand (network externalities), entrepreneurs, closeness to policymakers, capital, and widespread IT usage.

Food waste is a case in point. While minimizing or preventing food waste is important; food waste is often reused as a fertiliser. Using food waste as an energy source is also growing, as is investigating the interrelationships between waste, food, energy and water more broadly. Food waste is now frequently used for biogas generation; solutions are needed to minimize water consumption in the process of biogas generation. Wastewater treatment plants help both the conversion of wastewater into biogas and the production of organic fertiliser. Landfills can equally be a source of methane gas and biogas. Reportedly, in Sweden, more than 60 per cent of municipalities collect food waste for energy purposes, producing an estimated 5.2 petajoules (PJ) of biomethane annually that can be injected into the local gas grid or used as a transport fuel (REN21, 2019). Innovative city-based IT apps can help to track and prevent food waste. Food waste reduction measures work well in cities such as New York, which have all the right elements: high interest from consumers on the issue, the proximity to shipping from one place to another, the entrepreneurs and resources. Such solutions need to be scalable, sustainable and to go beyond wealthier cities, which the preventive food loss measures of UNECE are aiming at (see box 24).

³ For discussions on the governance of natural resources more broadly, refer to the *Natural Resource Nexuses in the ECE Region* (2020).

Traditionally, urban management for the food, water, energy, and waste sectors is operated in silos; that is, by different departments and different sets of policies and practices. However, the realisation of the merits of interconnections between these systems has become an aspiration for bringing them together as part of the combined and integrated “energy-food-water-waste” nexus, particularly at the urban scale. The aim of this is:

to look holistically at activating the sectoral inter-linkages and principles of a resource-efficient city... by establishing a closer dialogue between national and local governments to identify and remove policy barriers and create new strong partnerships at the local level. [This] aims to enhance co-operation between different levels of government, municipal administrations (departments) and planning offices, city administrations and across city jurisdictions (Lehmann, 2018).

More generally, making value out of what is seen as a “waste” so that it becomes an input resource for further processing is what defines the circular economy approach. According to one definition, a circular economy is “where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimized” (European Commission, 2015). By extension, a “circular city”: “aims to create a sustainable system that allows for the optimal use of city assets and products through re-using, refurbishing, remanufacturing, recycling and other circular actions” (United 4 Smart Sustainable Cities, 2020). Cities can also try out different ways of taxing externalities to encourage recycling and discourage clearly avoidable waste.

A circular economy is not limited to the material flows of solid or liquid waste, but can also include, for example, recycling of previously industrial lands (brownfields) as new urban areas, with low ecological impacts. For instance, in Pittsburgh (US), the new mixed-use development of the Hazelwood Green at the former brownfield site aims to achieve net-zero energy and climate-neutral standards for the district by adopting renewable energy solutions.

Land use planning and energy-circular economy can be further integrated with the support of district heating (and cooling) systems. For example, combined heat and power (CHP) generation is an effective way to capture thermal energy that is otherwise wasted into the atmosphere in conventional power generation. The heat generated through CHP can be used for space heating, cooling, domestic hot water and industrial processes. The integration of CHP into district heating systems, which supply heating and hot water, has been a long and well-established tradition in cities of the former Soviet Union and its successor States and some countries of Eastern, Central and Northern Europe.

Ideally, all these manifestations of circular economy – that is, with regard to land use, water, food, energy and more - are integrated into a singular ecological nexus as part of urban management. Hammarby Sjöstad, a former industrial area in Stockholm, generated much publicity when it was rebuilt as a compact green town, with a goal to cardinally reduce its environmental footprint in comparison with similar districts in Stockholm. It has become known for its “Hammarby model”, which includes a combined urban and engineering design where energy, waste and water are part of a singular ecological process. For its district heating system, heat is harvested from purified wastewater, waste incinerator and biofuels. The vacuum waste suction system transports household waste to the periphery of the district, which reduces the need for waste collection traffic.

In Jerusalem, the Sorek Treatment Facility collects domestic wastewater from the Jerusalem metropolitan area. The sludge is converted to methane gas and supplies 70 per cent of the electric energy needed for the facility to function; the treated water is redistributed for irrigating non-farmable vegetation such as street trees and parks (Water Technology, 2020).

Another example of a circular urban design is Vancouver, which, even in the absence of the culture of district heating in North America, has leveraged the opportunity provided by the 2010 Winter Olympic to regenerate the area of Southeast False Creek Neighbourhood with the inclusion of the “first in North America low carbon district energy system”. Its district heating system uses thermal energy captured from sewage to provide space heating and hot water in the neighbourhood, leading to a 60 per cent reduction of GHG associated with heating buildings (City of Vancouver, 2015).

Regretfully, such opportunities for transforming waste into resource at the time of comprehensive urban regeneration are often lost due to a lack of strategic oversight, national pressures, cross-party coordination, experience and/or a fear of opposition. In Cardiff, a new and modern waste incinerator opened in 2014 wasted the huge amount of heat it generated despite being located next to a large-scale Cardiff Bay redevelopment project; a plan for a district heat network utilizing this heat was only conceived five years later (BBC, 2018).

In Riga food waste is sent to produce renewable energy based on landfill gas, while the co-generated heat in this process is used in nearby greenhouses, growing off-season vegetables (FAO, 2016). District heating systems are also increasingly shifted to renewable sources. All of the district heating needs of Iceland were met by renewables (including recycled heat). Renewables also supply the majority of district heat in Switzerland, Lithuania, Denmark and France. As an example of the optimisation of energy flows to prevent losses, in Hamburg the local district heating network has been connected to electric heating technologies, enabling it to use surplus electricity from nearby renewable power projects. This can help to mitigate the volatile and unpredictable nature of renewable energy sources such as solar and wind, which can result in wasted capacity at time of imbalances between high supply and low demand.

Many places are experimenting with waste minimization. An example is the community-led development of the self-sustained, zero waste eco-village of Boekel in the Netherlands. A group of people plan to build their own sustainable eco-village in Boekel that produces zero waste and is self-sustained. The government has supported their efforts and offered space to realize this idea (De Beer, 2015).

The dissemination of knowledge concerning landfills and illegal dumping sites can also help to address the problem of waste. The “Ecomapa” of Ukraine is an online inventory and interactive map of landfills and serves as a platform to build coalitions. The map includes environmental information on recycling centres, landfills and waste management as well as hazardous waste. Individuals can also report locations where waste was illegally dumped (Ministry of Energy and Environmental Protection of Ukraine, 2020).

Box 24. International standards for preventing food losses

UNECE develops agricultural quality standards for agricultural produce, which are based on existing national standards, industry and trade practices. Over 100 standards have been adopted for the purpose of facilitating international trade. The international commercial quality standards of UNECE cover a wide range of perishable products, including fresh fruit and vegetables, dry and dried produce, seed potatoes, eggs and egg products, meat and cut flowers. The application of standards is harmonized internationally by UNECE by developing and disseminating explanatory and guidance material. In addition, UNECE defines and promotes uniform quality control procedures and the use of the model quality-conformity certificate. These measures aim to maintain the quality of food and prevent losses along the supply chain, guiding stakeholders on how to handle food and repurpose food otherwise lost in order to keep as much food as possible within the human consumption chain

and therefore maintain a sustainable supply of good quality food. Measures include maintaining quality from the farm to the city distribution points through international best practice; developing a smart mobile application for repurposing food removed from the supply chains; and developing a code of good practice to prevent food loss.

Source: UNECE (2017a).

3.8. When disaster strikes

Natural and technological disasters involve significant cost to human health, to physical capital and to natural habitats, leading to further public and private costs associated with aid, rehabilitation, resettlement, or conflict resolution. Due to the concentration of people and capital stock, cities are particularly vulnerable to the impacts of disasters, but they can equally do much to improve the more general capacities to address the risks.

SDG 11 Target 11.5 calls for governments to: “by 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations”.

The *Sendai Framework for Disaster Risk Reduction 2015-2030* is a global agreement to reduce and prevent disaster risks across the globe. It aims to strengthen social and economic resilience to ease the negative effects of climate change, and disasters caused by natural or technological hazards. The framework defines disaster as “a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts” (United Nations, 2016).

Similarly, in the context of climate, *The Paris Agreement* recognized the need to address loss and damage associated with the effects of climate change. The agreement identified areas of cooperation central to DRR and called for investments to address the underlying risk drivers associated with rising GHG emission levels and to inspire innovation and low-carbon growth. However, much greater ambition and accelerated action is required pre-2030 to meet the goal, outcome and targets of the Sendai Framework.

The nature of the risks cities are exposed to depends on the geographical location of the city or its internal circumstances. Many major cities were historically built close to water bodies (sea coastline or rivers), meaning they are likely to be exposed to water-related disasters, such as floods, storms and tsunamis. Water-related and weather-related risks are exacerbated by climate change, leading to a rise in the intensity and frequency of storms, floods, avalanches, heat waves and droughts. Many large cities in the UNECE region are also located in seismic active zones and are exposed to earthquakes or even volcanic activity (like Naples, Catania, Seattle). Recurrent natural disasters have historically prompted cities to build infrastructure to resist them, such as by channelling rivers, building dams or dikes or building earthquake-resistant buildings. However, this infrastructure may be compromised if the shock strikes harder than what it can resist, as has been the case with New Orleans and other cities in southern Florida hit by hurricane Katrina in 2005 (Dawson, 2017), or the Seine River floods in Paris in 2018 (Willsher, 2018).

Key aspects in mitigating the present and future negative impacts are improved adaptation and resilience. The United Nations Office for Disaster Risk Reduction (UNDRR) defines resilience as “the

ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management” (UNDRR, 2020).

Similarly, urban resilience can be defined as “the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience” (100 Resilient Cities, 2020). The notion of urban resilience can be extended to the capabilities of cities to cope with other challenges, hazards and shocks, both of natural origin (e.g. earthquakes, tsunamis) or technological origin (e.g. chemical/industrial accidents) and those which are socially produced (e.g. economic downturn, terrorism). In other words, urban resilience is a general quality of the social, economic and natural systems of the city to be sufficiently “future-proof” (Thornbush, Golubchikov and Bouzarovski, 2013).

Concerted efforts by multiple stakeholders, including local governments, decision makers, city officials, departments, central and provincial governments, the private sector, citizens, non-governmental organizations, community-based organizations, research institutions and international organizations, are required to achieve resilient urban environments. Stakeholders must collaborate to boost internal capabilities and capacities of urban systems to withstand these changes, as well as to minimize negative impacts and to maximize benefits. This includes exploring and enabling the use of existing or emerging technologies for hazard identification, risk prevention and reduction, detection and early-warning systems, emergency response and mitigation.

Modelling technologies can facilitate the exchange and update of detailed information about building infrastructure and other building and geographic data. “Building information modelling” (BIM) software helps create digital copies of built structures (houses, buildings, utilities, bridges, tunnels, ports, roads) along with their resource infrastructure (water, electricity, gas, communication) and building materials used (concrete, steel, glass, wood etc). This facilitates the design, construction and maintenance of the buildings. In combination with monitoring, BIM can help alert of any faults or structural weaknesses. In some countries, BIM has been made mandatory, for example for high-rise residential buildings in the UK (following the Grenfell Tower fire) or for certain government-funded projects in Russia, Denmark, the UK and the US (Paul, 2018).

Integration of BIMs with “geographical information systems” (GIS) allows monitoring of the state of the entire building stock on a local or regional scale along with other data. GIS can cover data from georeferenced seismographs over periods of time to identify patterns or trends and better predict the location and strength of geology-related disasters (earthquakes, volcanoes, tsunamis), while georeferenced population data can provide information about the number of people requiring rescue in a hazardous event. BIM and GIS can play a major role in guiding cities towards resilience through a more efficient cross-sectoral coordination, especially for emergency interventions in the face of natural or technological disaster.

Preventive measures can help to identify hazard-prone areas and restrict the construction of housing and other urban objects in such areas. Besides, cities, as socio-technical complexes, also all have different forms of technological hazards, including with respect to exposure to industrial accidents. The UNECE *Guidance on Land-Use Planning, the Siting of Hazardous Activities and Related Safety Aspects* (UNECE, 2017c) presents a good practice approach for integrated land-use planning. It helps countries to consider land-use planning, industrial safety, disaster risk and environmental assessment matters, among others, and to implement the provisions of the relevant UNECE instruments⁴ in an

⁴ Industrial Accidents Convention, Espoo Convention and its Protocol on SEA, Aarhus Convention and instruments developed under the Committee on Urban Development, Housing and Land Management

integrated manner. It supports governments in taking risk-informed decisions on land-use planning and siting, aware of possible environmental impacts and with the involvement of the public.

When a disaster strikes, much of the damage inflicted on infrastructure, economy and population is irreparable. The rebuilding process can take years to complete, without ever truly bringing back all losses. However, this also presents an opportunity for a more resilience-oriented and sustainable reconstruction and recovery. This is part of the building back better principle, introduced by the Sendai Framework. It is to make sure any post-disaster recovery activities are coordinated, effective, people-centred, inclusive and focus on enhancing wellbeing and further resilience of cities.

For example, following the earthquakes in central Italy in 2016, one of the priorities for city administrations was to preserve the historical centres which are crucial not just as heritage but also as central public spaces presenting an important attachment for the local population (Clemente and Salvati, 2017). This follows the experience from past earthquakes in the area such as Perugia in 1997. Tight coordination among stakeholders and inhabitants is crucial to ensure more inclusive and sustainable practices for reconstructed infrastructure, housing and public urban spaces.

The overall vulnerability of a city is ultimately determined by its physical shape and the quality of its socio-economic infrastructure. Factors, which leave cities badly exposed are a dilapidated and inefficient capital stock, buildings built in the absence or in violation of construction regulations, poorly maintained urban engineering systems, under-developed public services, social inequality, and, polarization and deprivation. It is not possible to make cities resilient overnight. Rather, resilience is purposefully and progressively “accumulated” by improving the quality of both the social well-being and the physical stock, while incorporating the relevant principles and considerations into all capital investment decisions.

In summary, even when working across different sectors and in a more integrated manner there are no simple and straightforward mechanisms to address all sustainability problems. However, this chapter has demonstrated the multiple and integrative roles that cities play in broader sustainability transitions. It has discussed what enablers and innovative solutions exist today that can be implemented in cities to address societal challenges or to embrace the opportunities that come out of the contemporary trends and challenges. Various capacities in that regard can be activated: for example, the importance to mobilise “idle” or neglected capacities; from reengaging with neglected small cities to reorienting strategies to meet human needs to making value out of waste.

The next chapter will explain how governments on national and municipal levels can activate capabilities of cities through policymaking and governance practices in a way which will make it possible/easier for cities to implement the innovative solutions described in this chapter. It introduces the notion of deliberative and flexible modes of governance that partner with stakeholders to explore opportunities and enable and at times support experimentation. What institutions and processes are needed to manage people-smart sustainable cities and promote experimentation more broadly? How can we ensure that investment and development are not locked in suboptimal practices?

4. How cities harness their potential and capabilities

4.1. Create, innovate, reflect

Cities need to build a strong enabling environment. Innovation is uncertain and risky, so it is impossible to know in advance what will work and what will not. This turns the traditional approach to governance, based on five-year plans, technology-specific regulation, the existing economic structure, and a long-standing legal, institutional, and cultural legacy, on its head. A focus on innovation instead requires cities to move from a top-down approach to a bottom-up one, seeing itself as an enabler that monitors what is going on, steps in when it might be helpful, and systematically and continuously monitors the impact of its interventions. Even with respect to “best practices”, while they can serve as inspirations, no-one can be certain if they will work in other contexts, or in some cases, without the incentives that sustain them currently.

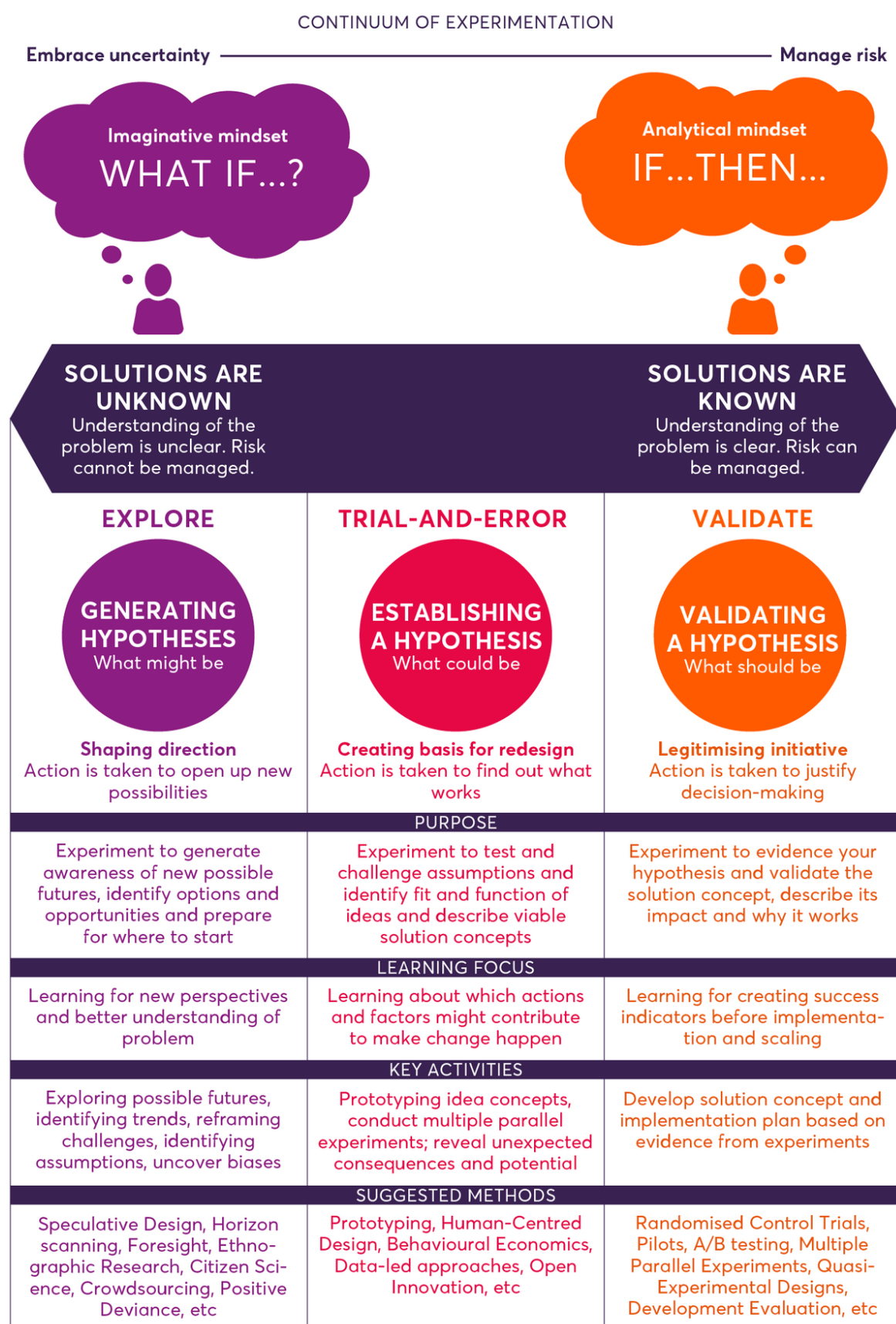
In order to fully explore their innovative potential for sustainable development and sustainability transitions, as well as to address the challenges they face, cities should develop an open culture of governance that facilitates reflective learning, creativity, innovation and co-creation. This can be supported by exploratory multi-level management mechanisms, facilitating collaboration across different sectors in order to gain evidence and confidence, to design, pilot, modify, and to scale up ideas (Quagiotto, Leurs and Christiansen, 2017).

Cross-sectoral collaboration and inter-institutional coordination are central in this respect, as is ensuring coherence among policies and measures across the board. Even if cities by the nature of their spatial location represent coherent entities, typically administrations maintain a siloed approach to managing urban resources and development. Innovative cities develop collaborative platforms to overcome this fragmentation and find solutions for generating genuinely integrative methods of public management.

However, smart policy intervention is not a prescribed set of strategies with expected results (see figure 6) but rather it is a continuous and exploratory process. It is set within the dynamic situations of real-life practices that are made up of complex systems of changing problems that interact with each other. Key actors in this process should therefore function as learning entities who actively and openly engage with one another to question their ideas and knowledge and make sense of what needs to be actually done; how this can be done; and what contextual factors may affect the implementation process.

This form of experimentation and exploration is important for finding new and innovative solutions for sustainable development where cities play a key role; for example, finding “key nodes in the system” which can have a broader impact on the efficient use of resources. Many urban problems and challenges require reflective practices that probe to a deeper level than simply trial-and-error experiences, although it is also true that without making mistakes it is not possible to innovate. Not only condoning, but openly embracing the failure and, perhaps most importantly, having the resources and incentives to learn from failure is essential. Urban living labs can be seen as a form of experimental urban governance; they represent the necessary flexible, inclusive and participatory settings for creation and innovation (see box 25). Generally, it is important to challenge neophobia (dislike of anything unfamiliar), to overcome entrenched interests, and to “un-tie” new major decisions from existing situations. Nourishing a culture of innovation is important for overcoming both industrial decline and uneven development (see box 26).

Figure 6. Experimental culture in government



Source: National Endowment for Science, Technology and the Arts (NESTA) (Quaggiotto, Leurs and Christiansen, 2017).

Box 25. Urban Living Labs as experimental platforms

Urban Living Labs (ULLs) are experimental urban projects on a local scale (street, neighbourhood, city) which involve participation by inhabitants and civil society, in close coordination with planners and academic researchers. ULLs aim to test spatial designs and innovations, learn from them and improve them in real-time (Bulkeley and Coenen, 2016; Culwick et al., 2019). For example, the EU-funded Regreen Project uses ULLs for European cities of different sizes (Velika Gorica, Aarhus, Paris) to test and monitor nature-based solutions in a bid to assess their feasibility on larger scales (Regreen Nature-Based Solutions, 2020).

ULLs are often assimilated into strategies of tactical urbanism, which consists of temporary measures to allow stakeholders to locally test the outcome of an intervention before scaling it up across the city or further. A major example of tactical urbanism is that of COVID-19 bicycle lanes. Many cities around the world, including Kreuzberg and Budapest (City of Budapest, 2020), have replaced car or parking lanes with wide cycling lanes in a bid to absorb the new traffic resulting from the loss of public transit capacity. These cycling lanes were created without going through in-depth traffic impact studies, but they function as an experimental measure which allow cities to better understand the potential results of a more extensive cycling network in cities often built around and for the automobile.

Box 26. The small industrial town of Renens reinventing itself through innovation ecosystems

The city of Renens (Switzerland) is an industrial town of 20,000 inhabitants close to Lausanne, by the Lake Geneva area. It has experienced years of decline caused by companies going bankrupt (the most famous being Kodak) or delocalised. Instead of allowing itself to transform into a suburban “dormitory” town, the local government planned its industrial revival as a virtuous circle by encouraging new industrial job creation. Taking advantage of the proximity of the Federal Institute of Technology (EPFL) of Lausanne, Renens transformed its defunct factory premises into spaces and platforms which facilitate innovation and start-up creation by students and young graduates. These platforms include Fab Labs (public laboratories with shared tools, equipment and computers, usually aligned with open-source development) and organizing Hackathons (48-hour start-up creation, from the idea to the business plan). A synergy was also created between new start-ups, business incubators and the network of industrial parks (technopoles) in the area. This strategy has allowed the revival of the small town after years of decline, while simultaneously maintaining its identity as an industrial hub.

Source: Clément (2018).

4.2. Know what works and what does not

Following on from the previous section, another important aspect is that policies should be crafted to enable critical assessment. This assessment should consider what works, what does not and the ability to stop what does not work, avoiding costly lock-ins and status quos. While considering “paths to take”, cities need to also figure out the “paths not to take”. It is necessary to avoid making new major decisions based merely on previous practices and existing infrastructure. It is very often the case that retaining old habits reproduces an inefficient status-quo and leads to the deeper engraining of unsustainable practices.

Learning and the exchange of good practice and experiences from other contexts is critically important. This includes the knowledge and exchange of international standards (see box 27).

There has recently been a progressive move towards a “what works” approach to development or what is also defined as evidence-based, results-driven interventions. An evidence-informed and what works approach can help to understand and evaluate policies in practice. At the same time, initiatives for people-smart sustainable cities are inevitably complex due to the involvement of multiple actors, as well as the dynamic and often unpredictable contextual factors at play. In contrast to technical decisions, designing and implementing effective social policies cannot be simply evidence-based. This is because decisions involve contested or “wicked” problems (shaped by different values and concerns) and very complex social, economic, political and institutional conditions for actually achieving change. Using evidence for making decisions in this context will therefore be “qualitatively different”, that is, dependent on the actors involved and the conditions in which they operate (Parkhurst, 2017: p. 5).

In other words, the demand is not only for what works but crucially for “why” and “how it works” (see box 28). This requires integrating additional approaches to and methods of generating project evidence and evaluation, including an on-going “critical scrutiny” of multiple contextual and implementation factors that may influence (worsen or improve) the desired urban change. Evaluation should be designed to include ongoing assessments throughout the life of the initiative; adaptation of the strategy when necessary; and integration of new and changing conditions. Often too much attention is given to the expected outcomes rather than to identifying mechanisms that have proven to have positive effects. The focus should be on documenting and analysing the change in practice and effects, expected as well as unexpected.

Box 27. UNECE Portal on Standards for the Sustainable Development Goals

The Standards4SDGs Portal aims to map standards to the goals and targets of the 2030 Agenda for Sustainable Development. It allows cities to identify standards by international and national organizations that are relevant to their areas. Standards are defined as documents approved by a recognized body that provides, for common and repeated use, rules, guidelines or characteristics for products or related processes and production methods, with which compliance is not mandatory. Standards provide a shared language, common metrics, and concrete tools to translate global principles into action. Standards can support all three dimensions of sustainable development.

The portal addresses an important gap in capacity building. On the one hand, policymakers are both insufficiently aware of standards and insufficiently empowered to use them as the basis for their choices at local, national, regional and global levels. On the other hand, standards organizations are not sufficiently aware of how standards can contribute to the SDGs. In addition to the standards database, the portal contains case studies on how standards have been used as the basis for policy interventions by local and national authorities, as well as e-learning training courses, covering risk management, conformity assessment and market surveillance.

Source: UNECE (2017e).

Box 28. What Works Centres in the United Kingdom

The What Works initiative aims to improve the way government and other public sector organizations create, share and use evidence in decision-making. The UK network of What Works Evidence Centres for Social Policy was established in 2013. There are now many centres in the network focusing on some of the most challenging social development issues (e.g. social care of children and homelessness). The Centres fill gaps in knowledge by running experiments or conducting new studies. Within this movement, it has been increasingly understood that the gaps are not just in the understanding of “what works”, but in the six Ws: “what works, for who, when, where and with who” (Mulgan, 2015; Mulgan and Breckon, 2018). Recently, there has also been the establishment of the

so-called “Evidence Quarter” to ensure a better coordination and integration of the different evidence frameworks applied by different Centres (Breckon and Sanders, 2019).

Source: UK Cabinet Office (2020).

4.3. Mobilise finance for a good cause

Public procurement stands for a substantial part of aggregate demand, overall and in cities in particular. If designed correctly, it has a crucial importance in channelling priorities and driving sustainable development, including by creating demand for innovative solutions.

Local fiscal and payment regimes can play a stimulating role in encouraging sustainable - and discouraging unsustainable - activities or lifestyles. Some examples are public transport fees, parking fees, congestion charges, property taxes and development charges. However, city-level responses to sustainability challenges are often circumscribed by the limited fiscal capacities and, indeed, by the limited fiscal autonomy of municipalities or regions. Even if substantial achievements can be reached with moderate cost – as with regard to, for example, the deployment of smart-city (ICT-based) technologies – many systematic and comprehensive policies are still capital intensive. City governments need to identify sustainable sources of revenue for these policies. Financial resources should also be sought from the private sector; public-private partnerships may share risk and raise finance for infrastructure and energy efficiency projects. In their turn, national governments must ensure adequate resource mobilisation for local and regional governments, because it is at the national level that different forms of taxes can be institutionalized more comprehensively and effectively.

Discussions around urban spending often have limited links to SDGs, the *New Urban Agenda* and other key international commitments and their principles, and lacking elaboration on, for example, what represents good or bad sources of revenues, or good or bad expenditure. The way cities operate much depends on how urban spending is allocated. Sprawl, segregation, socio-spatial inequality, congestion, lack of affordable housing and public services, and numerous other problems are the result of poor investment decisions which orient cities to develop in a particular way, serve particular interests, and systematically fail disadvantaged groups. Urban development projects are often happening at a cost to the most disadvantaged, through displacement, evictions, gentrification, land speculation, exclusionary practices.

Urban spending though can also work for a sustainable city, a just city, and a liveable city for all kinds of residents. There is no one-size-fits-all solution but possessing a set of principles is important. These principles should include: a purposeful search for equity; recognising multiple stakeholders that make cities - private as well as public, collective, cooperative, community and not-for-profit actors (this can include seed funding and grants for community groups); and creating enabling conditions for those multiple actors to participate meaningfully in the decision-making about urban priorities and spending and in urban economic life.

There are innovative and flexible tools that can help to work with those principles while cities look for mobilising the “right finance” with the private sector. Public-private partnerships (PPPs) typically include risk sharing and financing of infrastructure construction and operation around hard assets. The “people-first public private partnerships” (people-first PPPs) mechanism of UNECE emphasises SDG compliance and ensures that, out of all stakeholders, “people” are on the top. People-first PPPs ensure that people have access to better services at affordable prices. Furthermore, the people-first PPP impact assessment tool offers an evaluation methodology to benchmark and score PPP infrastructure projects against these principles, including with regard to their social, economic and environmental impacts (see box 29).

Procurement is also an effective instrument with which to stimulate innovation. The existing procurement processes in cities often make it difficult to acquire solutions which have yet to be fully proven. Procurement tenders often specify the physical attributes of the goods to be procured, derived from the attributes of goods that already exist in the market, and are awarded to the lowest bidder meeting these specifications. The result is that “cities are unable to benefit from emerging disruptive technologies quickly enough and are likely to become laggards instead of leading the way” (EASME and DG GROW, 2019a, pp. 20-21).

Instead of this, innovation-enhancing procurement specifies tenders in terms of the performance the goods (or infrastructure) have to deliver and selects the bid offering the most economically advantageous terms over the life cycle of the goods or infrastructure project. This approach allows specifying environmental and social performance criteria, among other things. The basic premise is that bidders focus on what is needed to be achieved but are left with plenty of room to develop and experiment with different solutions to achieve those goals. They are consequently paid based on the extent to which they achieve those goals, rather than on technical specifications. It allows bidding companies to offer innovative solutions meeting the performance criteria, rather than only products that already exist. This approach also generates incentives for companies to invest in research and development (R&D) in order to develop such innovative solutions.

To make innovation-enhancing procurement work, leading procurement agencies enter into competitive dialogues with potential bidders in order to understand the current state of technology and the potential for developing superior innovative solutions. Leading procurement agencies also use so-called “pre-commercial procurement”, that is, they provide grants to innovative companies, including local start-ups, to finance R&D and proof of concept on potential innovative solutions that could then at a later stage compete for a commercial procurement tender. Such change “requires an open innovation culture and the right set-up to allow more flexible engagement with local innovation ecosystems” (EASME and DG GROW, 2019b, p. 70). To facilitate citizen engagement, government procurement should make space for contractors to engage with citizens to identify problems and co-create solutions.

A good example of this is the Kyiv Smart City (non-government) initiative (Kyiv Smart City, 2020), which brings together Kyiv citizens, the business community, activists and city authorities to develop intelligent smart urban infrastructure and city services. Apart from being responsible for the deployment of digital infrastructure in the city and developing new service integration hubs (such as Kyiv ID accounts to access all online public services in the city), it provides enabling platforms for start-ups and innovative ideas which can then be upscaled in Kyiv and other cities. It also incorporates participatory budgeting as it allows social initiatives to emerge and be voted for, with the potential to receive support from the city budget. Kyiv Smart City has also attracted international partners who use Kyiv as an experimental testbed for their smart city ideas.

Box 29. People-first Public-Private Partnership instruments

UNECE prepares international standards and recommendations for people-first public-private partnerships, which are compliant with the SDGs. People-first PPPs represent a socially oriented framework that supports procurement for innovation; measuring sustainable development; and innovative partnership arrangements (e.g. building platforms that overcome negative externalities and ensure citizen engagement). People-first PPPs are evaluated according to a set of “quality infrastructure investments” criteria outcomes. These are:

- Increasing access and promoting equity, social justice and make essential services accessible without restriction on any grounds (e.g. race, creed etc.) to all
- Improving environmental sustainability and resilience, cutting CO₂ emissions to move to a green economy
- Improving project economic effectiveness and ensuring financial sustainability
- Being replicable so that PPP projects can be scaled up and achieve transformational impact
- Engaging all stakeholders either directly involved in the PPP project or who might be affected directly or indirectly in the short and/or long run.

The related work includes the development of people-first PPP impact assessment tool offering an evaluation methodology for scoring PPP projects and encouraging the various partners to make them people-first and SDG compliant. It offers a measuring framework to compare alternatives and provide a cost-benefit assessment of not simply the project per se, but its impacts across different social groups and areas. For example, if a new public transport route is to be built, how will it improve accessibility to schools, public infrastructure, hospitals and other services? Such tools can be tailored to different projects, with different weights allocated to different expected benefits.

Sources: UNECE International PPP Centre of Excellence (2019); Salvador et al. (2017).

4.4. Work with people and for people

The ability to engage systematically, meaningfully and productively with citizens, the private sectors and other stakeholders is what distinguishes people-smart sustainable cities. Adaptive multi-stakeholder governance should be oriented towards nourishing cities as centres of diffusion of ideas for SDGs, transformative thinking and investment, broader empowerment, engagement and co-production.

City governments should seek a broader participation of stakeholders, including the involvement of all different social groups of population in decision-making. This is to inform or to be informed by the knowledge of the local community and to share the ownership, vision and legitimacy of new strategies with a larger group of stakeholders, thus ensuring their more successful implementation.

The key question for progressive participation is to what extent residents are capable to actually initiate change and collectively shape cities to their aspirations and consequently share empowerment and pride in their cities. In other words, whether residents genuinely have the right to the city or whether this right is “privatized” by a small political and economic elite.

While citizen engagement is the must here, there should be an understanding that the participation of only some groups does not directly translate into fairness. First of all, in many contexts, people who engage more tend to come from the educated classes and have economic power, so power imbalances may only grow. Second, citizens will lobby for their own interests, which may not necessarily coincide with the broader interests of the society. Wealthy homeowners, for example, may want to stop affordable housing developments in their area. Cities also need to make sure to make decisions that benefit society at large, not just the voices that speak up the loudest.

Participatory planning and participatory budgeting are some of the tools for co-designing and co-producing cities and priorities directly alongside with their residents. In Paris, 5 per cent of their total investment budget (about EUR 100 million) has been distributed via a participatory budgeting programme every year, allowing people to propose and vote for different ideas (Veron, 2018). The Toronto Strong Neighbourhoods Strategy requires the City of Toronto to partner with residents, community agencies and businesses to invest in people, services, programmes and facilities in

identified neighbourhood improvement areas. The strategy strengthens the social, economic and physical conditions of the city and delivers local impact for city-wide change (City of Toronto, 2020).

Transparency, accountability and the effective inclusion of all groups and inhabitants in decision-making processes - including NGOs, local communities, academia, businesses and other stakeholders - are key ingredients for sustainable urban planning and management. Such participation and cooperation can also bring in missing technical expertise. For example, universities represent an intellectual resource at the local level that can support city governments in developing policies and strategies and play a key role in building knowledge on practices through changes in education curriculum and teaching methods.

The provisions of the Aarhus Convention and its *Protocol on Pollutant Release and Transfer Registers* (PRTR) (see box 30) can promote effective access to information and the informed participation of the public in decision-making relating to different aspects of urban development. This can help ensure that the development and implementation of plans, programmes and other decisions related to human settlement planning and management are pursued through transparent, accountable and participatory decision-making, thereby helping to identify the most sustainable measures at an early stage of planning. The Aarhus Convention is an important procedural tool to ensure the quality of life of urban residents and for urban environmental protection. It gives rights to city dwellers to directly participate in decision-making on, for instance, landscape design and alteration and urban planning, as well as to contribute their knowledge on real, local problems and propose solutions.

An example of how PRTR data can influence urban planning and the organization of a region comes from Israel. Israel used PRTR air emission data to account for health risks at the planning stage of an industrial zone of the city of Haifa. The city had the highest number of reporting facilities to the Israeli PRTR in 2017, particularly in the petrochemical industry. This helped decision makers to identify potential risks and find solutions. The National Economic Council decided to address the health risks by moving the refineries, based on the understanding that the pollution is preventing Haifa metropolis area from developing and that the move will lead to the revival of the entire region (Israeli Ministry of Environmental Protection, 2018).

Participatory, well informed and inclusive decision-making helps ensure that the final outcome of a plan, policy or project will be more acceptable, more sustainable and less harmful to the environment and health. It also means that hidden or unexpected aspects of a proposed plan can be uncovered early, helping to avoid costly mistakes and public discontent.

New technologies and digitalization, open data, open government, e-government initiatives and suchlike can help public authorities to make information publicly accessible more effectively and efficiently. It is easier and cheaper for authorities to actively disseminate data and information through online portals. Open data structures, in particular spatial data, have become available at a much lower cost. As a result, platforms can also visualize data in the form of maps and hence present information in a more user-friendly manner. In addition to making information available by public authorities, citizen-driven initiatives like citizen science increasingly have the potential to facilitate effective access to information and public participation in decision-making.

Digitalization allows the public to participate in decision-making easier through mobile apps and online platforms (see box 31). There is also a trend that NGOs, individual or groups of citizens are stepping in by programming their own mobile applications or online tools when they see that important (environmental) information is either not available or not provided in an easily accessible, user-friendly way by public authorities. They use this information to advocate for their right to a healthy environment and to provide direct feedback to local authorities on when they request the

authority to resolve an issue and take action to improve a government service. In addition, with an increasing use of the “internet of things”, public authorities start to draw on data collected by individuals through their personal monitoring devices and hence make this environmental information broadly available to the public.

There are still important issues with regard to these digital trends. For example, it is still common to find a silo approach towards open data, e-government and thematic datasets management. This can lead to the multiplication of systems, standards, tools and processes; sharing data between these systems often creates additional challenges when no common standard or interface exists. Using the same data standards and harmonized approach is required (European Environment Agency, 2019).

Furthermore, with a greater use of online participation platforms and mobile applications, there is a risk that groups that are less familiar with new technology are left behind (older persons, rural population). There may also be a lack of a systemic approach to identifying those citizens who need to participate. This ultimately leads to the exclusion of some vulnerable and marginalized groups. Finally, dishonest city politicians or administrators and other vested interest groups may manipulate technological algorithms and collected data if e-governance systems lack full public oversight, independent verification and audit. Therefore, new technologies should be used in a way that they are accessible and available in understandable formats. ICT tools must be adjusted to the various needs of the population to ensure an inclusive approach. In any rate, it is important to emphasise that ICT tools are complementary to more traditional tools and may not replace them in all situations. Digital technologies cannot and should not be the only means for citizens to engage with administrations.

Box 30. The Aarhus Convention and its Protocol on Pollutant Release and Transfer Registers

The provisions of the UNECE Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention), adopted in 1998, promote effective access to information and informed participation. Together with its *Protocol on Pollutant Release and Transfer Registers*, it protects every person’s right to live in an environment adequate to his or her health and well-being and enhances accountability, transparency and responsiveness of governments. It grants rights to the public and imposes obligations on parties and authorities regarding access to information and justice, and public participation in decision-making in national and international contexts. The Aarhus Convention is a global instrument; any United Nations Member State can accede to the Convention. Due to its cross-cutting nature, the Convention offers procedures and standards applicable in different sectors, such as urban development, tourism, energy and green economy. The *Maastricht Recommendations* (UNECE, 2015) developed under the Convention assist members of the public and officials at national and local levels on a day-to-day basis when designing and carrying out procedures on public participation in decision-making on different matters. Their seven-step model of effective public participation is widely applied in countries.

The *Kyiv Protocol on Pollutant Release and Transfer Registers* (PRTRs) became international law binding its parties in 2009. It is the only legally binding international instrument on pollutant release and transfer registers. Its objective is "to enhance public access to information through the establishment of coherent, nationwide pollutant release and transfer registers." PRTRs are inventories of pollution from industrial sites and other sources. PRTRs, in particular the map-based visualization of registered sources of pollutant releases, help to identify the most suitable place for different components of urban planning (houses, green zones, industrial facilities), thereby helping to minimize potential risks for the environment and health.

The portal Aarhus Clearinghouse (<https://aarhusclearinghouse.unece.org/>) provides a wealth of information and a collection of good practice examples at a local level regarding effective access to

environmental information and public participation in decision-making that can be used in urban areas. With the support of the Organization for Security and Co-operation in Europe (OSCE) and in cooperation with UNECE, more than 50 Aarhus Centres across 15 countries throughout the UNECE region support local communities in raising awareness and use of their environmental rights and can be instrumental in promoting environmental governance and well informed and engaged public in urban planning processes.

Source: UNECE (2020c).

Box 31. Engaging citizens: public participation platforms

The spread of ICT technologies has led to a vast number of information and e-governance systems that help engage citizens in environmentally relevant information and decision-making processes.

Single web access to environmental information in Ireland (www.epa.ie/irelandsenvironment). The environment portal is a winner of the Ireland eGovernment award. It provides access to all environmental information, licensing and permitting, enforcement regulation, monitoring and environmental assessment, research and education as well as key publications. It also provides access to videos, news and events. It has a user-friendly web-interface and a functionality for searching information.

Online platform of Slovakia facilitating public participation in decision-making (<https://eia.cyklokoalicia.sk>). The online portal “EIA in my neighbourhood” allows the dissemination of information and public participation in environmental impact assessments at a neighbourhood level. It provides access to all public consultations. It aims at involving the public at a very early stage of a project and increasing transparency.

Access to public records of the Norwegian Government and Municipality of Oslo (<https://einnsyn.no>). This electronic public records is a joint publishing system which allows government bodies at the national level as well as the municipality of Oslo to publish public records online. It provides access to records from the entire central (and some regional) government. On average there are 200,000 requests for information per year.

“My Berlin” Public Participation platform (<https://mein.berlin.de/>). The portal provides an overview of projects and opportunities to participate in decision-making, which are sorted by district. The database can be filtered by whether they are currently open for public consultation, as well as by district and theme. Under “results” information is given how the information and comments provided by the public will be used, by whom, as well as when and where results of the consultation will be made public.

4.5. Make the most out of spatial planning

“Spatial planning” is principal for the integration of different sectors and urban systems into a consolidated spatial strategy. This also includes “localizing” SDGs into local contexts and concerns. Indeed, in the “increasingly fragmented and specialized world, planning is the one academic discipline and professional pursuit that explicitly attempts to be holistic or at least integrative at the level of society as a whole... planning provides a context in which the specialized knowledge of others comes together and begins to make unified sense” (Rees, 1995: p. 355).

Planning systems vary across countries, but typically the instruments of spatial planning are organized hierarchically at different levels: national comprehensive and sectoral spatial plans (which can support the implementation of national urban policy); regional spatial plans; city and local development plans; and detailed building plans. Planning at the national level is critical when it comes to mitigating inter-regional inequalities, spreading out development opportunities and coordinating the construction of backbone infrastructural systems and improving intra-national connectivity. National planning can

often take the form of national urban policy, such as in Poland (*Krajowa Polityka Miejska*), which regularly sets out the urban policy-related activities of the Government.

Regional planning provides a strategic framework for land use, infrastructure, connectivity and environmental management on a broader scale than individual settlements. At the city level, urban design and layout, urban aesthetics, provision of transit and other public services, and integrated infrastructural systems are some of the urban planning considerations that have long been acknowledged among the principal instruments for sustainable cities.

Spatial planning is also important when it comes to housing policy. Land use strategies and processes of identifying developable land, alongside public conditions associated with its release for development, greatly impact housing supply and prices. Zoning restrictions protect the character of the city, health of residents, green belts and essential environmental quality, but if used too rigidly or without due consideration of social impacts they could also contribute to social exclusion (The Economist, 2020b).

This is particularly the case in the context of the deregulation and financialization of the housing markets, coupled with the privatization of social rental housing which took place in the 1980s-1990s in a push for homeownership. A lack of proper competition between different housing segments (i.e. between free market commercial housing, high-quality public housing, and rent-controlled tenure-secure private rental market) creates unhealthy demand for homeownership, pushes housing prices up and makes housing in “hot spot” areas beyond the reach of low-income earners and sometimes even average income earners. This also contributes to gentrification and segregation. Rather than aiming to counterbalance these socially negative processes, planning practice in many cities is sometime found to be complicit to them and, if so, needs to be firmly rethought (Badyina and Golubchikov, 2016).

Planning is also instrumental in environmental assessment and management, as well as identifying risk-prone zones, restricting building activities within them and for providing spatial strategies to safeguard urban infrastructure. Planning decisions on land use and urban layout have impacts lasting for decades and even centuries. Particular land use and infrastructural patterns create circles of “path dependence” where future investments are predetermined by existing infrastructure, locking places into particular uses, lifestyles and patterns. Spatial planning is important in order to prevent being locked into unsustainable or hazard-prone conditions that will be expensive or even impossible to alter later. The use of instruments like “strategic environmental assessment” (SEA) can assist planners in identifying the environmental and health concerns in proposed urban plans and developments. SEA ensures that explicit consideration is given to environmental factors well before the final decision is taken on plans and programmes which are likely to have significant environmental, including health, effects (see box 32).

The potential of urban planning is today realized in the design of new eco-, low carbon and smart cities or districts worldwide. While there are encouraging examples, it is even more important to act in existing urban districts, where there is a large potential for paving a more sustainable future through climate-smart urban planning.

The professional planning practice itself should grapple more effectively with the digital, technological and social realities of today, as well as expectations of citizens for people-smart sustainable cities. For example, in many countries (paradoxically in the wealthiest ones especially) the 21st century planning work still relies on the 19th century methods. Even in online public domains, planning-related documents frequently are accessible only as a batch of scanned PDF files, with little transparency, systematisation and inter-search functionality. Smart planning can provide more value and

convenience to the public. Digitally enabled planning, smart approaches using big data, modelling, 3-D visualisation, AI and augmented reality are already extensively used in commercial applications and can deliver better outcomes for a variety of stakeholders across the planning system.

Box 32. The Protocol on Strategic Environmental Assessment

The *Protocol on Strategic Environmental Assessment* (SEA Protocol) to the UNECE Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) provides a legal framework and set of procedures for the comprehensive integration of environmental and health concerns into a wide range of development activities, plans, programmes, policies and legislation in all economic sectors. The SEA Protocol also provides for extensive public participation in the governmental decision-making process. Unlike the Espoo Convention, which applies only to activities that are likely to cause impact across the national borders, the Protocol applies to domestic plans and programmes that set frameworks for activities that require an environmental impact assessment under national legislation. SEA can also provide a systematic integrated framework for considering sustainable development in urban planning too, including by considering alternatives.

SEA should be applied during the preparation of governmental strategic documents in order to ensure that the environmental and health implications of planned developments are analysed and considered early in decision-making processes, before the decisions are made. In addition, relevant authorities and the public should be properly consulted in the process. As a result, SEA increases the legitimacy of planning and decision-making processes and their outcomes. The range of the SEA application is much wider than that of the project-level environmental impact assessment (EIA). SEA applies to “strategic” planning documents and processes, such as plans or programmes, and to the extent appropriate to policies and legislation, while EIA is applied to individual proposed activities or development projects.

Source: UNECE (2017d)

4.6. Cooperate across borders

Many issues for cities are externalised to broader territories and require all kinds of multi-level and horizontal coordination and cooperation. This involves many aspects, including for example: regional territorial coordination across municipal borders; international transboundary cooperation among cities and urban agglomerations; information-exchange and learning; and the need for standardization among countries on product requirements, technological standards and protocols (see box 33).

Many important initiatives, projects and processes cross the boundaries of individual administrative jurisdictions (e.g. infrastructural projects or public transport). Metropolitan areas are often divided into a fragmented matrix of municipalities, which presents a demand for a regional State to coordinate municipalities on sustainable planning and transport development such as the Cardiff Capital Region (see box 34).

There are also examples of “transboundary urban agglomerations”, some of which even share major infrastructural facilities like airports; for example, Malmo-Copenhagen, Basel/Mulhouse/Freiburg. Cross-border cooperation can go from creating a mutual platform for getting stakeholders from cross-border cities to regularly meet and exchange expertise all the way to the creation of a cross-border local government body in a bid to mutualise infrastructures and resources. The Geneva metropolitan area has a cross-border administration and coordination body made of delegates representing the Swiss and French municipalities which constitute this area. The body oversaw the construction and

operation of the Leman Express, which became widest cross-border regional railway network of Europe through the coordination of vehicle, personnel and infrastructure management.

Cross-border cooperation facilitates economic integration, without forcing uniformity, in a bid to create transnational corridors, as is also exemplified by the Niagara Community Observatory in the Rust Belt of the USA and Canada. The observatory monitors the daily number of people and goods crossing the US-Canada border and promotes initiatives towards economic integration while preserving economic sovereignty. Some corridors monitored include the Buffalo-Niagara corridor which represents a metropolitan area of about 10 million people and was a point of passage for 16 per cent of all the US-Canada trade in 2017 (Friedman, Conteh and Philips, 2019).

The role of regional (sub-national) administrations as coordinating, enabling and funding bodies cannot be overstated. They can facilitate cooperation and overcome the potential fragmentation of local efforts. An effective instrument (especially for infrastructural projects) is regional spatial planning, which may be administered by regional governments. Cities which have a "regional" administrative mandate (often the case for larger cities) are more capable of facilitating larger projects and territorial cohesion.

City-focused cooperation also stretches internationally, which is important for learning good practices. This can include successes but also failures. There are alliances and networks of cities working across borders towards sustainability, such as the International Council for Local Environmental Initiatives (ICLEI), C40 (a network of megacities) or the World Smart City Forum. More than 130 cities, including smaller cities from Europe and other parts of the world, have started to organize themselves into a new initiative called Open and Agile Smart Cities (OASC). Their ambition is to exchange experiences along their digitization journey and align the urban data platform, common standards and application programming interface (API) they are based on to form a larger and more coherent ecosystem (EASME, 2019a). International organizations, including the United Nations, use their mandates to facilitate those networks and exchange. For example, UNECE has launched the new Forum of Mayors as a regular international exchange platform, following the Day of Cities in 2019 (see box 35).

Box 33. Multilateral environmental agreements to support transboundary cooperation and risk mitigation

The UNECE Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) sets out the obligations of parties to assess the environmental impact of certain activities at an early stage of planning. It also lays down the obligation of the States to notify and consult each other on all major projects under consideration (such as industrial facilities) that are likely to have a significant adverse environmental impact across boundaries.

The UNECE *Protocol on Strategic Environmental Assessment* (SEA Protocol) (see also box 32) sets out provision to ensure that individual parties integrate environmental assessment into their plans and programmes, such as land-use or strategic master plans at the earliest stages.

The UNECE Convention on the Transboundary Effects of Industrial Accidents (Industrial Accidents Convention) aims at protecting human beings and the environment against industrial accidents, including those caused by natural hazards (so-called NaTech). Its programme of work on land-use planning and industrial safety helps countries to make risk-informed decisions on the siting of hazardous activities, or significant modifications thereof, and to establish policies in areas which could be affected by the transboundary effects of an industrial accident.

The UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) provides an intergovernmental platform for climate change adaptation, including flood and drought management in transboundary basins. In 2018 the Water Convention in collaboration with UNDRR developed the *Implementation Guide for Addressing Water-Related Disasters and Transboundary Cooperation*, which also addresses the role of cities in climate change adaptation and disaster risk reduction. It promotes integrating adaptation and disaster risk reduction into urban redevelopment programmes and encourages continuous learning and city to city knowledge networks (UNECE, 2018b).

The UNECE Convention on Long-range Transboundary Air Pollution (Air Convention) seeks to reduce air pollution and emissions. The Air Convention provides access to emission, measurement and modelling data and information on the effects of air pollution on ecosystems, health, crops and materials. While parties set concrete emission reduction targets at the national level, fewer emissions at the national level achieved under the Air Convention also mean an improvement in the air quality at the city level. As air pollution needs to be tackled at all different scales, the newly established Expert Panel on Clean Air in Cities analyses and communicates the potential benefits of multi-scale air quality management and aims to find an optimal mix of local, national and international policy actions.

Source: UNECE (2018c).

Box 34. Sustainable transit in the Cardiff Capital Region

The Cardiff Capital Region consists of ten independent local authorities, including the Cardiff City Council. Both the Welsh Government and the ten local authorities of the region are grappling with a range of interconnected mobility issues, now within the context of the *Well Being of Future Generations Act* of Wales. This legislation dictates that public bodies have to adopt a more holistic, long term and sustainable approach in discharging their responsibilities, including transport and planning.

In response, a number of interrelated and more sustainable projects are being progressed across the Cardiff Capital Region. At the core is the development of South Wales Metro; it will see a significant uplift in rail services and capacity into Cardiff that can begin to offer a real alternative to travel by car. Within Cardiff itself, the city has published its Transport White Paper, which aside from more public transport and further Metro extensions, sets out the need to address air quality issues and provide more opportunities for active travel, especially cycling, through an expanded network of segregated cycle routes.

More broadly across the region, there is serious discussion about embedding transit-oriented development into the planning ecosystem and to see more activities located around public transport hubs. The upcoming regional strategic development plan will provide an opportunity to more explicitly link transport and land-use planning and do so in a far more sustainable way than the current planning system allows. This is a movement towards providing a more sustainable urban transit system integrated with a wellbeing-focused planning system.

Contributor: Mark Barry, Cardiff University.

Box 35. UNECE Forum of Mayors

The UNECE Forum of Mayors is a collaborative platform provided at the United Nations level which brings together cities and other stakeholders to discuss sustainable development. The format was launched in 2019 as part of the Day of Cities, when fifty mayors and deputy mayors came to Geneva to share best practices and define a new vision for urban sustainability. This event has successfully demonstrated the importance to open the multilateral stage to urban leaders as key agents of change in the new international architecture of policymaking and combating global challenges. Following the COVID-19 pandemic, in 2020

the theme of the Forum of Mayors was “city action for a resilient future: strengthening local government preparedness and response to emergencies and the impact of disasters and climate change”. The Forum of Mayors allows experiences, needs and challenges of cities to define the agenda of the UNECE, which is capable of providing direction to member States through its practical work as well as the negotiation of milestone documents, such as the *Geneva UN Charter for Sustainable Housing*. UNECE also encouraged the mayors to be part of its voluntary global campaign “trees in cities challenge”, where mayors can make a pledge to plant trees to combat climate change and foster urban sustainability and resilience.

Source: UNECE (2019b).

5. Summary points

A cities-based approach to sustainable development

Cities today are the driving force in economic, social, and cultural life, as well as environmental transformations. As such, cities must be paid particular attention in national, international and multilateral debates and policies. Cities are where many new solutions and innovation emerge, often through experimentation among stakeholders with research, products, services, business models, partnerships, and governance arrangements. Many cities pioneer solutions for sustainable development, which are then universally shared. The achievement of the majority of the United Nations Sustainable Development Goals (SDGs) is not possible without a deep and fundamental involvement at the city level and utilizing the massive innovative potential of cities. The centrality of cities to implement solutions for sustainability – in a manner that create values to all citizens – needs to be recognised and utilized across all fields of policy actions. Furthermore, as city administrators are implementing national and international commitments, their voice needs to be heard at the national and international levels too.

People-smart sustainable cities

This key notion, which is introduced in this publication, puts people and liveability right at the centre of urban sustainability. This is also to highlight the evolution of the idea of smart sustainable cities from its original digitally smart city connotations. Technology is critically important to provide capacities and facilitate sustainability, but it is not the end, nor a panacea. Technology is rather one means among many that should support the people-oriented approach. The notion of people-smart sustainable cities brings the focus more sharply onto human needs, quality of life, capabilities and capacity building, while still inviting stakeholders to engage in collaborative, inclusive - and yet pragmatic - politics for achieving sustainable development.

A whole urban system perspective

A cities-based approach to sustainable development requires working in a relational manner, where each city plays an integral part in transitioning towards sustainability. If the 2030 Agenda requests leaving no one behind, it is only logical to request leaving no city behind. This means that all cities need to have capabilities and resources to offer their residents the opportunity to enjoy a meaningful, creative and prosperous life. The “every city matters” principle requires redistribution, sharing and diffusion to favour the vulnerable parts in the urban system. While national political regimes vary greatly in their approaches, all governments can find the means to implement inclusive and just sustainability transitions across the whole urban system. National governments need to delegate to urban governments competence and enabling capacities, such as revenue generation authority and regulatory mandates, in order for them to be actively involved in a response to sustainability, unlock their potential and boost quality of life for citizens. Strengthened municipal finance and fiscal systems make cities more conducive to innovation and more attractive to people and businesses.

Cross-sectoral cooperation as an enabling condition

The siloed approach that still prevails in urban services management leads to fragmentation and missed opportunities with regard to efficiency, quality, and value creations. Working with a city in an integrated manner, through interconnection and innovation, sharing resources and providing necessary infrastructure and capabilities will allow potential of cities for sustainability to be more fully utilized. This includes mobilising “idle” or neglected capacities, with options ranging from reengaging with neglected small cities and marginalised communities to making value out of waste. In any case, the strong potential of cities with respect to sustainability should not be taken for granted but should be systematically nourished and promoted. This requires working across sectoral departments horizontally and at all levels of administration on urban matters. Vertical integration of policy also means feeding back urban experiences to the central government so that policy at all levels is well informed and can continue to evolve.

Sustainability as a culture of innovation and deliberation

What runs throughout this publication is also the fact that a systematic approach is needed which will nourish reflective learning, creativity, innovation and co-creation. Experimentation and exploration are important for finding new and innovative solutions. Key actors in this process function as learning entities who actively and openly engage with one another to question their ideas and knowledge, as well as make sense of what actually needs to be done, how this can be done, and what contextual factors may affect the implementation process. Local actors need to have facilitative frameworks that help them articulate their needs and negotiate possibilities to address them. Not only condoning, but openly embracing learning from failure, as well as, importantly, having the wherewithal and incentives to do this, is essential. Developing a culture of innovation requires being open to the world and learning from each other. However, the diffusion of models and knowledge is only positive as long as it accommodates the diversity of cities and their actual needs. Cities should take inspiration from each other and guidance from higher levels, but they should also retain their own identity and ambitions.

Cross-border and transboundary cooperation

Many issues for cities are externalised to broader territories and require multi-level and horizontal coordination, as well as international cooperation. This involves coordination across municipal and national borders; international transboundary cooperation among cities and urban agglomerations; information-exchange and learning; and interoperability of standards and protocols.

Policy instruments and agreements provided by UNECE

As demonstrated throughout this publication, UNECE, along with other United Nations and international bodies, plays a significant role in developing mechanisms which allow the integration of different fields of practices in relation to cities, putting them on the sustainability pathway. Coordination among national governments and city policymakers facilitated by UNECE furthers the mutual learning, exchange of experiences and lessons learned. This is important resource that should be fully explored and utilized by national and urban governments and other stakeholders in order to develop the pathway to a more liveable, green and prosperous urban future.

References

Publications

- Badyina, A. and O. Golubchikov (2016). "Gentrification in central Moscow – a market process or a deliberate policy? Money, power and people in housing regeneration in Ostozhenka". *Geografiska Annaler: Series B, Human Geography*. 87(2):113-129. DOI: <https://doi.org/10.1111/j.0435-3684.2005.00186.x>.
- Bulkeley, H. et al. (2016). "Urban living labs: governing urban sustainability transitions". *Current Opinion in Environmental Sustainability*. 22:13-17. DOI: <https://doi.org/10.1016/j.cosust.2017.02.003>.
- Carbon Neutral Cities Alliance (2019). *Carbon Neutral Cities Alliance 2019 Annual Report*. Available from <https://carbonneutralcities.org/cities/>.
- Charles, A (2015). "Can we build cities that anticipate the future?". *World Economic Forum*. 25 October 2015. Available from <https://www.weforum.org/agenda/2015/10/can-we-build-cities-that-anticipate-the-future>.
- CitiesAct (2009). *The Copenhagen Climate Communiqué*. Available from <http://www.cloverarchive.com/main/page/3125.pdf>.
- City of Copenhagen (2012). *CPH2025 Climate Plan, A Green, Smart and Carbon Neutral City*. Available from https://kk.sites.itera.dk/apps/kk_pub2/pdf/983_jkP0ekKMyD.pdf.
- City of Moscow (2020a). *Moscow Key Performance Indicators*. Available from <https://www.mos.ru/en/city/projects/development/> [accessed July 2020].
- City of Moscow (2020b). *Московский стандарт реновации*. Available from <https://www.mos.ru/city/projects/renovation/> [accessed July 2020].
- City of Ottawa (2016). *Guide for Older Adults: Services and Programs offered by the City of Ottawa*. Available from <https://documents.ottawa.ca/sites/documents/files/2019-.058%20Older%20Adult%20Booklet%20-%20ENG.pdf>.
- City of Ottawa (2020). *Older Adult Plan*. Available from <https://ottawa.ca/en/older-adult-plan> [accessed July 2020].
- City of Toronto (2020). *Toronto Strong Neighbourhoods Strategy 2020*. Available from <https://www.toronto.ca/city-government/accountability-operations-customer-service/long-term-vision-plans-and-strategies/toronto-strong-neighbourhoods-strategy-2020/> [accessed July 2020].
- City of Vancouver (1990). *Clouds of Change: Final Report of the City of Vancouver Task Force on Atmospheric Change*. Available from <http://a100.gov.bc.ca/pub/eirs/finishDownloadDocument.do?subdocumentId=3851>.
- City of Vancouver (2015). *False Creek Neighbourhood Energy Utility*. Available from <http://vancouver.ca/home-property-development/southeast-false-creek-neighbourhood-energy-utility.aspx> [accessed July 2020].
- City of Vienna (2013). *Gender Mainstreaming in Urban Planning and Urban Development*. Available from <https://www.wien.gv.at/stadtentwicklung/studien/pdf/b008358.pdf>.
- City of Vienna (2014). *Smart City Wien*. Available from https://smartcity.wien.gv.at/site/files/2014/09/SmartCityWien_FrameworkStrategy_english_onepage.pdf.
- Clément, J.-F. (2018). "Les Ateliers de Renens: Construction d'un site dédié à l'emploi". *Forum Bâtir et Planifier: la Ville Productive Conference*. Available from https://www.vd.sia.ch/sites/vd.sia.ch/files/20181112_Batir_Planifier_Cl%C3%A9ment.pdf.
- Clemente, M and L. Salvati (2017). "'Interrupted' Landscapes: Post-Earthquake Reconstruction in between Urban Renewal and Social Identity of Local Communities". *Sustainability* 9(11). DOI: <https://doi.org/10.3390/su9112015>.
- Cohen, G. (2017). "What is social infrastructure?". *Aberdeen Standard Investments*. 20 July 2017. Available from <https://www.aberdeenstandard.com/en-us/us/investor/insights-thinking-aloud/article-page/what-is-social-infrastructure>.

- Connolly, C., R. Keil and S.H. Ali (2020). "Extended urbanisation and the spatialities of infectious disease: Demographic change, infrastructure and governance." *Urban Studies*. DOI: <https://doi.org/10.1177/0042098020910873>.
- Culwick, C. et al. (2019). "CityLab reflections and evolutions: nurturing knowledge and learning for urban sustainability through co-production experimentation". *Current Opinion in Environmental Sustainability*. 30:9-16. DOI: <https://doi.org/10.1016/j.cosust.2019.05.008>.
- Dawson, A. (2017). *Extreme Cities: The Peril and Promise of Urban Life in the Age of Climate Change*. Brooklyn: Verso.
- De Beer, M. (2015). *Working towards Aarhus 2.0 in the Netherlands*. Ministry of Infrastructure and Environment of the Kingdom of the Netherlands. Available from http://www.unece.org/fileadmin/DAM/env/pp/ppdm/5th_PPDM/Presentations/MaaikedeBeer.pdf.
- DeVerteuil, G. and O. Golubchikov (2016). "Can resilience be redeemed? Resilience as a metaphor for change, not against change". *City*. 20(1):143-151. DOI: <http://dx.doi.org/10.1080/13604813.2015.1125714>.
- EASME and DG GROW (2019a). *Digital Cities Challenges: Designing Digital Transformation Strategies for EU Cities in the 21st Century*. Luxembourg: Publications Office of the European Union. Available from <https://www.digitallytransformyourregion.eu/sites/default/files/2019-09/EA-04-19-484-EN-N.pdf>.
- EASME and DG GROW (2019b). *Digital Cities Challenges: Designing Digital Transformation Strategies for EU Cities in the 21st Century. Final Report*. Luxembourg: Publications Office of the European Union. Available from <https://www.intelligentcitieschallenge.eu/sites/default/files/2019-09/EA-04-19-483-EN-N.pdf>.
- ESPON (2012). *SGPTD Second Tier Cities and Territorial Development in Europe: Performance, Policies and Prospects*. Available from https://www.espon.eu/sites/default/files/attachments/SGPTD_Final_Report_-_Final_Version_27.09.12.pdf.
- European Commission (2015). "Closing the loop – An EU action plan for the Circular Economy", Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. 2 December 2015. Available from https://eur-lex.europa.eu/resource.html?uri=cellar:8a8ef5e8-99a0-11e5-b3b7-01aa75ed71a1.0012.02/DOC_1andformat=PDF.
- European Commission (2019). *The Digital Cities Challenge: Designing Digital Transformation Strategies for EU Cities in the 21st Century*. Available from <https://www.intelligentcitieschallenge.eu/sites/default/files/2019-09/EA-04-19-483-EN-N.pdf>.
- European Commission (2020b). *100 climate-neutral cities by 2030 – by and for the citizens*. Available from <https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/82f1df57-b68b-11ea-bb7a-01aa75ed71a1>.
- European Environment Agency (2019). *Open data and e-government good practices for fostering environmental information sharing and dissemination*. Available from http://www.unece.org/fileadmin/DAM/env/pp/a_to_i/Joint_UNECE_EEA_workshop/Draft_OD_EGOV_GP.pdf.
- European Parliament and Council of the European Union (2010). "Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings". *Official Journal of the European Union* L 153 18.6.2010. Available from <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32010L0031andfrom=EN>.
- Food and Agriculture Organisation (2016). *Riga: From Food Waste to Healthy Off-Season Food*. Available from <http://www.fao.org/3/CA0496EN/ca0496en.pdf>.
- Foundational Economy Collective (2018). *Foundational Economy: The Infrastructure of Everyday Life*. Manchester: Manchester University Press.
- Foundational Economy Collective (2020). *What Comes after the Pandemic? A Ten-Point Platform for Foundational Renewal*. Available from <https://foundationaleconomy.com/> [accessed July 2020].
- Friedman, K., C. Conteh and C. Philips (2019). "Cross-border innovation corridors: How to support, strengthen and sustain cross-border innovation ecosystems". Niagara Community Observatory, Brock University. Available

from <https://brocku.ca/niagara-community-observatory/wp-content/uploads/sites/117/NCO-Policy-Brief-42-Friedman-Cross-Border-Innovation-FINAL.pdf>.

GIZ and ICLEI (2014) "Operationalizing the Urban NEXUS: Towards resource-efficient and integrated cities and metropolitan regions". On behalf of the German Federal Ministry for Economic Cooperation and Development. Bonn. Available from https://www.sustainable-urbanisation.org/sites/sgup/files/publications/operationalising_the_urban_nexus.pdf.

Golubchikov, O. and A. Badyina (2012). *Sustainable Housing for Sustainable Cities*. Nairobi: UN-Habitat. Available from <https://unhabitat.org/books/sustainable-housing-for-sustainable-cities-a-policy-framework-for-developing-cities/>.

Golubchikov, O. and A. Badyina (2016). "Makroregional'nye tendentsii razvitiya gorodov byvshego SSSR (The Macro-Regional Trends in the Development of Cities in the Ex-USSR States)". *Regional'nye Issledovaniya* 52(2):32-43. Available from <http://orca-mwe.cf.ac.uk/94430/1/golubchikov-2016-regionalstudies.pdf>.

Golubchikov, O. and P. Deda (2012). "Governance, technology, and equity: An integrated policy framework for energy efficient housing". *Energy Policy* 41:733-741. DOI: <https://doi.org/10.1016/j.enpol.2011.11.039>

Golubchikov O. et al. (2015). "Uneven Urban Resilience: The Economic Adjustment and Polarization of Russia's Cities". In: Lang T., Henn S., Sgibnev W., Ehrlich K. (eds). *Understanding Geographies of Polarization and Peripheralization. New Geographies of Europe*. London: Palgrave Macmillan. DOI: http://dx.doi.org/10.1057/9781137415080_15.

Golubchikov, O. (2017). "From a sports mega-event to a regional mega-project: the Sochi winter Olympics and the return of geography in state development priorities. *International Journal of Sport Policy and Politics*, 9(2):237-255. DOI: <https://doi.org/10.1080/19406940.2016.1272620>.

Golubchikov, O. and K. O'Sullivan (2020). "Energy periphery: Uneven development and the precarious geographies of low-carbon transition". *Energy and Buildings*. 211. DOI: <https://doi.org/10.1016/j.enbuild.2020.109818>.

GSM Association (2020). *The Mobile Economy 2020*. Available from <https://www.gsma.com/mobileeconomy/wp-content/uploads/2020/03/GSMA-MobileEconomy2020-Global.pdf>.

Habitat III (2016). *New Urban Agenda*. Available from <https://unhabitat.org/sites/default/files/2019/05/nua-english.pdf>.

Heslop, J., K. Morgan and J. Tomaney. (2019). "Debating the Foundational Economy". *Renewal: A Journal of Social Democracy*, 27(2). pp. 5-12. Available from http://renewal.org.uk/files/ren27.2_01editorial.pdf.

Israeli Ministry of Environmental Protection (2018). "Israeli PRTR as a tool for achieving Sustainable Development Goals". *UNECE*. 7 November 2018. Available from http://www.unece.org/fileadmin/DAM/env/pp/prtr/PRTR_Global_Round_Table/GRT-3/Presentations/Item3_c_1-ISRAEL.pdf.

ICLEI (2020). *100% Renewable Energy Cities and Regions Network*. Available from <https://iclei.org/en/100RE.html> [accessed August 2020].

Joint Research Centre (2015). GHSL. Available from <https://ghsl.jrc.ec.europa.eu/CFS.php>.

Klinenberg, E. (2018) *Palaces for the people: How social infrastructure can help fight inequality, polarization, and the decline of civic life*. London: Penguin.

Kollar, M., R.L. Bubbico, and N. Arsalides. (2018). *Smart Cities, Smart Investment in Central, Eastern and South-Eastern Europe*. Kirchberg: European Investment Bank. Available from https://www.eib.org/attachments/efs/smart_cities_smart_investments_in_cesee_en.pdf.

Latham, A. and J Layton (2019). "Social infrastructure and the public life of cities: Studying urban sociality and public spaces". *Geography Compass*. e12444. DOI: <https://doi.org/10.1111/gec3.12444>.

Lehmann, S. (2018). "Implementing the Urban Nexus approach for improved resource-efficiency of developing cities in Southeast-Asia". *City, Culture and Society*. 13:46-56. DOI: <https://doi.org/10.1016/j.ccs.2017.10.003>.

- Macrorie, R., S. Marvin and A. While. (2019). "Robotics and automation in the city: a research agenda". *Urban Geography*. DOI: <https://doi.org/10.1080/02723638.2019.1698868>.
- Marvin, S., et al. (2018). *Urban Robotics and Automation: Critical Challenges, International Experiments and Transferable Lessons for the UK*. UK-RAS Network. Available from https://www.ukras.org/wp-content/uploads/2018/09/UK_RAS_wp_Urban_010618_print.pdf.
- Move Green Association (2018). *Grazhdansky Monitoring Kachestva Vozdukh v Bishkeke*. Available from <http://movegreen.kg/wp-content/uploads/2018/05/air-bishkek-report-rus.pdf>.
- Nagenbord, M. (2018). "Urban robotics and responsible urban innovation". *Ethics and Information Technology*. DOI: <https://doi.org/10.1007/s10676-018-9446-8>.
- Nesti, G. (2019). "Mainstreaming gender equality in smart cities: Theoretical, methodological and empirical challenges". *Governing Smart Cities*, 24 (3): 289-304. DOI: <https://doi.org/10.3233/IP-190134>.
- OCHAOPT (2017). *Humanitarian Needs Overview*. Available from https://www.ochaopt.org/sites/default/files/hno_20_12_2017_final.pdf.
- OECD (2005). *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*. Available from <https://ec.europa.eu/eurostat/documents/3859598/5889925/OSLO-EN.PDF/60a5a2f5-577a-4091-9e09-9fa9e741dcf1#:~:text=The%20Measurement%20of%20Scientific%20and%20Technological%20Activities%20OIo,AND%20DEVELOPMENT%20STATISTICAL%20OFFICE%20OF%20THE%20EUROPEAN%20COMMUNITIES>.
- Parkhurst, J. (2017). *The Politics of Evidence. From Evidence-based Policy to a Good Governance of Evidence*. Available from http://eprints.lse.ac.uk/68604/1/Parkhurst_The%20Politics%20of%20Evidence.pdf.
- Rees, W.E. (1995). "Achieving Sustainability: Reform or Transformation?". *Journal of Planning Literature* 9:343-361. DOI: <https://doi.org/10.1177/088541229500900402>.
- REN21 (2019). *Renewables in Cities: 2019 Global Status Report*. Available from https://www.ren21.net/wp-content/uploads/2019/05/REC-2019-GSR_Full_Report_web.pdf.
- Restrepo Cadavid, P., et al. (2017). *Cities in Eastern Europe and Central Asia: A Story of Urban Growth and Decline*. World Bank Group and UKAid. Available from <http://documents.worldbank.org/curated/en/319131510892209158/pdf/AUS12288-REVISED-PUBLIC-ECABRIEFALLWEB.pdf>.
- Rodriguez Garzon, S. and A. Küpper (2019). "Pay-Per-Pollution: Towards an Air Pollution-Aware Toll System for Smart Cities". *2019 IEEE International Conference on Smart Internet of Things (SmartIoT)*. 361-366. DOI: <http://www.doi.org/10.1109/SmartIoT.2019.00063>.
- Rutherford, J. and O. Coutard (2014). "Urban Energy Transitions: Places, Processus and Politics of Socio-technical Change". *Urban Studies* 51(7):1353-1377. DOI: <https://doi.org/10.1080/19406940.2016.1272620>.
- Salvador, J., et al. (2017). *PPP For Cities Case Studies. Barcelona GIX: IT Network Integration (Spain)*. Available from <https://www.uneceppp-icoe.org/people-first-ppps-case-studies/ppps-in-it/barcelona-gix-it-network-integration-barcelona-spain/>.
- Salukvadze, J. and A. Golubchikov (2016). "City as a geopolitics: Tbilisi, Georgia – A globalizing metropolis in a turbulent region". *Cities* 52:39-54. DOI: <https://doi.org/10.1016/j.cities.2015.11.013>.
- Thornbush, M. and O. Golubchikov (2020). *Sustainable Urbanism in Digital Transitions, From Low Carbon to Smart Sustainable Cities*. Cham: Springer.
- Thornbush, M., O. Golubchikov and S. Bouzarovski (2013). "Sustainable cities targeted by combined mitigation-adaptation efforts for future-proofing". *Sustainable Cities and Society* 9:1-9. DOI: <https://doi.org/10.1016/j.scs.2013.01.003>.
- United Nations Department of Economic and Social Affairs (2018). *Population Dynamics*. Available from <https://population.un.org/wup/>.
- United Nations Department of Economic and Social Affairs and United Nations Development Programme (2012). "Synthesis of National Reports for Rio+20". United Nations Conference on Sustainable Development. Available from https://sustainabledevelopment.un.org/content/documents/742RIO+20_Synthesis_Report_Final.pdf

United Nations Office for Disaster Risk Reduction (2019). *Global Assessment Report on Disaster Risk Reduction*. Available from https://gar.undrr.org/sites/default/files/reports/2019-06/full_report.pdf.

United Nations Economic Commission for Europe (2011). *Climate Neutral Cities: How to Make Cities Less Energy and Carbon Intensive and More Resilient to Climatic Challenges*. Geneva: UNECE. Available from https://www.unece.org/fileadmin/DAM/hlm/documents/Publications/climate.neutral.cities_e.pdf.

United Nations Economic Commission for Europe (2015). *Maastricht Recommendations on Promoting Effective Public Participation in Decision-making in Environmental Matters*. Available from <https://www.unece.org/index.php?id=49142andL=0>.

United Nations Economic Commission for Europe (2017a). *Agricultural Quality Standards*. Available from <https://www.unece.org/leginstr/agri.html>.

United Nations Economic Commission for Europe (2017b). *Geneva Ministerial Declaration on Sustainable Housing and Urban Development*. Available from https://www.unece.org/fileadmin/DAM/hlm/sessions/docs2017/ECE_HBP_2017_1_ENG_cover.pdf.

United Nations Economic Commission for Europe (2017c). *Guidance on Land-Use Planning, the Siting of Hazardous Activities and Related Safety Aspects*. Available from http://www.unece.org/fileadmin/DAM/env/teia/images/1735403E_Final_ENG_web.pdf.

United Nations Economic Commission for Europe (2017d). *Second review of implementation of the Protocol on Strategic Environmental Assessment (2013-2015)*. Available from https://www.unece.org/env/eia/sea_protocol.html ; https://www.unece.org/fileadmin/DAM/env/documents/2017/EIA/Publication/ENG_Second_review_of_implementation_of_the_Protocol_on_SEA.pdf.

United Nations Economic Commission for Europe (2018a). *UNECE Air Convention: Expert Panel on Clean Air in Cities (EP-CAC)*, established at the 38th Executive Body of the Air Convention. Available from https://www.unece.org/fileadmin/DAM/env/documents/2019/AIR/EMEP_WGE_Joint_Session/UNECE_Air_Convention_Expert_Panel_on_Clean_Air_in_Cities_11-09-2019.pdf.

United Nations Economic Commission for Europe (2018b). *Words into Action Guidelines Implementation Guide for Addressing Water-Related Disasters and Transboundary Cooperation – Integrating Disaster Risk Management with Water Management and Climate Change Adaptation*. In support of the Sendai Framework. Available from https://www.unece.org/fileadmin/DAM/env/water/publications/WAT_56/ECE_MP.WAT_56_E_web.pdf.

United Nations Economic Commission for Europe (2018c). *UNECE Air Convention: Expert Panel on Clean Air in Cities (EP-CAC)*. December 2018. Available from https://www.unece.org/fileadmin/DAM/env/documents/2019/AIR/EMEP_WGE_Joint_Session/UNECE_Air_Convention_Expert_Panel_on_Clean_Air_in_Cities_11-09-2019.pdf.

United Nations Economic Commission for Europe (2019a). *2019 Report on the UNECE High-Performance Buildings Initiative*. Available from http://www.unece.org/fileadmin/DAM/energy/se/pdfs/geee/geee6_Oct2019/2019_Report_on_ICE-HPB_update.pdf.

United Nations Economic Commission for Europe (2019c). *World Forum for Harmonization of Vehicle Regulations (WP.29). How it works – How to join it*. 4th Edition. Available from <http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29wgs/wp29gen/wp29pub/WP29-BlueBook-4thEdition2019-Web.pdf>.

United Nations Economic Commission for Europe (2020b). *A Handbook on Sustainable Urban Mobility and Spatial Planning - Promoting Active Mobility*. Draft available from https://www.unece.org/fileadmin/DAM/trans/doc/2019/wp5/id_WP5-19_05e.pdf.

United Nations Economic Commission for Europe (2020c). *Aarhus Environmental Convention*. Available from <https://www.unece.org/env/pp/introduction.html> [accessed July 2020].

United Nations Economic Commission for Europe (2020d). *Ageing in Sustainable and Smart Cities*. UNECE Policy Brief on Ageing No. 24. Available from http://www.unece.org/fileadmin/DAM/pau/age/Policy_briefs/ECE_WG-1_35.pdf.

United Nations Economic Commission for Europe (2020e). *Transport Trends and Economics 2018-2019*. Available from http://www.unece.org/fileadmin/DAM/trans/main/wp5/publications/Mobility_as_a_Service_Transport_Trends_and_Economics_2018-2019.pdf.

United Nations Economic Commission for Europe and HABITAT III (2016). *HABITAT III Regional Report: Housing and Urban Development in the United Nations Economic Commission for Europe Region – Towards a City-Focused, People-Centred and Integrated Approach to the New Urban Agenda*. Available from <http://habitat3.org/wp-content/uploads/HabitatIII-Regional-Report-Europe-Region.pdf>.

United Nations Economic Commission for Europe and International Telecommunication Union (2016). *United 4 Smart Sustainable Cities*. Available from <https://www.itu.int/en/ITU-T/ssc/united/Pages/default.aspx>.

United Nations Economic Commission for Europe and World Health Organization Europe (2000). *Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes*. Available from https://www.euro.who.int/_data/assets/pdf_file/0007/88603/E89602.pdf.

United Nations Economic Commission for Europe and World Health Organization Europe (2013). *The Equitable Access Score-card supporting policy processes to achieve the human right to water and sanitation*. Available from http://www.unece.org/fileadmin/DAM/env/water/publications/PWH_equitable_access/1324456_ECE_MP_WP_8_Web_Interactive_ENG.pdf.

United Nations Economic Commission for Europe and World Health Organization Europe (2019). *The Human Rights to Water and Sanitation in Practice, Findings and lessons learned on equitable access to water and sanitation under the Protocol on Water and Health in the pan-European region*. Available from https://www.unece.org/fileadmin/DAM/env/water/publications/WH_17_Human_Rights/ECE_MP.WH_17_ENG.pdf.

United 4 Smart Sustainable Cities (2020). *A Guide to Circular Cities*. Available from https://www.itu.int/en/publications/Documents/tsb/2020-U4SSC-A-guide-to-circular-cities/files/downloads/20-00249_U4SSC_A-Guide-to-Circular-Cities.pdf.

United Nations (2015). *Paris agreement*. Available from https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf.

United Nations (2016). *Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction*. Available from https://www.preventionweb.net/files/50683_oiewgreportenglish.pdf.

United Nations (2017). *The Geneva UN Charter on Sustainable Housing*. Available from <https://www.unece.org/housing/charter.html>.

United Nations Office for Disaster Risk Reduction (2018). *Words into Action: Man-Made and Technological Hazards*. Available from http://www.unece.org/fileadmin/DAM/env/documents/2018/TEIA/Words_into_Actions.pdf.

URBACT (2019). *Gender Equal Cities*. Available from <https://urbact.eu/sites/default/files/urbact-genderequalcities-edition-pages-web.pdf>.

Varnai, P., et al. (2018). *The Silver Economy*. Technopolis, Oxford Economics. Available from http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=50754.

Wappelhorst, S. (2020). "The end of the road? An overview of combustion-engine car phase-out announcements across Europe". International Council on Clean Transportation. May 2020. Available from <https://theicct.org/sites/default/files/publications/Combustion-engine-phase-out-briefing-may11.2020.pdf>.

World Health Organization Europe (2019). "The PEP" brochure. Transport, Health and Environment Pan-European Programme. <https://thepep.unece.org/> ; https://thepep.unece.org/sites/default/files/2016-10/THE_PEP_Brochure-1_0.pdf.

Winfield, A., et al. (2019). *Ethical Issues for Robotics and Autonomous Systems*. Available from https://www.ukras.org/wp-content/uploads/2019/07/UK_RAS_AI_ethics_web_72.pdf.

Wisner, B., et al. (2004). *At Risk: Natural Hazards, People's Vulnerability and Disasters* (2nd ed). London: Routledge.

World Bank (2015b). *Competitive Cities for Jobs and Growth*. Available from <http://documents.worldbank.org/curated/en/902411467990995484/pdf/101546-REVISED-Competitive-Cities-for-Jobs-and-Growth.pdf>.

World Bank (2019). *GDP per capita, PPP (constant 2017 International \$) – Europe and Central Asia*. Available from https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD?contextual=regionandend=2019andlocations=Z7-DEandname_desc=falseandstart=2019andview=bar.

Yaraghi N. and S. Ravi (2017). "The Current and Future State of the Sharing Economy". *Brookings India IMPACT Series* No. 032017. March 2017. Available from www.brookings.edu/wp-content/uploads/2016/12/sharingeconomy_032017final.pdf.

Yenneti, K., R. Day and O. Golubchikov (2016). "Spatial justice and the land politics of renewables: Dispossessing vulnerable communities through solar energy mega-projects". *Geoforum* 76:90-99. DOI: <https://doi.org/10.1016/j.geoforum.2016.09.004>.

Yigitcanlar, T., et al. (2019). "Can cities become smart without being sustainable? A systematic review of the literature", *Sustainable Cities and Society* 45: 348-365. DOI: <https://doi.org/10.1016/j.scs.2018.11.033>.

Zuboff, S. (2019) *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*. London: Profile Books.

Web articles

100 Resilient Cities (2020). Available from <https://www.100resilientcities.org/resources/>.

Amnesty International (2020). "COVID-19, surveillance and the threat to our rights". 3 April 2020. Available from <https://www.amnesty.org/en/latest/news/2020/04/Covid-19-surveillance-threat-to-your-rights/>.

APM Research Lab Staff (2020). "The Color of Coronavirus: COVID-19 Deaths by Race and Ethnicity in the U.S.". 8 July 2020. Available from <https://www.apmresearchlab.org/covid/deaths-by-race>.

BBC (2018). "Cardiff council warm to incinerator heating scheme". 19 April 2018. Available from <https://www.bbc.co.uk/news/uk-wales-south-east-wales-43811174>.

Breckon, J. and M. Sanders (2019). "The Evidence Quarter – an idea to join up the UK's What Works Centres". *Nesta*. 23 May 2019. Available from <https://www.nesta.org.uk/blog/the-evidence-quarter-an-idea-to-join-up-the-uks-what-works-centres/>.

City of Budapest (2020). "Temporary bike lanes will help traffic during the pandemic". 6 April 2020. Available from <https://koronavirus.budapest.hu/en/2020/04/06/temporary-bike-lanes-will-help-traffic-during-the-pandemic/>.

DeVol R. (2020). "Coronavirus Regional Economic Impacts and Policy Responses". *Heartland Forward*. 23 March 2020. Available from <http://heartlandforward.org/coronavirus-regional-economic-impacts-and-policy-responses>.

Economist (The) (2020a). "Who cares? The pandemic shows the urgency of reforming care for the elderly". 25 July 2020. Available from <https://www.economist.com/international/2020/07/25/the-pandemic-shows-the-urgency-of-reforming-care-for-the-elderly>.

Economist (The) (2020b). "What is the future of the rich world's housing markets?". 16.01.2020. Available from <https://www.economist.com/special-report/2020/01/16/housing-is-at-the-root-of-many-of-the-rich-worlds-problems>.

European Commission (2020a). "Financing the green transition: The European Green Deal Investment Plan and Just Transition Mechanism". *European Commission*. 14 January 2020. Available from https://ec.europa.eu/regional_policy/en/newsroom/news/2020/01/14-01-2020-financing-the-green-transition-the-european-green-deal-investment-plan-and-just-transition-mechanism.

Florida, R. and Pedigo, S. (2020). "How our cities can reopen after the COVID-19 pandemic". *The Avenue*. 24 March 2020. <https://www.brookings.edu/blog/the-avenue/2020/03/24/how-our-cities-can-reopen-after-the-Covid-19-pandemic/>.

Hallgren, F. (2017). "What will the environmental weather be like today?". *IVL*. 5 June 2017. <https://www.ivl.se/english/startpage/top-menu/pressroom/press-releases/press-releases---arkiv/2017-06-05-what-will-the-environmental-weather-be-like-today.html>.

Harris A. (2020). "The Other Way the Coronavirus Will Ravage our Cities". *The Atlantic*. 1 April 2020. Available from <https://www.theatlantic.com/politics/archive/2020/04/coronavirus-cities-bankruptcy/609169/>.

Helsinki Smart Region (2020). Is Whim the Netflix of Mobility? Available from <https://helsinkismart.fi/portfolio-items/whim/> [accessed August 2020].

Henley, J. (2019). "Ten cities ask EU for help to fight Airbnb expansion". *The Guardian*, 20 June 2019. Available from <https://www.theguardian.com/cities/2019/jun/20/ten-cities-ask-eu-for-help-to-fight-airbnb-expansion>.

Kharpal, A. (2020). "Use of surveillance to fight coronavirus raises concerns about government power after pandemic ends". *CNBC*. 26 March 2020. Available from <https://www.cnbc.com/2020/03/27/coronavirus-surveillance-used-by-governments-to-fight-pandemic-privacy-concerns.html>.

Kyiv Smart City (2020). Available from <https://www.kyivsmartcity.com/en/> [accessed July 2020].

Martinez Euklidiadas, M. (2020). "Paris wants to become a 15-minute city". *Tomorrow.Mag by Tomorrow.City*. 18.05.2020. Available from <https://www.smartcitylab.com/blog/governance-finance/paris-15-minute-city/>.

Ministry of Energy and Environmental Protection of Ukraine (2020). *Ecomapa* Interactive map of georeferenced reported natural landfills. Available from <https://ecomapa.gov.ua/> [accessed July 2020].

Modijefsky, M. (2019). "Lyon: putting accessibility at the heart of city life". *Eltis*. 14 March 2019. Available from <https://www.eltis.org/discover/case-studies/lyon-putting-accessibility-heart-city-life>.

Mulgan, G. (2015). "The six Ws: a formula for what works". *Nesta*. 19 March 2015. Available from <https://www.nesta.org.uk/blog/the-six-ws-a-formula-for-what-works/>.

Mulgan, G. and Breckon, J. (2018). "Celebrating five years of the UK What Works Centres". *Nesta*. 29 January 2018. Available from <https://www.nesta.org.uk/blog/celebrating-five-years-of-the-uk-what-works-centres/>.

Nilsen, T. (2019). "This is how Acting Deputy Governor Maria Derunova plans to make Murmansk great again". *The Barents Observer*. 20 October 2019. Available from <https://thebarentsobserver.com/en/life-and-public/2019/10/how-deputy-acting-governor-maria-derunova-plans-make-murmansk-great-again>.

Organisation for Economic Co-operation and Development (2020). "Building Back Better: A Sustainable Resilient Recovery avec COVID-19". *Tackling Coronavirus (COVID-19): Contributing to a Global Effort*. 5 June 2020. Available from <http://www.oecd.org/coronavirus/policy-responses/building-back-better-a-sustainable-resilient-recovery-after-covid-19-52b869f5>.

Office of National Statistics (UK) (2020). "Deaths involving COVID-19 by local area and socioeconomic deprivation: deaths occurring between 1 March and 31 May 2020". 12 June 2020. Available from <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/deaths-involvingcovid19bylocalareasanddeprivation/deathsoccurringbetween1marchand31may2020> [accessed July 2020].

Paul, S. (2018). "BIM adoption around the world: how good are we?". *Geospatial World*. 15 December 2018. Available from <https://www.geospatialworld.net/article/bim-adoption-around-the-world-how-good-are-we/>.

Pilkington, E. (2020). "Black Americans dying of Covid-19 at three times the rate of white people". *The Guardian*. 20 May 2020. Available from <https://www.theguardian.com/world/2020/may/20/black-americans-death-rate-covid-19-coronavirus>.

Quaggiotto, G., Leurs, B. and Christiansen, J. (2017). "Towards an experimental culture in government: Reflections on and from practice". *Nesta*. 6 March 2017. Available from <https://www.nesta.org.uk/blog/towards-an-experimental-culture-in-government-reflections-on-and-from-practice/>.

Regreen Nature-Based Solutions (2020). "Urban Living Labs". Available from <https://www.regreen-project.eu/urban-living-labs/> [accessed July 2020].

Schwartz M. (2020). "These N.Y.C. Neighborhoods Have the Highest Rates of Virus Deaths". *New York Times*. 18 May 2020. Available from <https://www.nytimes.com/2020/05/18/nyregion/coronavirus-deaths-nyc.html>.

Shenker, J. (2020). "Cities after coronavirus: how Covid-19 could radically alter urban life". *The Guardian*. 26 March 2020. Available from https://www.theguardian.com/world/2020/mar/26/life-after-coronavirus-pandemic-change-world?CMP=share_btn_link.

Tabbitt, S. (2020). "Using digital twins to maximise returns on existing infrastructure". *SmartCitiesWorld*. 2 April 2020. Available from <https://www.smartcitiesworld.net/special-reports/using-digital-twins-to-maximise-returns-on-existing-infrastructure>.

Telenor Group (2020). *Tech Trends 2020*. Available from <https://www.telenor.com/innovation/research/tech-trends-2020/> [accessed July 2020].

Thornhill, J. (2019). "Smart cities still need a human touch". *Financial Times*. 5 August 2019. Available from www.ft.com/content/67c52480-b51f-11e9-8cb2-799a3a8cf37b.

UK Cabinet Office (2020). *What Works*. Available from <https://whatworks.blog.gov.uk/about-the-what-works-network/> [accessed July 2020].

United Nations Office for Disaster Risk Reduction (2020). *Resilience* (UNDRR Terminology). Available from <https://www.undrr.org/terminology/resilience> [accessed July 2020].

United Nations Economic Commission for Europe (2017e). *UNECE Portal on Standards for the SDGs*. Available from <https://standards4sdgs.unece.org/> [accessed July 2020].

United Nations Economic Commission for Europe (2019b). *Trees in Cities Challenge*. Available from <https://treesincities.unece.org/>.

United Nations Economic Commission for Europe (2020a). "Growing old in the city: age-friendly environments are needed to create sustainable and smart cities for all ages". Available from <http://www.unece.org/info/media/news/population/2020/growing-old-in-the-city-age-friendly-environments-are-needed-to-create-sustainable-and-smart-cities-for-all-ages/doc.html>.

United Nations Economic Commission for Europe (2020f). *About the Protocol on Water and Health*. Available from <https://www.unece.org/?id=2975> [accessed August 2020].

United Nations Economic Commission for Europe (2020g). *UNECE releases new dataset for tram and metro statistics, supporting informed policy responses for sustainable post-COVID mobility*. 18 May 2020. Available from <https://www.unece.org/info/media/presscurrent-press-h/transport/2020/unece-releases-new-dataset-for-tram-and-metro-statistics-supporting-informed-policy-responses-for-sustainable-post-covid-mobility/doc.html> [accessed August 2020].

United Nations Economic Commission for Europe (2020h). *Data Sources on Coronavirus Impact on Transport* (Wiki). Available from <https://wiki.unece.org/display/DSOCIOT/Data+Sources+on+Coronavirus+impact+on+transport> [accessed August 2020].

UNECE International PPP Centre of Excellence (2019). *People-first PPPs*. Available from <https://www.uneceppp-icoe.org/people-first-ppps/> [accessed July 2020].

United Nations (2020). *Austria: Gender Building*. Available from <https://www.un.org/ruleoflaw/blog/portfolio-items/austria-gender-budgeting/> [accessed July 2020].

Uppsala Kommun (2020). *Uppsala – Award Winning Climate City*. Available from <https://www.uppsala.se/climatecity> [accessed July 2020].

Vander Ark, T. (2018). "How Cities are Getting Smart Using Artificial Intelligence". *Getting Smart*. Available from <https://www.forbes.com/sites/tomvanderark/2018/06/26/how-cities-are-getting-smart-using-artificial-intelligence/#675780b53803>.

Veron, P. (2018). "Participatory Paris: Home of the largest participatory budget in the world". *RSA Journal*. 9 July 2018. Available from <https://medium.com/rsa-journal/participatory-paris-home-of-the-largest-participatory-budget-in-the-world-37425aab9a99>.

Vosloo, S., M. Penagos and L. Raftree (2020). "COVID-19 and children's digital privacy. How do we use technology and data to combat the outbreak now, without creating a 'new normal' where children's privacy is under constant threat?". *UNICEF*. 7 April 2020. Available from <https://www.unicef.org/globalinsight/stories/Covid-19-and-childrens-digital-privacy>.

Water Technology (2020). "Sorek-Refa'im Sewage Treatment Plant". *Water Technology*. Available from <https://www.water-technology.net/projects/sorek-treatment/> [accessed July 2020].

World Health Organization (2020). *Developing age-friendly cities and communities: Case Studies from around the world*. Available from <https://extranet.who.int/agefriendlyworld/resources/age-friendly-case-studies/> [accessed July 2020].

Willsher, K. (2020). "Paris mayor unveils '15-minute city' plan in re-election campaign". *The Guardian*. 7 February 2020. Available from <https://www.theguardian.com/world/2020/feb/07/paris-mayor-unveils-15-minute-city-plan-in-re-election-campaign>.

Willsher, K. (2018). "Paris on flooding alert as rising Seine causes travel disruption". *The Guardian*. 25 January 2018. Available from <https://www.theguardian.com/world/2018/jan/24/paris-flooding-alert-rising-seine-transport-disruption>.

World Bank (2015a). *Brief on Smart Cities*. Available from <https://blogs.worldbank.org/digital-development/building-smarter-cities>.

General comments:

- 1- Put all tables, boxes, figures closer to where they were first referred to. I noticed they are placed after each section.
- 2- No abbreviations in headings and no first letter capitalized unless it's a name or title (I made an exemption on box 1 and box 35 for UNECE).
- 3- "Member States" with member in capital is only for the United Nations, not for UNECE.
- 4- Spelling are inconsistent. All corrections made were based on UN Editorial Manual.
- 5- This doesn't have the Copyright page yet as the copy is from the Information document.
- 6- We should not use contractions, e.g. UNECE's, city's.
- 7- I did not check the list of sources (that is too much for me to do). PLS MAKE SURE ALL SOURCES ARE CHECKED.