European Commission

THE HUMAN CENTRED CITY

Opportunities for Citizens through Research & Innovation

Research and Innovation

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The human-centred city:

Opportunities for citizens through research and innovation

Report of the High-Level Expert Group on Innovating Cities

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MAIN RECOMMENDATIONS

A series of recommendations can be drawn from the report 'The human-centred city: Opportunities for citizens through research and innovation'. These are central and should guide integrated research and innovation (R&I) actions.

The first set of recommendations concerns a new approach to R&I actions:

- R&I actions based on this report should be truly integrated and cut across two or more of the dimensions presented in the report while keeping measurement and governance as key principles.

- Citizens should always be at the centre of any R&I action in terms of concepts, design, execution and dissemination.

- R&I actions can generate innovations that are opportunity-enhancing for citizens, creating prosperity, well-being and high-quality jobs in all cities of Europe.

- Sustainability is central and shapes conceptualising all other urban outcomes, from growth and jobs (prosperity), the built environment (place) and governance to how places are made and function.

- Measurement and evaluation are leading accountability principles for R&I actions.

- The approach to R&I actions proposed in this report should remain an open framework flexible enough to deal with unknown developments and challenges for cities.

The second set of recommendations concerns the key summary input for R&I actions:

- Think, plan and act in city-making from a 360º perspective. This lens helps the needs and priorities of differing groups — the young, the old, women, men, differing ethnicities and origins, abilities and lifestyles — to be seen. This has impacts for how places are shaped, what people's economic prospects are and as result, how resilient the city can become.

- Put issues of affordability centre stage. This implies inclusiveness and implementing strategies that focus on disadvantage and inequalities. It affects spatial and physical planning as well as income distribution issues and fostering affordable technologies.

- Understand the psychological manifestations of absorbing deep-seated changes that are underway and their consequences, such as climate change, and assess the best routes for individuals to be willing to change behaviours towards more sustainable lifestyles.

- Embed circular thinking in how places are physically put together and how our economic system can work as a means of creating more sustainable development pathways.

- Ensure technology developments, especially digitisation processes, are human-centred and not technology-driven and support low-cost technologies to meet global challenges such as climate targets.

- Shift to place-based thinking, which implies an integrated approach to city development as it considers both urban hardware infrastructure and its diverse activities, from the social to the economic. These activites are the software aspect.

- Recouple social, economic and environmental agendas. This implies rethinking the criteria for what makes a prosperous place and how to achieve inclusive prosperity and jobs within planetary boundaries.

- Focus on good-quality affordable housing as central for cities to address their core challenges, including: tackling inequalities and social division, bringing skills to the places where they are needed, maintaining mixity and diversity, and ensuring a fair and creative urban society.

- Recognise that cities are nodes of global networks of skills, knowledge, capital and ultimately (public and private) value. Building physical and non-physical connectivity and collaborative networks across all types of cities and regions is central to innovation. This also makes places more resilient and is a key objective for human-centred sustainable cities.

- Be aware that cities are the places where skills are often created, matched and combined. It is in cities that preparing for the future of work will take place and so can steer how skills are adapted to establish more cohesive urban environments.

- Acknowledge that a human-centred city involves a fundamental behavioural change, not only by civil society but also by firms and governments at all levels.

- Absorb how digitisation, artificial intelligence and sensing technology are fundamentally changing the way we think about city and urban life and how these will be organised in the next decade. R&I opportunities and threats should be explored from different dimensions, as well as measuring outcomes and identifying appropriate governance arrangements.

- Establish governance arrangements focused on a quadruple-helix approach to visioning and implementation, whereby the city administration, the private sector, knowledge institutes and citizens determine strategy and how places should develop.

- Create measurement tools to consider the city as an integrated ecosystem, with people, place, prosperity and resilience at its core.

1. EXECUTIVE SUMMARY

'The Human-centred city: Opportunities for citizens through research and innovation' outlines how R&I policy can focus its activities, how Horizon Europe funding can deliver on the United Nations (UN) Sustainable Development Goals (SDG) — in particular the 11th of its 17 goals: 'To make cities inclusive, safe, resilient and sustainable' — and how cities have a decisive role in accelerating society's transition to reach the other 16 SDG. That 11th goal and other major global agreements frame our report and its recommendations.

The world faces an urgent requirement to act dramatically. To manage the transition is a systemic challenge. It cannot be tackled piece by piece. It can only be addressed in an integrated way. This is the task to which Horizon Europe, and within that its innovative cities initiatives and its research and innovation actions, must respond, encapsulated in the EU's 'Climate-neutral and Smart Cities' mission ([1]).

The scale of what we need to do is clear. According to the Intergovernmental Panel on Climate Change (IPCC), we have 12 years to a climate catastrophe unless the 1.5°C temperature-rise limit is achieved by emissions reductions and more. The annihilation, furthermore, of wildlife is now an emergency that threatens biodiversity and civilisation. Our global food system needs to shift as it is unsustainable, unhealthy and destabilising. Linked to this is that globally, populations are rising while our ability to sustain life on Earth is shrinking.

Cities are major consumers of global resources and energy. They intensify climate change, water, food security and resource shortages. Air pollution, congestion and noise are responsible for growing rates of premature deaths and related diseases.

This systemic challenge focuses on four interconnected questions that cluster in cities. These questions are the risk nexus, the combination of escalating problems interacting with each other and agglomerating our problems into one: the inability of the current economic order, which is 'materially expansive, socially divisive and environmentally hostile' ([2]), to provide the equality and stability citizens increasingly demand. To avoid crisis turning into collapse, a fundamental rethink of the structure and operation of the current economic system is necessary. This will affect lifestyles. Another pattern of growth is

[1] Mazzucato, Mariana, *Mission-oriented research & innovation in the European Union: A problem-solving approach to fuel innovation-led growth*, 2018 https://ec.europa.eu/info/sites/info/files/mazzucato_report_2018.pdf

[2] European Commission, *Final report of the High-Level Panel of the European Decarbonisation Pathways Initiative*, 2018 https://ec.europa.eu/info/sites/info/files/research_and_innovation/research_by_area/documents/ec_rtd_decarbonisation-report_112018.pdf

required that both ensures that we operate within planetary boundaries as well as provides the ability to create wealth and innovations. Guiding a digitising age and the technologies associated with it is vital to guarantee that the evolving fourth industrial revolution is progressed in a human-centred way. Digitisation, designed and used well, can help create a fourth industrial revolution that is lean, clean and green. Yet threats of algorithmic control remain. Our task is to redesign the world and all its systems — ethically, politically, economically, socially, technologically and culturally.

Cities are complex metabolisms that attract people, economic activity, resources, opportunity and innovation. To function well, they rely on systems and networks, from transport to energy, food, water, waste management and security as well as human tangible and intangible culture. There are increasing vulnerabilities, including the disruptive impacts of shocks, especially those driven by climate change or pollution. The recent financial crisis has exacerbated stresses and social conflict. It has increased the polarisation of society. Psychologically overwhelmed people are unclear what their role is in averting the impending crisis.

Cities are the laboratories of solving the problems of their own making. This includes addressing energy and resource efficiency, climate change and pollution, connected urban mobility, water, waste, sustainable food systems and cultural diversity, establishing emotionally sustaining, physically attractive and aesthetically gratifying environments built on strong cultural identities as well as cities' overall health and well-being.

Within the range of seemingly intractable problems, there are substantial opportunities. These can be harnessed in innovative cities, which identify, nurture, support and promote skills, expertise and talent and open mindedness. They include people and organisations and foster widespread participation to tap into the widest reservoir of potential. They have enabling conditions, such as a regulations and incentives regime, that are shaped and encouraged by the political and public framework, including the public administrations.

The priority for creative thinking, action and targets for innovation in cities today is to address global challenges. Cities are accelerators of opportunity. Their proximities force-feed interaction, exchange and innovation. Cities are containers where high skills, expertise, strategic knowledge, artistic talent, research, ambition and entrepreneurship coalesce. The more the collective intelligence, energy and focus the diversity of actors in cities bring together, the more creative and innovative they are. Within this, public procurement can play a major role as it is one of the greatest levers to help guide innovation processes.

The most innovative cities have a physical setting that is well-assembled, where there is history, character, distinctiveness, diversity and vitality, with high levels of liveability and all the necessary support facilities, from health and education to culture and public spaces. All of these generate a rich civic life.

Our guiding principle is that cities should be more human-centred. This is not just a right, but also involves responsibilities, obligations and duties. To be a city for citizens where citizens become city-makers and shapers, makers and co-

creators of their evolving urban development is not an entitlement. It means being an active citizen concerned with the local and European context and with the urgency of the global context.

Complex problems can only be unscrambled and dealt with systemically using both expert knowledge and that of citizens, as well as by breaking silos and assessing problems in an integrated way. The overall dynamic of cities and their potential is shaped, too, by a vortex effect that strengthens some cities and weakens others We address four big themes that must be seen in an integrated way. They are '**people', 'place', 'prosperity'** and '**resilience**'.

The **people** dimension looks at making the most of diversity and social inclusion, building community and social bonding, creating an inclusive city for all to avert inequalities and spatial segregation and engaging citizens. The **place** dimension focuses on planning within planetary boundaries, with renewables and energy efficiency at its core. It includes decarbonising all our systems, rethinking food systems, adaptive reuse, shared and smart mobility services, fostering the circular economy and embedding cradle-to-cradle business models, and creating a built environment that works for people and emotionally fully meeting needs. The **prosperity** dimension looks at the genesis, diffusion and absorption of innovation in a systemic way. It highlights an inclusive model of city level innovation by addressing skills and the unequal distribution of opportunities. It stresses the need to achieve full economic returns from mixity and diversity and models able to finance public services and urban policies. The **resilience** dimension establishes how foundations for building resilience can be created, based on vulnerability profiles with mechanisms to avert shocks and risks including building institutional capacity.

Two cross-cutting dimensions complete the loop: **governance** fit for purpose for our age — adapted and aligned to the aims of global priorities and agendas — and **measurement** with benchmarks that are driven by the indicator set established by SDG 11 as well as a method to evaluate an integrated innovative urban ecosystem.

2. SETTING THE SCENE

Introduction

The zeitgeist, or spirit of the times, is one of rising anxiety. There is fear that our escalating problems cannot be solved without a shift in thinking, planning and action. A business-as-usual approach, many feel, will not get us to where we need and want to be, which is, as UN SDG 11 states: 'To make cities inclusive, safe, resilient and sustainable'.

That goal frames our report and the recommendations proposed, as does the EU's mission to aim for 'Climate-neutral and Smart Cities' and the recommendations proposed by Professor Mariana Mazzucato ([3]) for how to implement and govern a mission-oriented process, which is a problem-solving approach to fuelling innovation-led growth.

That goal frames our report and the recommendations proposed, as does the EU's mission to aim for 'Climate-neutral and Smart Cities' as well as other major global agreements, such as the Paris Agreement on climate change from COP 21, UN-Habitat's New Urban Agenda, the Global Covenant of Mayors, the Urban Agenda for the EU, and the Sendai Framework for Disaster Risk Reduction 2015-2030. Additionally important are: the World Urban Forum Declaration on Cities 2030, with its focus on tackling all inequalities and especially 'encouraging the sharing of creative solutions and innovative practices which enable a shift in mindset necessary to drive change'; the Global Solutions Summit, which provides policy advice to the G20 and which has focused on the need for systemic change and a paradigm shift, especially recoupling social and economic agendas; and finally, the global discussion on cities, which is increasingly focused on being human centred, as with the work of the United Cities and Local Governments (UCLG).

The **main objective** of this advisory document is to outline how research and innovation policy in the European Union (EU) can focus its activities on cities, how Horizon Europe funding can deliver on SDG 11 through innovation and how innovative cities can have a central and decisive role in accelerating society's transition to reach the other 16 SDG.

The document focuses specifically on **gaps in research and innovation**. Readers should not expect to see proposals related to technical questions, for instance on smart cities or mobility developments such as autonomous vehicles, that various Directorate Generals (DG) and Horizon 2020 (H2020) funding have extensively covered elsewhere. However, sensing systems will be ubiquitous and are involved in all the issues addressed as a basic infrastructure. This is because they involve big data, which is used to manage assets and resources more efficiently. Our focus instead is to highlight how human beings are put at the

[3] Mazzucato, Mariana, *Governing Missions in the European Union*, 2019 https://ec.europa.eu/info/sites/info/files/research_and_innovation/contact/documents/ec_rtd_mazzucato-report-issue2_072019.pdf

centre of development and how they adapt and become active citizens in addressing global concerns.

The bigger context

Cities are interconnected systems that attract people, economic activity, resources, opportunity and innovation. To function well, they rely on complex systems and networks — from transport to energy, food, water, waste management, institutions and security — that ensure their health and well-being. Yet cities suffer from increasing vulnerabilities and the disruptive impacts of single or multiple shocks, from climate change to pollution, from economic recessions to mass migrations that expose cities to long-term stresses.

The recent financial and economic crisis and the uneven patterns of recovery have exacerbated the polarisation of society. The high-quality jobs available for the highly skilled contrasted with an increasingly precarious situation for most citizens aggravates and intensifies tension, challenging the well-being of citizens.

The scale of the challenge becomes clearer when assessed against the backdrop of the 12-year limit hypothesised by the IPCC. They argue that a climate catastrophe will become inevitable unless we limit the temperature rise of the climate to 1.5°C through emissions reductions and more. Another challenge is how we address increasing social conflict and rising income and wealth disparities, exacerbated by our labour market. Furthermore, our biodiversity and natural resources depletion challenge is vast as since 1970, humanity has wiped out 60 % of mammals, birds, fish and reptiles. This annihilation of wildlife is now an emergency that might threaten civilisation.

The link here is that globally, too, our population is rising while our ability to sustain life on Earth is shrinking. Western production and consumption patterns only accelerate this process. This highlights both demographic questions and the need to move to a more sustainable economy and society.

Urban environments also amplify global threats as they are the major consumers of global resources and energy. Projections suggest this trend will continue growing in the next 20-30 years.

It is the combination of escalating challenges interacting upon each other and the need to act with urgency — the risk nexus — that shapes our biggest challenge as it agglomerates all societal and environmental challenges into one massive one. This is a substantial, strategic governance dilemma.

Overriding everything is digitisation and impending artificial intelligence and its potential role in helping to create a fourth industrial revolution that is lean, clean and green. There are strong opportunities, yet there are threats of unsustainable inequality, algorithmic control and people's sense of feeling disempowered.

People are psychologically overwhelmed and do not know what their role is in averting the impending crisis. There is a systemic crisis, especially when our

economic order is seen as 'materially expansive, socially divisive and environmentally hostile' ([4]).

In sum, this sets us a task to redesign the world and all its systems — ethically, politically, economically, socially, technologically and culturally.

The role of cities

The fight on climate change and achieving carbon neutrality, sustainable development and a circular economy will be won or lost in cities. Whilst national governments have the authority to define the overall regulations and policy landscape, cities often have greater legitimacy thanks to their closer proximity to citizens and their needs. They are the catalysts to enable the transformation as they are more closely connected to citizens, and so can accelerate that transition of society.

Cities are complex organisms with inextricably inter-linked challenges, yet they are also the laboratories of solving the problems of their own making. This includes generating new economic and social opportunities for all citizens while addressing energy and resource efficiency, climate change and pollution, connected urban mobility, water, waste, sustainable food production systems and issues of cultural diversity. It includes establishing emotionally sustaining, physically attractive and aesthetically gratifying environments built on strong identities as well as cities' overall health, resilience and well-being.

Cities contribute to climate change, water, food security and resource shortages, and air pollution, traffic congestion and noise in cities contributes to an increasing number of premature deaths and related diseases.

Overall, this threatens the capacity of individuals, communities, institutions, businesses and systems within a city to survive, adapt, and grow, as chronic kinds of stresses proliferate.

Separately and linked is the evolving dynamics of cities where there is a positive relationship between urban density, productivity, innovation and prosperity. Its flipside is that a growing number of cities are being left behind or shrinking.

Cities, crucially, are the places through which the European Commission can accelerate society's transition by funding R&I projects that pilot investments for the future ([5]). R&I actions have a key role as accelerators that help cities tackle their challenges in new and innovative ways, generating new opportunities for all citizens in rich and poor areas of the EU.

[4] European Commission, *Final report of the High-Level Panel of the European Decarbonisation Pathways Initiative*, 2018 https://ec.europa.eu/info/sites/info/files/research_and_innovation/research_by_area/documents/ec_rtd_decarbonisation-report_112018.pdf

[5] European Commission, *Investing in European success: Innovating cities in Europe and worldwide*; European Commission, *EU Research and Innovation (R&I) actions for and with cities*, a yearly mapping report that provides an overview of the main EU R&I actions funded under H2020 and past Framework Programmes FP5, FP6 and FP7.

What is an innovative city?

Cities are living organisms and metabolisms — combinations of built physical fabric, human creativity and activities, transactions, the in- and outflows of resources, products and people. What happens in a city is both tangible and intangible. People and their cultures define place and place shapes its people.

Within the challenges addressed are innumerable opportunities to develop innovations, especially when the creativity required has a purpose, such as the mission to create 'Climate-neutral and Smart Cities'. That goal provides creativity's lifeblood. Innovations today should be focused on sustainable solutions that allow us to move towards resilience. People's motivation, will and capacities can unleash that innovative potential, which all cities have, to address not only their own challenges but also those of the world.

Innovative cities identify, nurture, support and promote skills, expertise and talent. They include people and organisations and foster widespread participation to tap into the widest reservoir of potential. They have enabling conditions that are shaped and encouraged by the institutional and political framework, including the public administration.

The priorities for creative thinking, action and targets for innovation in a city depend on context. Today, this means addressing the global challenges noted. Cities are accelerators of opportunity. Their proximities force-feed interaction, exchange and innovation where the right ecosystem conditions are in place. Cities are containers where high skills, expertise, creativity, strategic knowledge, research, ambition and entrepreneurship can coalesce. The more collective intelligence, energy and strategic focus the diversity of actors in cities can bring together, combine and re-combine, the more innovative they can become. A key role here is to connect public and private organisatons, civic interests and learning institutions in a fully functional urban ecosystem.

Innovative cities have hard and soft infrastructures, both physical institutions, such as strong public and private research entities, as well as financial resources. All these are necessary to generate, develop, prototype and follow through on innovations. Not all innovations are technical as many are concerned with policy or social and cultural innovation. Additionally, innovative cities display an open mindset and attitude that helps cultivate exchange and networking. This establishes a culture of creativity and innovation.

The public sector has the potential to provide overall guidance and to offer clarity in its perspective, purpose, direction. Innovative cities have leaderships with ambition and vision. They are strategic and create a regulatory and incentives regime to match urgent tasks and priorities. These set strategic policy principles that are non-negotiable yet, when implementing these, innovative places are alert and tactically flexible to be responsive to changing circumstances. Within this strategic agility, they are professional in that they deliver on what they say. Furthermore, they have an integrated vision of

policymaking and strive to break down the traditional silo system, keeping the best of its vertical knowledge.

Industry and learning institutions are innovative, with a strong focus on new trends, emerging technologies and fledgling sectors, such as green economy, the creative industries or how to use digital possibilities. Their commitment to research and development is well above average and cross-fertilisation the norm.

Such cities exploit and harness their innovation potential. This involves strong communication and connectivity across divisions or silos as well as intense networking internally and with the wider world. Such places foster entrepreneurship and have incentives to match, whether these are focused on business opportunities or social, cultural and environmental aims. That entrepreneurial attitude is embedded across city institutions. Finally, the most innovative cities have a physical setting that is well-assembled. There is history, character, distinctiveness, diversity and vitality, with high levels of liveability and all the necessary support facilities — from health, to culture to public spaces — that generate a rich civic life.

There are innumerable examples of innovative projects in cities. One thinks here of Bilbao's public space management, Copenhagen's progress in driving sustainability, Helsinki's use of inclusive and participative data-sharing initiatives, Eindhoven's leadership in generating a quadruple-helix approach to its development, Reggio-Emilia's student-centred, self-directed and experientially driven educational philosophy, Barcelona's approach to pushing intercultural approaches to city-making and much more. The task for all cities is to become comprehensibly innovative. That is the challenge that this report sets.

A major driver to generate urban innovation is procurement — a strong power of local government. To harness supplier innovation through procurement, the public sector can be more demanding customers by setting innovation criteria. It can move away from the 'race to the bottom' by determining that the lowest price is not the main criterion in awarding contracts ([6, 7]).

Our response

Our guiding principle is that cities should leverage the opportunities offered by innovation in order to become more human-centred. This is a right, but also involves responsibilities, obligations and duties. To be a **city for citizens** where **citizens become city-makers** and shapers, makers and co-creators of their evolving urban development is not an entitlement. It means being an active citizen concerned both with the local context and the urgency of addressing the global context.

[6] Landry, C., *The Creative City: A Toolkit for Urban Innovators*, Earthscan, 2000.
[7] Hyams, J. and Landry, C., *The Creative City Index: Measuring the Pulse of the City*, Comedia, Gloucestershire, 2012.

Our approach is systemic as only then can complex problems be unscrambled and appropriately dealt with. This means recognising expert knowledge as well as that of citizens, but also breaking silos and assessing problems in an integrated manner from which it is easier to find solutions and opportunities. The innovation arena then expands to a variety of well-connected and communicating actors — public, private, civic.

We acknowledge, too, that generating knowledge about cities involves a close partnership between citizens, cities and learning institutions. Therefore, the research agendas need to be jointly framed with cities as they do not want to be merely case studies; they want more direct involvement in shaping and implementing research agendas. There are already numerous examples of such deeper collaborations, such as the Amsterdam Smart City initiative where the city explores interdisciplinary metropolitan solutions in close collaboration with both public and private partners and citizens. It seeks to add value to research in practice, using the city of Amsterdam as a living lab. Another is the Helsinki Urban Academy, where the city's research department works with the University of Helsinki and Aalto University to identify issues and help implement solutions. Indeed, many of Europe's larger cities have well-funded research entities that are beginning to operate in similar ways.

We highlight, too, that the city is our joint commons and therefore the powerful role civil society and public engagement can play in helping achieve the EU mission for cities. That implies finding means for citizens to be involved in the creation, research and implementation of R&I actions and giving citizen science a higher profile. The recent urban activism and new formats for learning and sharing that are evolving are all witness to this changing landscape.

Embedded, therefore, is a policy-learning loop whereby the assessment and evaluation of progress in making cities innovative leads to learning that fosters further policy innovation.

Structure of the report

This report first highlights **three issues** that cut across and shape the overall dynamic landscape of cities and their potential futures:

- the risk nexus and its dangers, which creates immense uncertainty;
- the vortex effect, which strengthens some cities, and its obverse, shrinking cities or regions, and the urban dynamic with its local/global linkages;
- the digitising world and technologies associated with it, especially artificial intelligence and its manifestations on everything, including ensuring digital rights and sovereignty of both citizens and cities.

Four main dimensions highlight big themes that determine the urban metabolism. These must be seen in an integrated way. They are `**people',**

'place', 'prosperity' and addressing those well makes achieving the fourth, '**resilience**', easier.

- The **people** dimension looks at making the most of cultural diversity, building community and social bonding, creating an inclusive city for all to avert inequalities and spatial segregation, addressing demographic dynamics and fostering good living conditions and accessibility to services. At the same time, it recognises the real and symbolic significance of tangible and intangible cultural heritage and the importance of individual and collective memory for the life of the city.

- The **place** dimension focuses on planning within planetary boundaries, with renewables and energy efficiency at its core. This includes decarbonising all our systems, rethinking food cycles, adaptive reuse, shared and smart mobility services, fostering the circular economy and embedding cradle-to-cradle business models and creating a built environment that works for people in day-to-day terms as well as emotionally.

- The **prosperity** dimension includes looking at the genesis, diffusion and absorption of innovation in a systemic way for cities to generate economic opportunities, jobs and development. It highlights an inclusive model of city-level innovation by addressing skills and the unequal distribution of economic and employment opportunities. It looks at how disruptive new technologies can be harnessed to global agendas. It stresses the need to achieve full economic returns from mixity and diversity and models that are able to finance public services and urban policies.

- The **resilience** dimension establishes how the foundations for building resilience can be created based on vulnerability profiles, with mechanisms to avert shocks and stresses and that include building institutional capacity.

Finally, **two cross-cutting** dimensions complete the loop. They are:

- **governance** fit for purpose for our age and that is adapted and aligned to the aims of global priorities and agendas;

- **measurement** that proposes benchmarks driven both by the indicator set established through SDG 11 and by looking at how an integrated innovative urban ecosystem can be evaluated. It stresses the power of big data that can monitor both the ongoing dynamics of urban systems but also the need to understand and assess trends as well as how the trade-offs in moving towards the transition can be judged.

The world faces an urgent need to transition dramatically. To manage **the transition is a systemic challenge**. It cannot be tackled piece by piece. It can only be addressed in an integrated way. This is the task to which Horizon Europe and within that, its innovative cities initiatives, must respond.

3. FORCES SHAPING URBAN CHANGE

Three forces both shape and threaten cities' potential to become and be innovative to reach their wider aim of being inclusively sustainable. They affect all other issues addressed in 'The human-centred city'. These forces are: the risk nexus; the shifting dynamics between large and smaller cities and between those globally connected and those more adrift; and lastly, the all-pervasive impact of a digitising world and the technologies related to and enabled by it.

The **risk nexus** creates deep uncertainties. It is a profound problem as inextricably interwoven crises interact with the need to respond with urgency. Big isolated problems become a massive, fragile one as we try to navigate its complexities and to counteract its vulnerabilities. Within this, uncertainty has grown dramatically, and traditional planning models focused on 'predict and provide' are showing their weakness.

It is tempting to think that today's cities are too big, and too clever, to fail. Cities possess immense capacity to adapt. Just as they have always done in the past, they are constantly evolving to meet the rapidly expanding opportunities of a globalised economy. However, such is the scope, scale and pace of change in a world of 7.7 billion people that it now threatens to exceed the capacity of even the best-managed cities to adapt to the extent of the forces we have unleashed.

These are not unmanageable stresses. Essential knowledge, technologies and appropriate engineering skills already exist or are within reach. There is also no fundamental economic barrier to managing them. Yet there are substantial barriers to allocating the necessary capital to the right socially driven objectives in an effective and timely way. It is the complex and dynamic nature of the relationship between the components of this risk nexus that is not yet well-understood. This presents increasing difficulties for governments. Managing these interactions well requires that governments at all levels, from the local to the global, achieve a transformation in their policy coherence.

The institutional structures governments currently have in place tend to tackle each problem area separately. Typically, energy, water, food, climate, poverty and diversity are each dealt with by different a government department or agency. Each has a separate constellation of supporting professionals and cluster of related businesses. This significantly increases the risk of policy cannibalism as the solutions to one problem serve simply to add to the difficulties of another. Governance structures have not kept up to date ([8]).

The main R&I required is to understand these interacting dynamic forces and their complex structures and how policy-driven pathways can be created and implemented. Complexity itself is a problem of major proportions.

The **landscape of cities** shows there are 18 EU cities of over one million inhabitants, with strong impacts on their hinterlands. Increasingly they are

[8] Burke, T. and Landry, C., *The Fragile City & the Risk Nexus*, Comedia, Gloucestershire, 2014.

metro-regions. An additional 43 cities have over 500 000 inhabitants, with 85 between 250 000 and 500 000 inhabitants. Significantly, nearly 700 cities have under 250 000 and over 50 000 inhabitants. This makes the EU a place of smaller cities within which a few cities dominate as transactional hubs that contribute to shaping the strategic global economic, political and cultural agendas. They are intensely connected into the global system.

The right blend of influence and power makes these few European cities suck in opportunity, resources, expertise and talent as well as deep global connections. Their centrality generates a **vortex effect**, making them attractive and desirable to differing audiences by drawing in power brokers, investors, industrialists, shoppers, tourists, property developers, thought leaders, strategists, artists and ordinary people. This creates a self-reinforcing resonance.

The innovative potential and prosperity of cities depends increasingly on their capacity to be part of global networks of capital, skills, knowledge and trade (of goods and services). Local success depends on global connectivity. Unavoidably, every city region of real ambition wants to move up the value chain and **capture centrality** for themselves. This is why they are continuously searching for global niche opportunities as well as linking to the centres of significance. Within this force field, many cities struggle, especially those with weaker governance systems, institutions and strategic capabilities. They are mostly shrinking and ageing as their previous roles in a less-globalised world disappear.

R&I actions include: first, to explore how the overall **drawing power** of cities operates, which is an accumulation of interactive movements of talent attraction and retention, accrual and leakage of resources and power as well as the qualities of attractiveness and the drivers of value chain upgrading and linkage creation; second, to investigate the scope for smaller places to reposition themselves, especially as quality-of-life issues move more strongly to the fore. This repositioning creates new potential for second-, third- and fourth-tier cities, as larger metro areas become more dysfunctional and digitisation allows people to be easily connected.

The **digitised city** is already with us, but it needs a jointly created vision of where to go next. Digitisation represents a tectonic shift of an immense force. Its devices are changing society and social life, culture, levels of connectivity and the economy as well as cities. They are both liberating and potentially invasive, with unpredictable effects on different social, ethnic and economic groups and our sovereignty.

Steadily and then suddenly, as if in the blink of an eye, the 'anytime, anyplace, anywhere' phenomenon — enabled by digitisation — is now changing how we interact with space, place and time and whose deeper effects have only just begun. There is excitement and concern in equal measure.

The impacts and influence of the digital age are vastly stronger than some tinkering on top of business as usual. They will be as powerful as the climactic changes that swept through our world with the industrial revolution 200 years ago. This movement concerns us all, and the open data agenda, smart city ideas or evolving collaborative governance models are just some responses to this bigger dynamic unfolding.

Undeniably, untold promises and opportunities to improve our quality of life are possible by making life more citizen-centric, more local, more convenient or more efficient and by creating smart solutions to curtail energy over-use or crafting ingenious ways to enable seamless connectivity. Filling the city with self-regulating sensors brings real-time feedback loops into their own. Yet the ecological footprint of digital technologies, the combination of big data, sensors, and 5G mobile infrastructure will have a major impact on the energy consumption of cities.
The positives mesh, as with all new technologies, with dangers encapsulated in the phrase 'surveillance capitalism' ([9]). Here, being controlled by algorithms or the ever watchful eye of surveillance and facial recognition, suffering overload of constant data cascading over us and unemployment created by the power of intelligent robots are the most pressing dangers. A crucial question is also who owns the robot as it is the latter that are taking jobs.
The sophisticated merging of computing power and vast archives of data will enable robots to perform any job that has a routine component and will increasingly hollow out middle-income employment — impacting a group that so far has been largely unscathed.

Digitisation has reduced the cost of sharing information and coordinating activities across large distances. In response to this change, some economic activities in advanced economies have been relocated towards low-cost locations initially inside and now increasingly more outside the EU. This has involved a profound re-organisation of economic activities along global value chains, changing the global economic landscape and the relative position of all cities.

The current phase of the process of digitisation coupled with increased robotisation is moving to a completely new level, with the separation of labour from labour services. Workers do not need to be physically located in the same place where their services are being offered, creating new patterns of spatial disconnect between production and consumption.

Technology is not an end in itself or a rigid force with a predetermined direction. What shape it takes depends on how we design technology based on positive social objectives so that digital technologies facilitate an equitable and democratic society, where basic liberties and rights are protected, where strong public institutions function in the public interest and where people have a say in how things work. Issues of concern are a lack of control of (personal) data and the absence of privacy as a result of: a digital space increasingly being governed by a handful of platform providers; a misguided perception that the digital space is only a marketplace, so marginalising the role of public institutions and other non-market actors; the monopolisation of the internet by large and primarily non-EU corporations, leading to loss of sovereign oversight of our digital space and economy; the deterioration of online public debate due to the increase in misinformation and the reinforcement of filter bubbles; a lack of democratic oversight over the digital space, leading to mistrust in the democratic process overall; and finally a lack of EU-based digital development and service delivery,

[9] Zuboff, Shoshana, *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*, PublicAffairs, 2019.

leading to a loss of innovation and opportunities for social and economic development in line with European values.

R&I actions required include understanding the social, economic, political and public policy impacts of digitisation (and robotics) on the existence, rise and decline of cities and their sustainable future. Second, they require exploring alternatives to the dominant technological and business models — alternatives that are open and collaborative rather than closed and competitive. Here, digital social innovation (DSI) and the work of the Commons Network present a radical alternative, focused on using open and collaborative technologies to put people at the heart of how modern cities develop. Last, they require understanding what impact innovation can have in both involving citizens in decision-making as well as fostering behaviour change to address sustainability goals in this new context.

4. PEOPLE

'What is the city but the people?' ([10]) A city is a blend of people with all their cultures, complexities and differences, their hopes and fears and psychological make up. A city without people is an empty shell. A people focus looks at the city from within a 360º perspective. This lens helps seeing the needs and priorities of differing groups — the young, the old, women, men, differing ethnicities and origins, abilities and lifestyles. Only when these are aligned do cities work well.

Why are we dealing with this issue?

There has been a dramatic shift towards the human perspective in cities, with a renewed stress on the lived experience of people in place and their sense of belonging, identity and civic pride as well as their desire to be more active participants in shaping, making and co-creating their evolving city. A human-centred city is concerned with the emotional, mental, physical and economic well-being of its citizens. It is a place where people feel they belong and so invite others to make things happen, be creative, be social and move towards good health, and where the landscape has been designed at a human scale so as to be experienced through the main five human senses

This refocus on the human being responds to the sense that people have been lost in planning, designing and making cities, where largely there was a focus on the physical infrastructure, on the car, on technologies. This has left us with a legacy of cities that are too often soulless, ugly and difficult to navigate and that lack human scale. The response has been varied. It includes: the New Urban Agenda (UN2016) and its European complement the Pact of Amsterdam (EU 2016), UNESCO's Quito contribution the *Culture: Urban Future* report, Creative Europe's 'Human Cities' initiative ([11]), the United Kingdom innovation agency NESTA's programme ([12]), a wide variety of city visions or plans with 'human' in the title ([13, 14, 15]), the shift in design to human-centred thinking and academic work such as that at Aalto in Helsinki ([16]) and publications such as *Cities for people* ([17]) or *Seeing Like a City* ([18]). The human-centred notion is becoming all-pervasive. Its time has come.

The human-centred notion is implied in H2020's 2018-2020 work programme 'Europe in a changing world: Inclusive, innovative and reflective societies' but

[10] Shakespeare, *Coriolanus*.
[11] http://humancities.eu/
[12] https://www.nesta.org.uk/feature/10-people-centred-smart-city-initiatives/
[13] https://www.un.org/sustainabledevelopment/blog/2016/10/unesco-report-a-human-centred-city-is-a-culture-centred-space/
[14] https://www.greeninstitute.org.au/events/making-canberra-human-centred/
[15] https://www.ideo.org/approach
[16] https://www.aalto.fi/aalto-living-platform
[17] Gehl, J., *Cities for people*, Island Press, 2013.
[18] Amin, A. and Thrift, Nigel, *Seeing like a City*, Cambridge, Polity Press, 2016.

not explicitly expressed. This report aims to go beyond simply introducing this priority and places it at the core of Horizon Europe programme for cities.

Cities are places where difference meets and that diversity often has countless dividends. But they are also competitive arenas, where social and spatial segregation, divisions of rich and poor, social exclusion and tensions can erupt. Social, cultural and economic capital are unevenly distributed as are affordable housing and services, access to green infrastructure, health and educational facilities or the cultural offer. The rise of the precariat has moved apace and with it, restricted opportunities to be employed so exacerbating the unequal exposure and access to urban amenities. Individualism, segregated diversity and inequality emerge as embedded, inherent features of the urban landscape.

Logic of the intervention

People want a combination of qualities from their city: **anchorage**, a sense of the familiar, the more constant, shared cultural heritage and tradition; **possibility**, the ability to have choices, options and a 'can do' environment; **connections**, which are links to their family networks, more extensive groups and the wider world; **conditions** to flourish so that they can become the best they can be; and finally the occasional **inspiration**, which can range from spiritual to cultural experiences ([19]).

To achieve the above aims and to cope with the emerging world means providing the conditions for people to be and become capable, competent active citizens alert to the dangers and potentials of the evolving world. A major pre-condition involves overcoming many obstacles to ensure that participation and engagement is possible for all, especially when easily accessible lifelong learning opportunities are present and within that a strong focus on digital literacy. R&I actions need to explore what has worked and under what conditions, and within which areas innovative approaches are necessary and what they might look like.

Priorities and R&I actions for people

Several major challenges demand urgent R&I actions to create human-centred cities and are highlighted as the following five R&I priorities:

1. making the most of cultural diversity
2. building community and social bonding and avoiding fragmentation
3. creating an inclusive city for all so as to avert inequalities
4. addressing demographic dynamics,
5. fostering good living conditions and accessible services.

[19] Landry, C., *The Civic City in a Nomadic World*, nai020, Rotterdam, 2017.

Making the most of diversity

Cities are becoming increasingly multicultural and ethnically diverse. People from different origins and backgrounds concentrate in cities, creating a mix of cultures, race and origins. Diversity and intercultural urbanity are praised and thrive in some cities. However, they do not in many, where that mixture is failing to produce social cohesion and cultural interchange. A sense of community and belonging barely exist. Interethnic intolerance and conflicts shape the life of many places, driving to terrorism as its most extreme manifestation. The result in cities is that enclaves, as distinctive and interesting as they can be, remain strong and are growing.

Top-down prescriptions will not work in addressing these issues. An intercultural lens provides a means to explore differences and re-assess policy, strategies and plans, from physical design to service provision to cultural programming. A policy shift is required that acknowledges the multicultural perspective and differences, bringing differing communities together and focusing on what they can jointly do. This is the intercultural approach that goes beyond equal opportunities and respect for existing cultural differences to pluralist transformations of civic culture, institutions and public space.

R&I actions are needed to understand the bonds that make cohesive communities out of our differences, identifying the drivers of integration, investigating how prejudice influences behaviour and how mutual understanding between different groups can be fostered. The impact of intercultural projects aiming to improve social cohesion needs to be assessed and better disseminated. Second, innovative zones of encounter need to be created. These can be both physical places and activity programmes such as those using art or drama, as well as enablers of participation across decision-making structures and all walks of life, from work to education and to free time. Third, research needs to identify methods to enhance the diversity dividend that highlight the potential power of intercultural exchange, sharing, mixing and reciprocal understanding and provide information on how hybridity and ethnic or cultural differences might boost urban creativity and innovation.

Cities are the principal destination for migrant settlement. The recent refugee crisis has exacerbated tensions in Europe. The dilemmas and reactions to increased migration flows are well-rehearsed and researched, as are the conditions of first and second-generation and recent incomers' experiences. Immigrants tend to be worse off than the native-born in most fields, such as access to the labour market or opportunity, educational achievement, material living conditions, cultural rights or being stigmatised. Children lack supporting environments at home and parents lack skills, time or resources to support children through their educational experiences, resulting in persistent disadvantage. Especially worrying is the fact that in the EU, youth unemployment among native-born immigrant offspring is almost 50 % higher, and in some countries three times higher, than among young people with native-

born parents ([20]). Those employed are twice as likely as native-born peers to live below the poverty line.

R&I actions should focus on exploring the educational needs of migrants and creating learning environments where they can make the most of their potential. They should them aim to understand the perceptions of different ethnic communities and create pathways to integrate their approaches and values as integration is not simply accepting other (predominantly white) cultures. This approach includes tailoring learning strategies toward the needs of different populations, rather than importing educational or cultural models that only work for some. Lastly, actions should identify ways to foster intercultural and multilingual learning, so creating opportunities to meet aspirations.

Building community and social bonding

Rapid urbanisation has fractured traditional bonds of community. This is not helped by built environments full of cars and concrete. Loneliness is a rising crisis in the middle of this multitude of people, leading to anxiety, depression and other mental distress. The desire for and necessity of community has not changed, but how it is expressed has. The digital world makes it less bound to fixed physical spaces of traditional community limited to family and a few outsiders. The digital sphere can re-create some of the social bonds, connections and interactions across distance and at a more local level. Yet communication in the flesh gives us touch, feel, tone of voice, body language, facial expression and visual cues. Our social and our tribal nature and our in-group and out-group instincts are in tension when our world continues to shrink and our cities become more mixed, more nomadic and more diverse. Uncertainty makes people and places cradle themselves back into their tribal instincts and sharp distinctions between a 'them' and an 'us' emerge. Fear is triggered by the fractured sense of belonging and community. People feel overwhelmed and insecure by the disruptions and speed of change.

The social bonding experience and social needs in cities differ according to the spatial setting and throughout people's life cycle, as well as according to age, class and income factors. The inner-city rings are often in transition, a mix of decay, changing uses and gentrification and a cosmopolitan atmosphere, which is perhaps their main strength. The outer urban areas are mostly residential, which determines how social life unfolds as does the experience of edge-of-town living. Blending people and places for gathering are increasingly crucial to build the exchanges that ultimately shape civic life, whether with friends, professional networks or outsiders.

Technologies can also help to strengthen citizenship. Movements like DSI, Smart Citizens and citizen science create opportunities for people to organise themselves, create common value and participate in city-making. Co-creation,

[20] https://www.oecd-ilibrary.org/docserver/9789264234024-3-en.pdf?expires=1558870372&id=id&accname=guest&checksum=82A1543CCE98C35BD1B8830FA2CD7315

makerspaces and urban labs combine real interactions and the development of 21st century skills.

Much has been researched on community life, social innovations and creating physical and social senses of place, but the problems noted continue to shape city life. R&I actions need to put more emphasis on experimenting with further methods to enhance the collective urban experience to reconnect fragmented communication and nurture common events such as festivals, cultural, sporting and spectacular events where citizens can share experiences together. Further actions should catalogue and address the crisis of loneliness in cities across all age groups and find ways to counteract their negative consequences. Crucially, they should explore how enhancing living conditions can avoid gentrification.

An inclusive city that averts inequalities

Inclusive cities inspire their citizens to be not just a resident but an actor, a stakeholder — to be empowered. Only then can their motivations be triggered and their right to the city blended with taking responsibilities. However, the socio-economic divide is complex and structurally anchored and deep. It affects cities' ability to build an inclusive society. In Europe, divides have been rising in the past decades. The long-term trend of increasing income inequality is at its highest ever and not shifting with economic recovery. Inequalities differ across the countries of Europe, as do unemployment rates. The global financial crisis has exacerbated these trends. There are close links between socio-economic backgrounds, achieved income, wealth distribution, educational performance, cultural skills and health outcomes.

Education can drive social mobility but also reproduce and reinforce existing social divides: more educated people are more likely to self-improve. The less educated have more temporary, part-time, lower-paid and routine jobs, as do migrants or women, and these jobs are more likely to be automated. This strengthens the low-skills trap as lower middle-class people have fewer assets to invest in themselves and proportionately more debt, which lead to fewer opportunities to develop a career. Disconnected low-skilled youth are at risk of being permanently left behind. Work is the pre-condition to make more of oneself and to avoid social exclusion. However, it is not equally accessible, so gender, ethnic and origin imbalances continue and high levels of unemployment persist, which are both personally and socially damaging. This all wastes capacities and does not tap into the hidden reservoir of potential and talent in society.

Huge R&I efforts are needed to bridge educational and income gaps. Much has already been invested in addressing these issues, but inequality and social traps persist. Inter-disciplinary and multidimensional R&I actions that combine spatial, economic and social interventions and cultural understanding are most urgently needed. Imaginative methods and actions have to be explored and assessed to create jobs and give marginalised residents the opportunity to enjoy the benefits of economic growth. These would combine preventive and curative solutions to escape low-skill traps, including developing the soft and transferable capacities necessary to help the less favoured as well as proposing how to scale up

solutions that have worked in some places. Part of this research is to review both the role of 'champions' that can act as changemakers in deprived neighbourhoods and the impact of inter-generational methods of integration. Finally, efforts are needed to assess how decentralising decision-making and power and giving voice to traditionally excluded groups and their community initiatives strengthens capacities at local level and whether this helps people climb up social and economic ladders.

The dilemmas of demography

Cities need a good balance between age cohorts to replenish the work force, thereby providing the conditions for productivity, economic health and overall well-being. There is a link between age and productivity as without human capital, economic vigour is stunted. Projections for 2050 are worrying and at times referred to as the 'demographic suicide' ([21]). The EU-28 could stagnate by then at 500 million people, with a dramatic loss in the 20-64 age bracket (49 million) and substantial gains among those over 65. Those active workers will agglomerate more in hub cities, leaving swathes of declining cities with older age profiles. The picture changes dramatically in other parts of the world. In India, that younger cohort will grow by around 350 million while Africa's population will grow by one billion, of which 130 million are from North Africa. This demographic time bomb will exert immense pressures on climate and force migrations. At the same time, European ageing populations will demand younger active people. Migration will be less contentious in host countries, especially when the economy can absorb people. However, tensions might escalate when economies stop growing. Denial is not an option so radically different policy approaches are needed.

Europe's population is on the move. The search for jobs and the famous 'war for talent' shapes movements across Europe. Younger people are leaving Southern Europe, especially its rural areas, in search of work in urban areas of the north west — a possible omen of extended, continuing decline. Capital and strong secondary cities are more likely to have a younger population than their country, while Europe's rural areas tend to have older populations as do poorer economies. These factors interrelate, as people choose to have fewer children for economic reasons and those of child-bearing age have left declining areas.

R&I actions need to investigate and provide solutions to the impacts of ageing on wealth creation and how they can be mitigated. Additionally, the influence of and on Europe of its global position when addressing climate, refugees and demographic issues in an integrated way is poorly analysed. Finally, research and policies are needed to understand and address the precise dynamics of who and where people are over- or under-represented in the workforce in different countries, as well as population differences between urban and rural areas.

[21] https://www.robert-schuman.eu/en/european-issues/0462-europe-2050-demographic-suicide

Well-being for all

Well-being is an integrated concept covering economic, social, environmental, democratic, emotional and personal dimensions such as mental health. It involves self-acceptance, personal growth, purpose in life, mastery over one's environment, individual autonomy and positive relations with others. The urban setting creates the conditions within which well-being emerges or suffers. Here the natural environment, living conditions, the planning, availability and accessibility of facilities — from parks to retailing and culture to care services for all ages — are important. Additionally, having one's voice heard and feeling one is part of making and shaping the city is crucial as is trusting those who make decisions, whether in the public or private sphere. Together, these are the pre-conditions for having higher life satisfaction, feeling well and being happier.

Several factors affect well-being in cities. Unequal distribution of resources engenders negative downstream effects, from crime to lack of care for the environment or disruptive attitudes or behaviours. Mental health issues are rising, especially in cities, and converging evidence reveals that growing up in the city doubles the risk of developing health problems beyond those from the environmental causes of noise or pollution later in life. Bad eating habits are also both a cause and an effect of stresses on well-being as the ingredients of junk food are addictive.

The embedded and increasing inequalities in provision and uneven access to housing, healthcare, social services, care facilities or cultural activities within cities remains a contentious issue as they create differences in people's living conditions and their health prospects across and within population groups.

Housing and its affordability play a crucial role in people's sense of well-being. Here, new models of ownership, financing, organising and managing are growing apace to shape market forces so that they improve opportunities for cities to be better balanced.

There are two under-acknowledged issues. First is the dramatic cultural shift in changing knowledge transmission patterns. For the first time in history, new technology means that the young are teaching the old rather than the reverse. Historically, young and old connected naturally but current lifestyles are breaking these links. Generational fractures are exacerbating with more nomadic lifestyles as family and friends live further apart, creating less opportunity for mixing across the ages. This requires psychological adjustment on the part of older people.

Second, there is a deep, overall psychological impact on people of the vast changes happening in the world at escalating speed. Periods of history involving mass transformation, such as the Industrial Revolution or the technological revolution of the past fifty years, can produce confusion. Partly, there is a sense of liberation given the possibilities, yet it is combined with a feeling of being swept along by events and feeling out of control, especially given the impending climate change crisis. Absorbing the implications of this requires psychological

adjustment. It makes people feel insecure and uncertain about what to do and how their individual actions can help avert the growing problems ([22]).

R&I actions should explore integrated methods and examples to develop well-being agendas cutting across departments responsible for housing, physical planning, education, culture, economic development and social protection, aside from those involved with health. Within this, research is needed on how to deal with psychological stressors of urban and global change and the factors that reduce it. Cities are planned and made within a limited perspective, mostly that of middle-aged men. Further actions are needed to understand well-being needs across age groups, backgrounds and lifestyles and how to design cities through different lenses, such as cities seen through the eyes of women, children or older people. That research needs to see whether this approach harnesses communities' creative potential and capacities to enhance well-being. It also needs to investigate the psychological impacts of reassessing intergenerational connections and what means can achieve better community cohesion and quality of life for all ages, including what initiatives can create senses of community or belonging and decrease the costs of socialising.

R&I actions involving multidimensional teams should assess how to develop affordable healthy lifestyles. This involves exploring how the urban form and physical structure of cities shape health outcomes and what physical environments, such as particular forms of public space and activities within them, foster a feeling of ease, a sense of seamless connectivity or being closer to nature as so promote healthier places. Research should explore Europe's ageing population from a perspective of their potential and examine relevant social innovations. Simultaneously, in an innovative way, it should look at specific needs, from urban planning to new forms of housing to transport or forms of healthcare, including assessing the impact of cultural activities on healthcare or possibilities from artificial intelligence.

A final coda: culture can play a good role in all the issues covered by this **people** section. The best cultural policies, strategies and actions combine a focus on enlightenment, empowerment, entertainment, employability and creating economic impact. More people, more organisations, more towns, cities, regions and countries for more reasons are finding that culture and its associated creativity have something for them, especially in the context of creating a sense of belonging and place, in helping to trigger renewal, in providing work, in breaking down prejudice, in engaging hard-to-reach and vulnerable people. Participation in culture in particular has vast impacts on people's sense of self and confidence.

Culture has also a major role to play in the envisioning and the creation of the future of cities. Co-creation, design of human-centred technologies and applications, critical making and fostering interdisciplinary collaboration are necessities for being able to deal with the complex transformation with which cities are confronted.

[22] https://www.urbanpsyche.org/

5. PLACE

The **place** dimension refers to the physical city and all the processes whereby cities marshal, consume and process resources. Cities and their peri-urban areas are a combination of hard and soft infrastructures. They are a metabolism and a system of systems. They both are man-made physical infrastructures and blend with natural elements as well as the activities that give them life or act as its nervous system. Such activities can be inflows of construction materials, water, food products and fuels, as well as the outflows of finished products, emissions and waste, discharged into the water, the air or the soil.

Spaces become places when they are imbued with meaning by their citizens, by their history, their culture and purpose or an ambition of what decision-makers want them to be in the future. That ambition today must include becoming carbon neutral. Places are planned in multiple ways in terms of functions, practicalities, space, design and aesthetics. It is the ambition and strategic vision that guides their trajectory. Traditionally, planning for cities was seen largely as land-use planning focused mostly on technical aspects, such as where functions, from housing to retailing to waste facilities, were to be located or the heights of buildings or widths of roads. This determined how the various planning elements fitted together.

Why we are dealing with this issue?

The planning paradigm is in the process of dramatic change as the notion of **place-based planning and placemaking** has emerged. The future shape of cities is determined by concentrating on the look and feel of places, their form and their character instead of focusing only on conventional categories of land use. This new approach focuses on how all aspects of planning and their associated needs and priorities can be embedded into places and fit together in an integrated and systematic way.

Three issues now drive and frame overall planning and design and include new language. The first is sustainability and resilience. Here rethinking resource use and cradle-to-cradle thinking are examples, as is the attempt to move towards carbon neutrality. The second is the liveability, quality of life, well-being and happiness agenda. This is planning for better places to live, whose criteria include environmental quality, reduced levels of crime and increased safety, walkability, increasing and improving public space and encouraging greater public transport use to reduce the dominance of the car, along with health provision, access to shops and services, recreational facilities and cultural activities. It is the human-centred approach. Finally, the equity agenda focuses on averting spatial segregation, using planning regimes to foster affordability or avoid gentrification pressures and to promote social inclusion, including through innovations.

These priorities increasingly shape the look, feel and operations of the city, from the micro to the macro. Green roofs are one small building block towards sustainable urban development as the vegetation converts CO_2 into oxygen and filters particulate matter from the air. The planning of walkable connected places through urban design both helps sustainability goals and encourages a healthier lifestyle. The dramatic rise in third places — other than home or the office — from cafes to co-working spaces has substantially reduced office space provision in cities and therefore the appearance of cities.

Decisions on place, thus, influence all the other dimensions addressed, such as what the city feels like for people emotionally, how it performs economically and how it affects cities' clean, green and circular performance, liveability and sustainability. The day-to-day experience of cities for people is affected mostly by how the collective decision-making processes have put the city together — the pattern of urban quarters, the layout of streets and the location of functions, from transport nodes to the various clusters of retailing or entertainment to health facilities or community centres.

This is why cities, too, are increasingly being planned with greater emphasis on design quality and aesthetics, with a balance between occasionally extraordinary structures and the mass of ordinary buildings. There is also more focus on an enhanced public realm. Successful city-making is mostly anchored around vital public spaces, be they a civic square, a crossroads junction, a main street, third places, a public market, a library, a rail station or a campus. Those public places are most dynamic and resilient when they reflect and boost a community's distinctive public life, economy, and culture. When the people using them are involved in their creation and continual re-creation, management and governance, they generate civic pride and are increasingly loved, as leading urbanists from Jane Jacobs and William H. Whyte onwards have stressed. Such placemaking requires place-led governance, which requires all disciplines, hard and soft, to work together in an interdisciplinary way. Often this involves acknowledging the importance of social innovations rather than technical solutions in making city life. That place capital in turn helps achieve other goals more efficiently, so contributing to building community capacity, equity and prosperity.

Progressive mobility thinking plays a crucial part in both placemaking and helping sustainability, leading to the emphasis on convenient public transport systems, shifting mobility modes away from the car towards walking and cycling. Combining and integrating all transport modes and city services and establishing interaction between them can deliver the greatest added value. This integration of transport modes needs to be supported by robust systems to anticipate system breakdowns, optimise material resources or the flow of passenger and goods, prepare for planned events and respond to unexpected ones. Collaboration with all the major stakeholders is key, including local authorities to embrace the era of intermodality.

Within this quality of life focus, the issue of affordability is rising dramatically up the agenda. Housing availability at differing price points is crucial and especially social housing to avoid social tensions. The question is where it is to be located.

It is especially a problem in more successful cities, where gentrification pressures are immense and often lead to a dramatic decline in locally distinctive shops as global chains take over the retailing system. This loss of character has driven movements to value heritage, both tangible and intangible. Heritage protection is increasingly urgent as it helps anchor a sense of belonging.

Orchestration is the watchword and within that an understanding of the impacts of deep trends, which include how internet platforms such as Airbnb can threaten housing availability, especially in successful cities, or how internet shopping is transforming the high street, new working patterns are changing office supply and over-tourism is threatening the identity of many cities. A further challenge on the horizon is how autonomous data systems are seeking to build cities with less human involvement and intervention using predictive analytics to determine how cities are formed, so reducing our free will to shape the future. The contrast here is with new emerging networks, such as the Fab City Global Initiative, whose manifesto chimes with all the themes of this report ([23]).

Crucially, it is the global threats that affect people's experience of their city, as breathing becomes more difficult or smell or noise make urban life unpleasant. All these movements have changed our expectations of **place**. This change involves a culture shift for those responsible for decision-making and planning as well as rethinking their education, training and professional development. Additionally, it implies creating legal frameworks to meet new priorities and future needs of cities, within which R&I can help.

Urban environments amplify global threats such as climate change, water and food insecurity, mobility issues and resource shortages. Simultaneously, they can provide a holistic framework to address such threats, especially through the urban strategies and plans adopted. This framework includes healthy blue and green infrastructures and the social and spatial dynamics encouraged in and around the city, mobility planning, the development of sustainable physical infrastructures, how sustainable consumption and production are incentivised or how natural resources, food and waste are managed. Addressed well, this approach can support the needs of present and future generations in a sustainable way.

Cities mirror other ecosystems in terms of scale. Their uniqueness is that they are planned, designed, constructed and controlled by humans supported by technologies. The city is an **urban metabolism** where all the physical and biological process of the city system transforms resource inflows into useful, finished products and services. At the same time, those processes, essential to the functioning of cities, generate waste and emissions, traffic congestion and noise and severe problems from soil, water and air pollution — including poor indoor air quality. These are responsible for premature deaths and related diseases [i]. According to UN-Habitat, cities worldwide currently consume over

[23] https://fab.city/
https://fab.city/uploads/Manifesto.pdf

two-thirds of the world's energy and generate more than 70 % of CO_2 emissions, while waste is a further problem ([24]).

The United Nations projects an urban population growth of 2.5 billion by 2050. Currently, 75 % of Europeans live in cities. This proportion is projected to rise to up to 85 % by 2050. An increase of 36 million people living in cities offers some of the best opportunities to **decarbonise**. Cities contain the highest emitters, such as buildings, transport systems and waste, and so provide the greatest potential to have a positive environmental impact in terms of increasing air quality, reducing noise, improving energy efficiency or capturing CO_2.
Cities need a long-term integrated urban planning and design and spatial development vision for their **built, green and blue infrastructures or nature-based solutions**. If such high-performing infrastructures and spaces that balance built and natural environments are put in place, they can in principle provide ecological, environmental and social benefits while improving resilience to climate change and fostering economic growth.

In 2016, the world generated 2.01 billion tonnes (267 kg per capita) of municipal solid waste annually. This number is expected to increase by 70 % from 2016 levels to 3.40 billion tonnes in 2050. At least 33 % is not managed in an environmentally safe manner, and without improvements emissions will increase by up to 2.6 billion tonnes of CO_2-equivalent by 2050 ([25]). In 2017, in the EU-28, the total municipal waste generated amounted to 248 million tonnes (487 kg per capita), with only 29 % recycled ([26]).

The thinking about urban systems must shift away from linear systems that receive inputs and produce outputs. Instead, design should be circular using business models that replace the 'end-of-life' concept with the **reduce, reuse and recycle** and **cradle to cradle concepts** — a continuous cycle of preserving value and optimising resources.

A sustainable city should feed itself, with a sustainable reliance on its peri-urban areas and its surrounding countryside to reduce its food miles and ecological footprint. Ensuring healthy, sustainable, equitable and affordable food availability means rethinking the food system and eating habits and promoting sustainable safe local **food** production.

Any urban strategy, its planning and approach to its socio-spatial dynamics within and around cities needs to address all these issues. Here, digitisation is a resource, with its data gathering possibilities, its ability to automate processes

[24] Commission communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'A Europe that protects: Clean air for all' https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52018DC0330&from=FR

[25] Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank, *What a waste 2.0: A global snapshot of solid waste management to 2050*, International Bank for Reconstruction and Development/The World Bank, Washington, DC, 2018 https://openknowledge.worldbank.org/bitstream/handle/10986/30317/9781464813290.pdf

[26] Eurostat https://ec.europa.eu/eurostat/statistics-explained/index.php/Municipal_waste_statistics

and its capacity to add sensors to the city so allowing immediate just-in-time feedback loops and responsiveness.

The aims and targets formulated here are in response to the global challenges, such as climate adaptation, environment quality, technological innovations, population growth and urbanisation, and are aligned with international agreements.

Changes in the energy landscape in the EU have been partly driven from the top down but also from bottom-up decisions ([27, 28]). The EU has performed important work on energy issues with legislation regarding the built environment. This has led Member States to develop concrete action plans with high-impact potential ([29]). The EU Framework Programmes for Research and Technological Development, FP7 and H2020, have given a major boost to these plans with their Energy-efficient Buildings Public Private Partnership (EeB PPP) initiative. This dual approach covers both new buildings and the deep energy retrofitting of existing buildings. It was identified as one of the most strategic programmes for reducing CO_2 worldwide. The interaction between buildings and mobility solutions for renewable energy production and storage has become a key issue. In 2018, in response to the EU's plan for decarbonisation by 2050, the Commission presented its strategic long-term vision for a prosperous climate-neutral economy by 2050.

The Commission formulated ambitious urban mobility policy objectives ([30]) based on the established need to cut transport GHG emissions by 60 % compared to 1990. These include the full phasing out of conventionally fuelled vehicles in city centres by 2050 and close-to-zero-emission logistics in cities by 2030. Mobility service innovations can contribute to transport decarbonisation levers by shifting demand, rethinking land use management, encouraging modal shifts or fuel substitution and making the fuel/energy nexus more efficient. The importance of speeding up decarbonisation efforts post COP21 is reflected in a Commission Communication ([31]).

The Commission defined an agenda ([32]) built on and integrating seven transport research areas: smart mobility and services; transport infrastructure; transport electrification; vehicle design and manufacturing; cooperative, connected and automated transport; network and traffic management systems; and low-emission alternative energy for transport. The Transport Research and Innovation Monitoring and Information System (TRIMIS) is a tool to establish and implement that agenda and is the Commission's instrument for mapping technology trends and research and innovation capacities in the transport field.

[27] EU 2020-2030 Climate and Energy Plans.
[28] Clean Energy for All Europeans Package, 2018
[29] EUR-Lex, Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive2012/27/EU on energy efficiency, 2018 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.156.01.0075.01.ENG

[30] European Commission transport white paper, 2011.
[31] European Commission communication on low-emission Mobility, 2016.
[32] European Commission, *Strategic Transport Research and Innovation Agenda (STRIA) Roadmap Factsheets*, 2017.

Cities can drive the circular economy agenda forward as major engines for economic growth, so unlocking economic, environmental, and social benefits ([33]). The SDG for 2030 encourage nations and leading cities to innovate with circular ideas. Cities have opportunities to improve their efficiency and environmental impact by embedding circularity principles in urban infrastructures and services, from mobility to energy and healthcare.

The Commission has defined a plan with a set of measures with step-up actions to mobilise stakeholders on the circular economy ([34]). This plan aims to adopt a circular economy strategy on plastics, along with EU legislation relating to waste, food and feed as well as encouraging and ensuring the recovery of critical raw materials and valuable resources or adequate waste management in the construction and demolition sector.

'By 2020, ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15 % of degraded ecosystems' ([35]). The EU R&I policy agenda on Nature-Based Solutions and Re-Naturing Cities, implemented through H2020, seeks to enhance the awareness and engagement of end-users, stir market uptake and develop an EU-wide knowledge base on nature-based solutions.

The EU aims to tackle food and nutrition security with R&I policies designed to future-proof our food systems to make them sustainable, resilient, diverse, inclusive and competitive for the benefit of society, adopting a systemic approach ([36]).

To manage water, the EU has adopted a comprehensive policy framework ([37]) to achieve the objective of restoring EU waters to good status and ensuring their sustainable use, as well as identifying and dealing with flood risk. Water management needs to be taken account of in spatial planning policies, in building-design codes and in regeneration programmes aimed at ensuring liveable cities. Restoring forgotten urban rivers back to cities can be a catalyst for reconnecting citizens with nature, as happened in Munich with the Isar restoration and the restoration of the Emscher river in the Ruhr area.

Logic of the intervention

[33] https://www.ellenmacarthurfoundation.org/our-work/activities/circular-economy-in-cities
[34] Closing the loop — EU Action Plan for the Circular Economy.
[35] The EU Biodiversity Strategy to 2020, target 2 https://ec.europa.eu/environment/nature/biodiversity/strategy/index_en.htm
[36] European Commission, *FOOD 2030: Future-Proofing our Food Systems through Research and Innovation*, 2017.
[37] Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy

The EU has recognised sustainable urbanisation as a global challenge. In line with the objectives of Horizon 2020 ([38]), this new 'Innovating Cities' R&I Strategic Agenda aims to mobilise and help cities to address complex and cross-cutting challenges by developing integrated, innovative solutions within the concept of the 'city as an ecosystem'.

EU R&I policies in, for and with cities can provide significant contributions to the sustainable transition towards a liveable planet. This includes creating more liveable and human-scale physical environments, moving towards carbon neutrality, establishing clean and connected mobility, fostering resource and energy efficiency, improving indoor and outdoor air quality, incentivising a circular economy, highlighting the potential of the creative economy and fostering new social practices or innovations that meet social and global purposes. It needs better-than-existing solutions. The overall intention is to enhance the well-being of citizens whilst simultaneously creating the conditions to adapt to climate changes.

Priorities and R&I actions for place

The proposed R&I actions have been gathered around three main issues, considered the most catalytic in enabling the transition:

1. decarbonisation and the target of limiting global warming to 1.5ºC
2. circularity
3. planning for a better built environment.

These affect how cities are planned and managed. The more precise details of the R&I actions are elaborated in the appendices.

Decarbonisation and limiting global warming limit to 1.5ºC

Many European cities are facing serious challenges regarding demographic change, the need for energy efficiency, effective land-use, coping with diversity and integration, including all population groups, the burden of municipal liabilities, the need to protect environments and establishing and promoting sustainable urban lifestyles. Some EU cities are recognised as pioneering references and good practice, many of them thanks to EU R&I support through the FP5, FP6, FP7 and H2020 programmes ([39]). Yet most EU cities are still on a

[38] European Commission, *Investing in European Success — Innovating cities in Europe and worldwide*, 2019 https://ec.europa.eu/info/sites/info/files/research_and_innovation/research_by_area/documents/ec_rtd_investing-in-european-success_032019.pdf

[39] European Commission, *EU research & innovation for and with cities — Yearly mapping report*, 2017.

pathway towards sustainable growth. Global cities partnerships have brought valuable expertise and know-how to mutual learning and cooperation ([40]).

R&I actions are needed to assess what factors, such as regulations, funding, or technical capacity stemming from the local, regional, national or EU levels, best trigger the necessary strategic planning that helps implement local climate change mitigation and decarbonisation. Within that, they can assess what level needs to be reinforced and by which actor. Here, social and technological innovations should complement each other. Knowledge gaps remain about the contribution of lifestyle and behavioural change in helping decarbonisation. Saved CO_2 emissions due to social innovation initiatives should be evaluated, including past and present projects.

The EU has become a leader in developing renewable and low-carbon approaches. There are three key areas of technological R&I: energy efficiency, smart grids and integration of renewables into the energy system ([41]).

Despite the impact of technology has in addressing environmental issues, the most immediate actions may be to regulate and modernise physical infrastructure such as those in the building, transportation and waste sectors. R&I actions are needed to improve the energy efficiency of existing building stocks at district level. These include policies, innovative technologies, new materials and financing instruments across all EU building typologies to reduce emissions and energy consumption ([42]). R&I actions are needed to lower emissions by reducing energy consumption in heating, cooling ([43]) and lighting of buildings and by integrating solutions for renewable energy production and storage for buildings and mobility. Building design and additional insulation will also require additional R&I on materials that are more compact, more affordable, more circular and easier to install: the 'solar-skin', where every component of a building can contribute to generating renewable electricity, combined with innovative design features for climate adaptation.

Energy transition must include people who have first-hand knowledge of energy poverty, to find solutions. Energy poverty has both economic and social causes and implications, including people's lack of sufficient income to meet rising energy bills, while energy-inefficient housing locks people into poor living conditions that can be detrimental to their well-being. The better use of renewable energy systems integration (smart grids) is crucial to enable 'prosumer' participation and to incentivise demand flexibly to help use energy more efficiently. Energy poverty is very dependent on energy prices in each Member State so developing smart metering systems, accurate monitoring and dynamic pricing approaches is vital. Governance models are needed to support

[40] The Sino-German project, *The learning city: An innovative approach for mutual learning of sustainable urbanization between China and Germany* https://wupperinst.org/fa/redaktion/downloads/projects/Learning_City_Approach_ML.pdf

[41] European Strategic Energy Technology (SET) Plan https://ec.europa.eu/research/energy/index.cfm?pg=policy&policyname=set

[42] European Commission, *EU Buildings Factsheets*, 2018b https://ec.europa.eu/energy/en/eubuildings-factsheets

[43] European Commission, *Heating and Cooling*, 2018c https://ec.europa.eu/energy/en/topics/energy-efficiency/heating-and-cooling

energy-efficient interventions without leaving behind low-income householders ([44]). Self-generation or community energy schemes can help to overcome poverty. How the energy transition can address poverty and inequality requires research that maps socio-demographic groups at risk of energy poverty. For example, energy cafés in the UK are a new format for community organisations to engage with energy locally to combat energy poverty. Rotterdam is working on this issue to understand how to maximise inclusive energy transition investments ([45]). It is equally paramount to improve cities' knowledge about the relationship between energy poverty and health at a district scale. Here, the Barcelona climate plan is a model ([46]).

Nature and nature-based infrastructure are being recognised as critical to liveable cities. They can be win-win solutions as they meet both specific service targets, such as for water supply or flood management, and have many spillover benefits, such as creating new parks, advancing equity and health for underserved neighbourhoods ([47]). Environmentally friendly planning and design, including of the built, blue and green infrastructures and bioclimatic architecture, improve adaptation and resilience to climate change through carbon sequestration and passively modulating the urban micro-climate. Innovative strategies to reduce the urban heat-island effect are needed that promote and develop bioclimatic architecture solutions as well as developing biomaterials for construction and retrofitting. Permeable urban surfaces to reduce soil sealing through nature-based solutions are essential, as are linked urban forestry strategies.

Blue and green infrastructures and nature-based solutions are a major business opportunity for mainstream companies as well as start-ups and so can attract investment and new businesses, often with novel business models, whilst simultaneously reducing resource consumption. This investment could help to save the costs resulting from negative environmental effects and bring health benefits.

R&I is needed on how to maximise the potential of built, blue and green infrastructures to both improve the health and well-being of citizens and mitigate climate change. Indoor and outdoor air pollution above health limits poses a major challenge to urban populations. Policy measures are needed to address both decarbonisation and air quality targets in an integrated way. Research and data are needed on particles, microbes, volatile organic compounds from

[44] Pye, S., and Dobbins, A., *Energy Poverty and Vulnerable Consumers in the Energy Sector across the EU: Analysis of Policies and Measures*, 2015 https://ec.europa.eu/energy/sites/ener/files/documents/INSIGHT_E_Energy_Poverty_-_Main_Report_FINAL.pdf

[45] Rotterdam Resilience Strategy Consultation Document https://100resilientcities.org/wp-content/uploads/2017/06/strategy-resilient-rotterdam.pdf

[46] City of Barcelona, *Barcelona's Commitment to the Climate*, 2012 http://ajuntament.barcelona.cat/ecologiaurbana/sites/default/files/Barcelona_Commitment_to_Climate.pdf

[47] Ratti, C., *The Future of Cities*. Roberts, S., *Communal spaces for great sustainability*. Harper, C., *Urban farming. Freeing agriculture from Climate Slavery*. Pictet Report Issue 22, Winter 2018.

products, building dampness, levels of exposure and effects on vulnerable populations.

Urban mobility is vital to European society in providing access to services for passengers and goods in order to support economic prosperity. To manage the increasing demand for mobility, a wide range of complementary mobility solutions and future mobility projects will have to solve a host of complex issues, including congestion, pollution, access and gridlock. Research is needed to assess the comparative effectiveness of differing solutions. Transport safety is equally important as 40 % of road fatalities happen in cities in Europe (c. 11 000 per year). Research is needed on how to reduce accident rates, fatalities and casualties within each mode.

Mobility provision needs coordination and should encourage shared modes, including low-energy and autonomous vehicles. New urban systems, services, urban data-management platforms and multimodal travel are gradually emerging. Their economics and how they are governed are key issues. Authorities need new skills to assume their role in this changing environment, including as mediators and interfaces between different urban stakeholders, as designers of platforms to acquire and store urban data, and as managers of the community and public space in the public interest.

The ecological emergency will require creativity, collaboration and knowledge to find innovations suited for local situations and policy goals. Breaking silos between energy, climate and transport areas is crucial to build sustainable low emission places.

Circularity

Circularity must become the essence of any economic development and management of daily city life. Awareness and cooperation among key actors — businesses, consumers, NGOs and government — are needed for cities to make the circular future a reality through systematic distribution, communication and the promotion of circular practices and addressing barriers such as finance, institutional, social and technical issues. The circular economy is also closely linked to the sharing-economy idea. This is linked to the idea that owning is increasingly less relevant and access to facilities and resources is more important. This has led to ideas such as mobility as a service. Here, the culture of consumption changes towards seeing products as a service, so ensuring they are used most efficiently.

Greater rates of urbanisation are expected, so significant infrastructure investments will be made in cities ([48]). 'Cities could be uniquely positioned to drive a global transition towards a circular economy, with their high concentration of resources, capital, data, and talent over a small geographic territory, and could greatly benefit from the outcomes of such a transition' ([49]).

[48] World Bank, Urban Development Overview, March 2017 http://www.worldbank.org/en/topic/urbandevelopment/overview

[49] https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Cities-in-the-CE_An-Initial-Exploration.pdf

Cities are the place where most materials are used and wasted, and where buildings, vehicles and products are under-used. In the urban context there is significant structural waste in key sectors such as mobility, food and the built environment. In Europe, mobility captures 13 % ([50]) of an average European household budget, and cars are particularly inefficient: cars are parked 92 % of the time, and when used, fewer than two of five seats are occupied on average ([51]). Shifts towards car-sharing options or alternative means of mobility are picking up speed as citizens change behaviours and cities invest in infrastructure that offers alternative choices. Around 31 % of food is wasted along the value chain, and the average office is used only 35-50 % of the time, even during working hours ([52]).

It is well-documented that 75 % of natural resource consumption occurs in cities, which at the same time produce 50 % of global waste and 60-80 % of greenhouse-gas emissions, due in part to the adoption of the 'take, make, dispose' linear economic model ([53]). The negative impacts of this practice in cities include air, water and noise pollution and greenhouse-gas emissions. The types of challenges cities are facing in a linear economy, suggest the need for a shift to a 'circular city'. Cities, to be innovative, need to attract people, businesses and economic activity. R&I is needed on how cities should be planned and designed and financed to become carbon neutral, zero waste and smart, keeping materials and products in use. The substitution of products with services provided to customers and of purchase transactions with more sustainable use forms will be crucial. Regarding materials, Research can also help develop economic incentives for producers to make products that can be easily recycled or reused. New regulation is needed to reduce resource use and waste generation in production processes and to support industrial symbiosis. Better product design is needed. Innovative product design will lead to products that are more durable and efficient.

Local governments are in a unique position to plan, design and finance their cities and systems with a circular vision. Here, research on how to plan and design infrastructures, vehicles, buildings and products that are durable, adaptable, modular and easy to maintain and repurpose should be a priority. R&I is needed on how to integrate waste management with manufacturing processes and consumption so that both products are fit for reuse and recycling at affordable costs.

The construction sector can substantially contribute to using resources responsibly within a circular economy model. A spin-off is that it can foster social equity, given the vast amount of material and energy resources required to

[50] Ellen McArthur Foundation, *Growth within a Circular Economy Vision for a competitive Europe* https://www.ellenmacarthurfoundation.org/assets/downloads/circular-economy/Growth-Within-Report.pdf

[51] European Commission, *EU Transport in figures — Statistical pocketbook 2018*.

[52] Ellen MacArthur Foundation, SUN and McKinsey Center for Business and Environment, *Growth Within: a circular economy vision for a competitive Europe*, 2015.

[53] UNEP, *Resource Efficiency as Key Issue in the New Urban Agenda*, http://www.unep.org/ietc/sites/unep.org.ietc/files/Key%20messages%20RE%20Habitat%20III_en.pdf

produce and maintain built environments and the emissions and waste they generate. Sustainable construction needs R&I on the design and management of built structures as well as on the behaviour of materials throughout their use-cycles.

Sensitive restoration, reuse or remodelling of building stock must be a target for city makers. Adaptive reuse of existing buildings and infrastructures should be prioritised over new construction. R&I is needed on how digitalisation can help optimise solutions, including biomaterials and other bio-based solutions if they have a lower environmental footprint and a higher potential for circularity than currently used materials. New strategies are needed to engage architects and engineers to become active agents of sustainable design by incorporating in buildings different innovative materials that can be obtained from recycled waste.

In cities, the construction waste from renovating buildings and transport infrastructure should be managed upstream with digital tools that help and promote deconstruction planning rather than demolition. Innovative models for waste management are needed to help cities rethink traditional collection and disposal infrastructures. Managing waste to minimise emissions should be a priority for cities. The existing legal frameworks for domestic and industrial waste are not yet fully application in all Member States. R&I is paramount to create improved and affordable solutions.

In line with the other priorities of this report, local policymakers and their co-created urban food policy frameworks have a key role in convening, connecting and supporting food system actors and citizens to build and deliver solutions based on sound science, research and innovation. This would go beyond existing fragmented initiatives limited solely to production and consumption.

Within this overall discussion on circularity and reducing emissions, more efficient food systems that reduce food waste and new bioeconomy approaches that turn waste into value and replace fossil fuels through renewable biological resources can significantly contribute to climate mitigation ([54]).

Alternative urban food strategies, including those focused on reducing food miles and urban agriculture are needed as well as smart reserve-food storage and the management of proximity production in neighbouring rural areas to limit transport and consequently reduce CO_2 emissions. Regarding food-packaging, research is needed on alternative new bio-degradable materials. Food waste should be reduced, and adopting smart labels could be a solution to disrupt traditional expiration dates.

It is agreed that circular economy principles applied to city systems can bring many benefits. However, R&I is needed to understand at what scale these principles can help policymakers to generate economic development and reduce carbon footprints, primary-material consumption and consequent costs with waste management. In terms of mobility related to food systems, and the built environment sectors, it is important to get detailed evidence on how the cost of

[54] European Commission, updated Bio-economy Strategy and its Action Plan, 2018.

products and services is reduced, the value of spending less time in congestion and the improvement of indoor air quality and reduction of air pollution.

Planning for a better built environment

The task is to see the built city and the activity programmes as a communications device to help meet the objectives of the strategic research agenda for innovating cities. In other words, how a city can visibly communicate its intent to be more sustainable.

The cities we have mostly disappoint. More of them are ugly rather than beautiful. Few reflect truly the diversities that make up most urban populations. Most are unsustainable. Most look the same with their bland business districts, similar shopping experiences or overwhelming tower blocks, often with suburbs sprawling endlessly into the far horizon. Most urban environments are standardised. There is too much traffic and noise, with cars having dominated development over the past decades. Few places delight.

The built environment communicates the collective intent, ethos and culture of those who have planned and designed their city. It reflects the ambition and priorities of all the stakeholders — public, private and civic — and the extent to which the common good can be experienced. Cities are more balanced when they acknowledge and plan by going with the grain of their distinctiveness, their genius loci and when they value their heritage. Dense and mixed-use historic centres, with their adaptive re-use and relative intimacy, are often the form planners are attempting re-create today to inspire sustainable planning patterns and processes, including at the wider territorial scale. This recognition, in addition, fosters the civic pride that in turn generates the commitment, motivation and will to care. R&I actions include cross-disciplinary assessment of which place-based urban development patterns generate greater social and economic success and consequently resilience.

The way the built environment is put together needs to reflect and visibly communicate the spirit and ambition to be sustainable and inclusive. To see bike-, car- and van-sharing stations sends a message, as does installing green facades or living walls that can benefit the environment, buildings and human welfare. They help air purification, dust suppression, noise and heat reduction and biodiversity and can protect buildings. Aesthetically, they are pleasing. To experience walkable districts that seamlessly connect via public transport or Wi-Fi reminds us how individual car use can eventually become unnecessary. Reclaiming the hard urban infrastructures from roads as shared public space allows citizens to slow down, interact and create community and a sense of place can begin to emerge. Interactive video screens that explain the flows, energy use and state of the city have become important in effecting awareness and behaviour change. R&I actions include assessing the relative impacts of the approaches noted above in encouraging inclusiveness and becoming more sustainable. R&I is needed on new forms of what George Monbiot calls ‘public luxury and private sufficiency’ by strengthening the quality and availability of shared goods, services and networks, reducing duplication of resources across

individual households, and strengthening community involvement and collective responsibility ([55]).

Equally, a well-designed public realm communicates generosity and accessibility, and that generosity tends to trigger further generosity from citizens in a reciprocal way. The opportunity for differing parts of the city to come together in a more neutral territory fosters chance encounters, and those threads of small meetings are what ultimately create civic life and community. They make people feel they are important. The design of place then affects behaviour and our psychological sense of feeling at ease as interactively the city affects us and we affect the city. People will then be more likely to invest themselves in a sustainable, aesthetically conscious and emotionally aware city. R&I actions include reviewing the extent to which and how these psychological insights can contribute to a better understanding of place that encourages the overall objectives of this report.

The dynamics of European cities highlights a series of dilemmas that planning policy can help. The most important are affordability and especially the pressures of gentrification and the role of social housing, as well as how disruptive technologies such as Airbnb can reduce local housing stock, especially in more successful cities. Here Fairbnb is a new initiative that aims to counteract such negative consequences. The lack of affordable and quality housing is a critical matter everywhere and many cities are addressing the issue as it exacerbates social tension in cities dramatically. The Housing Partnership, a pilot partnership established within the framework of the Urban Agenda for the EU, has as its main objective 'to have affordable housing of good quality'. This initiative, focused on affordable public housing, state aid rules and general housing policy, developed an action plan in December 2018 ([56]). The R&I actions proposed are to establish an overview of the effectiveness and impact of real schemes that have been enacted that chime with their recommendations, such as the regulations and incentives regime to protect vulnerable groups, mechanisms to curtail speculation, and the extent to which co-ownership and co-management can stabilise housing developments, help tenancy security and achieve rent stabilisation.

Energy-efficient long-term solutions for affordable housing or addressing energy poverty are needed, as is long-term investment in partnerships with cities to produce affordable housing of good quality in cities in the EU. In vortex cities, where gentrification pressures are immense, a responsible construction sector is needed to provide affordable housing using affordable materials and eco-materials. R&I action needs to explore which legislation, incentives or financing models have been most effective to establish new standards on affordable housing solutions that equally combine renovation and energy efficiency.

[55] European Commission, *Europe's Sustainability Puzzle* https://ec.europa.eu/epsc/sites/epsc/files/epsc_sustainability-puzzle.pdf

[56] European Commission, Housing Partnership Action Plan 2018, Urban Agenda for the EU https://ec.europa.eu/futurium/en/system/files/ged/final_action_plan_euua_housing_partnership_december_2018_1.pdf

6. PROSPERITY

In order to 'make cities and human settlements inclusive, safe, resilient and sustainable' (SDG 11), human, technological, economic and financial resources need to be mobilised in new and innovative ways in all cities and regions of Europe. Innovation is fundamental in order to maintain and sustain European prosperity and well-being within planetary boundaries. Innovative urban ecosystems with their constellation of local stakeholders are central to this process.

Innovative cities contribute to the genesis and co-creation of 'new sustainable combinations' in terms of new products, new processes, markets, sources of inputs, suppliers or value chains as well as new organisations, social arrangements or policies that will shape a sustainable economic future. In so doing, cities have the potential to act as human-centred sustainable engines of economic development, job creation and prosperity for Europe, its Member States and beyond.

This dimension aims to support cities in enhancing their innovation capacity and addressing new urban challenges within a systemic, inclusive and cross-sectorial urban ecosystem framework. R&I actions within this dimension aim to advance existing knowledge on innovative urban ecosystems by fostering the co-creation of new insights and solutions to address the socio-economic and financial challenges to cities within planetary boundaries. R&I actions aim to advance our understanding of how the economy influences sustainable urban development and generates public value, to explore new and alternative ways to complement market-based solutions with new innovative solutions, and to identify policy instruments suitable for building prosperous and resilient local economies in both developed and less-developed regions of Europe. This contributes to accomplishing the overall mission of SDG 11 and in particular SDG 11.A by 'support[ing] positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning'.

Why are we dealing with this issue?

The economic importance of cities is increasing. 'They account for 60 % of national GDP, have higher rates of firm creation' ([57]) and have been growing 50 % faster than other areas over the 2000s (JRC Data Platform). Economic opportunities and jobs created in cities attract an increasing number of people to them, with the population living in OECD cities growing by 0.75 % per year over the past two decades. However, cities provide economic opportunities in ways

[57] Organisation for Economic Co-operation and Development, *Regions and Cities at a Glance 2018*, https://www.oecd.org/cfe/2-pager_RAG-final.pdf

that are highly selective and uneven across groups, based on skills, ethnicity, gender, age, etc. Inequalities in cities have been growing over time, with the wage premium for low-skilled workers constantly shrinking as revealed by recent research ([58]). In addition, the prosperity generated by cities is often coupled with environmental degradation, traffic congestion and inadequate urban infrastructure, making the environmental footprints of cities a key challenge for policy makers at all levels in Europe and beyond. The well-being and prosperity of European cities and their communities and inhabitants might be jeopardised by the de-prioritisation of investments in critical infrastructure and public services or by weakening environmental targets to levels that will fall short of fulfilling the obligations in the Paris Agreement. However, 'the adoption of Agenda 2030 for Sustainable Development recognised for the first time in the history of development the transformative power of urbanisation as a tool for economic development as reflected in Sustainable Development Goal 11' ([59]). Reflecting this major policy shift, The Urban Agenda for the EU ([60]) has stated the EU-wide objective to stimulate growth, liveability and innovation in EU cities by establishing a new working method to 'ensure maximum utilisation of the growth potential of cities and successfully tackle the social challenges (…)' by ensuring that 'the European Commission, Member States and cities will work together to ensure that the urban dimension is strengthened in (all) EU policies' ([61]).

In light of these high-level policy debates, maintaining and spreading prosperity across the entire urban system while creating sustainable liveable inclusive cities for all is the biggest urban challenge Europe is currently facing. The nature of the social and economic challenges to cities outlined in the 'Setting the scene' section of this report makes it clear that 'business as usual' is not possible. To address current challenges to sustainable and inclusive prosperity in cities, the EU needs to foster the co-creation of new insights and solutions applicable to both developed and less-developed regions of Europe.

How can cities remain or become innovative? How can they contribute to economic development in Europe by developing new creative insights for a sustainable future? How can urban development remain inclusive and territorially cohesive? To successfully address the challenges outlined above, R&I actions for innovative cities should take a fully systemic approach to the genesis, diffusion and absorption of innovation. Innovation itself cannot be understood as a purely technological process. Innovation is rather the multi-dimensional outcome of the operation of an 'innovation system' of the city, where people, organisations and competences take centre stage. This urban innovation ecosystem embraces the city-level network of actors and institutions in the public and private sector

[58] https://www.nytimes.com/2019/01/11/upshot/big-cities-low-skilled-workers-wages.html
[59] United Nations Human Settlements Programme, *Economic Foundations for Sustainable Urbanization*, Nairobi, 2017, p. 8 https://unhabitat.org/books/economic-foundations-for-sustainable-urbanization-a-study-on-three-pronged-approach-planned-city-extensions-legal-framework-and-municipal-finance/
[60] https://ec.europa.eu/futurium/en/urban-agenda
[61] European Commission, *The State of European Cities 2016*, Luxembourg, 2016, p. 15, doi:10.2776/770065.

whose activities and interactions generate, import, modify and diffuse new knowledge and ideas within and outside the city and across the whole urban hierarchy.

Logic of the intervention

R&I actions targeting the prosperity of innovative urban ecosystems need to embed their objectives within the broader framework of the Commission's overarching economic policy objectives, including the Europe 2020 agenda for growth and jobs as well as the key expenditure principles underlying the EU budget. In addition, all actions need to be evidence-based, supported by careful small-scale experimentation and evaluation of existing evidence on 'what works' in practice in different national and regional contexts of the EU.

R&I actions within this dimension shall aim to produce an impact in all Member States and regions of Europe, acknowledging the large heterogeneity in terms of socio-economic conditions, technological capabilities, innovation potential, absorptive capacity, skill intensity and competences, institutional quality, prosperity and wealth of the cities and regions of Europe. Solutions to the global challenges to cities identified by these R&I actions cannot be relevant and applicable only to 'leader' Member States, cities where various types of innovation are already flourishing or where innovative ecosystems are well-functioning already. An inclusive and cohesive model of city-level innovation and prosperity takes centre stage in this priority.

R&I actions within this priority are grounded on solid well-tested concepts that can be easily recognised by all potential users of Horizon Europe. Special attention will be devoted to facilitating the participation of cities themselves as key actors in Horizon Europe actions. Cities (through their representative and administrative bodies) should be encouraged and supported to take an active role in mobilising other stakeholders to participate in the proposed R&I actions. Given the heterogeneity of EU regions and cities in terms of their institutional and administrative capacity (as well as in terms of their familiarity with R&I action application and management procedures), special attention and resources will be targeted towards capacity-building actions in order to offer all EU cities equal opportunities for participation.

In addition, to mobilise the private sector (beyond publicly subsidised niche initiatives) in the co-creation of innovative solutions, R&I actions are based on a clear economic rationale and offer opportunities for market-driven economically viable solutions as well as for alternative non-market-orientated models of delivery where feasible. Horizon Europe should facilitate the identification of market-based solutions, address information asymmetries and other forms of market failure as well as generate public goods. At the same time, non-market-based solutions should be explored to design and develop new and innovative ways to address the needs of citizens.

Five main pillars (Fig. 1) can be identified behind urban (and regional) economic development, job creation and prosperity ([62]): innovation and human capital; localised knowledge flows, agglomeration and urbanisation economies; global networks and value chains; national, regional, and local public policies; and regional systems of innovation and institutions. A coherent approach to welfare-enhancing urban innovation should take into account simultaneously all these axes, their interactions and their synergies in an integrated manner. Investments in innovation and skills are two fundamental elements for urban and regional economic development and prosperity ([63]). However, this relationship it is not linear: investing more resources in research and development does not automatically produce more local innovation, more and better jobs or local wealth ([64]). The relationship between investment in R&D, human capital and the generation of innovation is extremely complex and influenced by the interdependence of other factors: exposure to localised knowledge flows and internal urbanisation economies, the nature and quality of 'urban' innovation systems and global connectivity.
Urbanisation and agglomeration economies can facilitate the combination and re-combination of knowledge and skills, making cities places where 'local buzz' can flourish and boost the return to innovation efforts. However, urbanisation and density can also generate congestion and cognitive lock-in. The ultimate balance depends on the interaction with the other two factors.

The capability of the urban environment to generate innovation (and translate it into development, jobs and prosperity) depends on the functioning and quality of its innovation system and their governance. The ways in which urban actors act as a system, how they make it easier for new 'entrants' to connect to it and how easy are their interactions become of primary relevance. The quality of urban and regional governance is also central in this context: an open system needs supportive institutions and organisations, appropriate and flexible 'rules of the game' with timely enforcement as well as the capacity to manage institutional change, learning and adaptation ([65]).

Urban ecosystems are key hubs of internationalisation processes, inter- and intra-firm global networks, offshoring and international outsourcing ([66]). These forms of 'global networks and connectivity' are the key factors shaping the functional link between local innovation efforts and the upgrading of local technological competence across sectors and activities. Global value chains form complex networks of production, and innovative activities pursued along the value chain represent the strategic integration of geographically distinct paths of innovation ([67]).

[62] Crescenzi, R. and Rodríguez-Pose, A., *Innovation and Regional Growth in the European Union*, Springer, Berlin, Heidelberg and New York, 2011.
[63] Glaeser, E., *Triumph of the city: How our greatest invention makes us richer, smarter, greener, healthier, and happier*, Penguin Books, New York, 2014.
[64] Moretti, E., *The new geography of jobs*, Houghton Mifflin Harcourt, Boston, 2012.
[65] Storper, M., *Keys to the City. How Economics, Institutions, Social Interaction, and Politics Shape Development*, Princeton University Press, New Jersey, 2013.
[66] Sassen, S., *Cities in a World Economy*, SAGE Publications, New York, 2011.
[67] Crescenzi, R. and Harman, O., *Move On Up! Building, Embedding and Reshaping Global Value Chains Through Investment Flows. Insights for regional innovation policies,* OECD Working Paper, 2019.

The connectivity of a city, its exposure to knowledge flows coming from and going towards other regions of the world, is crucial for its innovative trajectory. However, how these forces can be effectively balanced within a suitable framework remains a fundamental area of investigation that this priority aims to address.

Finally, public policies at all levels may play a fundamental role in shaping local technological trajectories (as well as in jeopardising them where they fail to deliver or pursue misleading or over-ambitious objectives). Innovation policies for cities call for a careful theory-driven and evidence-based approach to facilitate and nurture regional and urban innovation systems.

Priorities and R&I actions for prosperity

The intervention logic discussed above offers the foundations for the identification of the R&I actions to be prioritised for Horizon Europe to support innovative urban ecosystems in Europe.

To reflect the 'integrated approach to prosperity in sustainable innovative urban eco-systems', R&I actions are organised around five key priority areas:

1. innovative cities, creativity, culture, skills and the unequal distribution of opportunities
2. urbanisation economies and eiseconomies, mixity and diversity
3. urban innovation systems, institutions and economic governance
4. globally connected cities
5. public policies:
    - financing public services, affordable housing and urban policies
    - urban policies that work (Figure 2).

Innovative cities, creativity, culture, skills and the unequal distribution of opportunities

This priority will investigate the nature and impacts of new forms of urban-level innovation beyond technological processes (including social innovation and innovation in services and their provision as well as the role of creative industries). It will also explore the links between urban socio-economic needs and how city-level innovation can respond to these needs over and above the adaptation of 'standardised' solutions. Research on the link between needs and innovative (market-driven and non-market-driven) solutions will also shed new light on how to decouple urban prosperity from resource use and how this decoupling impacts community cohesion.

The capacity of cities to deal with new technological challenges also depends on new insights on the city-level impacts of: robotisation and artificial intelligence; global economic integration and disintegration; economic and financial shocks; and the emergence of sharing, creative and circular economies. These major shifts need to be understood with reference to: the quantity, nature and composition and evolution of the workforce of EU cities (innovative and non-innovative); the future of the location of innovative activities in cities; income and wealth inequalities; and the formation of populistic and anti-system movements. An in-depth understanding of these phenomena will make it possible to develop economic monitoring systems for EU cities based on statistical as well as real-time data to assess the degree of adaptation and resilience to these changes as well as to identify and address skill shortages and skill mismatch in cities and prepare for the future of work.

Cultural and creative industries have the potential to act as drivers of the capability of cities to build a prosperous, sustainable and resilient economic future. R&I is therefore needed to explore their impact on urban economic growth, development, jobs and well-being in cities of varying conditions to clarify the economic nexus between these concepts in terms of causality and policy guidance. Do 'strong' cities attract creative and cultural activities or, vice versa, do culture and creativity generate new economic opportunities in cities? Can all cities be creative or would urban policies targeting creativity foster territorial competition and a zero-sum game? What is the role of cultural and creative sectors as a driver for innovation and resilience? What are the spillovers into the rest of the economy? Do creative and cultural industries require new skills and business models to function properly (with special reference to the 'sharing economy')? What can cities and other local stakeholders do to facilitate this? R&I actions will address these fundamental (still unanswered) questions, going beyond best practices and individual case studies in order to explore the extent to which cultural and creative industries can practically contribute to the economic future of EU cities and to sustainable economic development in line with SDG 11.

The R&I actions discussed above will be coupled with actions aimed at understanding the potential conflicts between environmental, economic and social objectives, developing new metrics and tools to identify and measure these potential trade-offs and identifying new ways to achieve more just innovative solutions on the ground. Special attention will be devoted to the evaluation — through research and demonstration actions — of 'circular' and 'shared' solutions. (Do they work in practice? Under what conditions? In what types of cities?)

Urbanisation economies and diseconomies, mixity and diversity

The emergence of new disruptive technologies and the evolving demand for skills constantly shapes and re-shapes the global urban economic landscape. In this context, Europe needs to better understand the economic impacts of the rise, expansion and decline of cities and the associated policy options in terms of

innovative technological and policy sustainable solutions. R&I actions need to shed new light on how city size and density impact the economic performance of firms and workers and their location choices. R&I action will also explore the economic linkages between cities, the urban hierarchy and peri-urban and rural areas, shedding new light on the evolution of these linkages over time and in response to technological change and economic integration or specialisation.

In addition, R&I actions will explore the city-level economic impact of immigration, de-population and ageing and will investigate the provision of services in spatially inter-connected regional functional environments. Research will be needed to fully capture the economic returns from mixity and diversity in cities. How do mixity and diversity shape innovation and economic activity in innovative cities? Is there an optimal level of 'diversity' in innovative cities? How does this impact sustainability?

R&I actions of different forms will also explore the wider economic and non-economic impacts of different types of intra-city and inter-city infrastructural connectivity, with special reference to the new mobility needs fostered by changes in the spatial division of labour within and across cities, and new forms of sustainable urban mobility. This will be coupled with research and small-scale experimentation of new models of public finance for investment for renewing and upgrading transport systems and city infrastructure to match the new and emerging needs identified in the complementary R&I actions discussed above, within planetary boundaries.

Urban innovation systems, institutions and economic governance

The capability of cities to respond with innovative solutions to the challenges explored above crucially depends on their capacity to act as a well-coordinated 'urban innovation system'. More in-depth knowledge is therefore needed to identify (and experiment with) new models of urban economic governance and regulation and assess their implications for urban prosperity in different types of regions (more- or less-developed, weaker or stronger institutional conditions). R&I actions in this priority area will cover: research and experimentation of new forms of economic governance of cities, with special reference to the framework and regulatory conditions to support innovation in all economic sectors; prosperity implication and regulation of urban transport systems, with special reference to the sharing economy, self-driving cars and digital platforms; new flexible forms of participatory urban planning regulation; prosperity implications of new forms of governance for environmentally sustainable economic and commercial activities in cities; and impacts on prosperity and possible trade-offs of new forms of urban governance for the sharing and circular economies. The analysis of the circular economy of cities will deserve special attention, exploring new ways to reconcile circularity and prosperity.

The investigation and experimentation of these new forms of governance of urban innovation systems will be coupled with R&I actions exploring the socio-

economic and sustainability impacts of different types of urban-level institutions and their quality. This will involve the definition of appropriate metrics and typologies to classify city-level institutional arrangement in different Member States and link them to different types and qualities of innovative urban ecosystems.

Furthermore, R&I actions will explore the role of trust, cooperation and social and relational capital at the city level to explore to what extent relations can replace and complement transactions in urban economies, as well as experiment how 'sharing' can replace 'ownership' of key assets (including housing) and the practical viability of circular economy solutions. At the same time, the impact of crime, corruption and distrust will also be explored with reference to its economic and sustainability implications.

Finally, within this priority, R&I actions will devote special attention to urban commons as motors for new sustainable opportunities for urban prosperity. R&I actions will address fundamental questions: how to allow urban commons (if at all possible) to involve progressively more sophisticated activities, e.g. from gardening to housing, from traditional activities to innovation; how to reduce barriers to entry to broaden participation in urban commons to new categories of individuals beyond limited groups of highly motivated local stakeholders; how to mobilise economic and financial resources within tight (public) budget constraints and by mobilising private investment; how to reconcile with existing economic incentives, constraints and trade-offs the time and resources needed for urban commons to expand and prosper; what type of systemic adjustments will be needed, at what cost and with what types of impacts on inequalities; what policies work in low-trust low-social-capital (often) low-income cities to promote urban commons. R&I actions in this area will need to move beyond case-studies of niche elite experiences (often directly or indirectly subsidised by the public sector) to address these issues from a systematic cross-sectional perspective with implications for the entire EU.

Globally connected cities

Acknowledging that innovative urban ecosystems can only thrive as part of a global network of inter-connected cities paves the way to a set of R&I actions aimed at understanding the drivers and consequences of the global connectivity of cities. In particular, R&I action will be needed in order to explore how and on what grounds cities are included or excluded from: a) knowledge and innovation networks; b) global value chains and global investment and corporate networks, with special reference to innovation-intensive firms (globalisation of R&D); c) networks of highly skilled individuals and migration (city-level drivers of brain-drain and brain gain); and d) touristic flows and networks.

R&I actions will also explore urban-level impacts of sustainable global connectivity (understood as in points a, b, c and d above) on cities of different types. They will explore how these impacts depend on socio-economic conditions, technological capabilities and skills endowment as well as physical connectivity and position in urban hierarchy and EU core-periphery patterns. The

same actions will also shed new light on the sustainability and environmental implications of different forms of global connectivity between cities.

Furthermore, new research and experimentation is needed on the link between urban policies and planning and corporate behaviour. How do firms react and adapt their strategies in response to different urban policies and qualities of public decisions? How do they keep the balancing of their respective priorities within planetary boundaries? How can cities negotiate 'deals' that work for local citizens and the economy with major global corporate actors and platforms (e.g. Airbnb)? How can they reinforce their institutional capacity?

R&I actions within this priority will also explore the potential impacts and possible active-management solutions for data collected and stored by private companies as part of the provision of services to citizens (for example with reference to trip data collected by personal mobility providers or access data collected by internet service providers through Wi-Fi services in public spaces, etc.). New models of cooperation and data ownership and analytics will be explored and tested.

Finally, special attention will be devoted to the connectivity of cities through local, national and global touristic networks. R&I actions will explore: the factors that allow cities to link to global touristic networks; the factors that shape the impacts of this connectivity on local prosperity as well as on the local environment and on the preservation of local cultural heritage; the role of platforms, tour operators and other private actors in shaping flows and impacts in different types of cities. R&I will link with themes in the **place** dimension of this report to explore the socio-economic, equity, redistribution and financial (public and private) impacts of touristic flows (including the existence of threshold effects) as well as the impacts of policies aimed at fostering these flows to promote local prosperity. R&I will look in particular at the distribution of negative externalities and benefits among different groups of citizens and firms, linking this with CO_2 implications, de-carbonisation, etc.

Public policies (1): Financing public services, affordable housing and urban policies

R&I actions discussed in all priorities outlined above will offer new insights into the functioning of innovative urban ecosystems and their economies and will propose new and innovative solutions to existing and emerging challenges and opportunities, within planetary boundaries. However, cities will need economic and financial resources to implement new prosperity-enhancing innovative solutions and achieve the objective of SDG 11. Therefore R&I actions are needed to identify new approaches and innovative funding models for sustainable urban services, development and innovation policies and affordable housing, with special reference to public-private partnerships, crowdfunding, new finance technologies, alternative models of ownership and the use of green bonds.

New R&I actions will also look into the role of cities as intermediaries in facilitating access to credit for innovation and start-ups to support entrepreneurship in areas of special (social and environmental) interest or need. R&I actions will also assess: existing and new models of municipal service provision; the development, upgrading and maintenance of local infrastructure as well as the upgrading of the built environment (e.g. retro-fitting of buildings); and affordable housing as well as the associated finance bottlenecks and alternative solutions (including alternative ownership models). How can the best social and environmental outcomes be delivered while being economically viable? How can this be measured? What kind of procurement procedures are needed to ensure this? What models of partnership between business, government and community actors are needed? What are the impacts of the privatisation of municipal service provision or infrastructure? What alternative models exist and how do they perform across different European cities and types of services and infrastructure (e.g. water, energy, waste, affordable housing, mobility)? How can these 'new models' be financed, with special reference to less economically advanced cities? How can the capacity of cities be reinforced in less-developed (often low-trust, institutionally weak) regions and countries to deal with the challenges of innovative finance? Both research and demonstration actions will be needed to address these questions in a convergent manner.

Capacity-building at the city level will form a fundamental part of this priority. The use of innovative green finance requires the development of appropriate capacity among urban administrators and leaders.

Public policies (2): Urban Innovation Policies that Work

All R&I actions outlined above will respond to the call for evidence-based policies in all areas of EU funding. Consequently, a dedicated cross-cutting R&I action will consist of an ongoing evaluation programme on 'Urban Innovation Policies that Work'. The objective of the proposed R&I action will be to: develop a systematic review of different types of innovation and sustainability policies implemented in different realms, from 'traditional' R&D subsidies to co-working spaces and training programmes; collect beneficiary-level information for the largest programmes that show the most significant potential for replication in other contexts and implement full counterfactual impact analysis; research the factors conditioning the sustainability success and failure of the various policies in order to provide insights into how to improve existing and new policies; implement small-scale experiments, with suitable parallel and controlled counterfactual testing, to evaluate the impact of changes to the structure of existing and future policies and programmes.

R&I actions in this area will also involve the organisation of training sessions and demonstration sessions to diffuse the culture of policy evaluation in urban administrations and co-create new practical policy options and solutions based on solid evidence from evaluation and experimentation.

In addition, R&I actions in this area will involve: demonstration and information sessions open to citizens on the benefits of various Horizon-Europe-funded

programmes in the field of environmental sustainability to increase awareness and direct participation; and analysis of the most appropriate incentives to facilitate the active participation of citizens throughout their lifetime, following the evolution of their needs and interests.

Finally, a dedicated set of R&I actions in this priority will explore the economic viability of technological solutions and public policies that work in the best-performing cities and explore through research, demonstration and living labs how and under what conditions these can be transferred into other cities in the EU.

7. RESILIENT CITIES

The disruptive impacts of single or multiple shocks, such as climate change, loss of biodiversity, air pollution or natural risks, create problems, expose cities to vulnerabilities and might create additional long-term stresses. Modern society has become remarkably skilled at understanding how to mitigate conventional risks that can be relatively easily isolated and managed. However, there is still poor understanding of the complex stresses and shocks created in the interconnected systems of a city, which traditional forecasting and prevention find hard to predict. In complex and interconnected systems such as cities, feedback loops (mutual causal interactions between different systems), threshold effects (sudden and radical changes which occur after surpassing a certain limit) and cascading disruptions (impacts that generate a sequence of impacts in other systems, creating wider disruptions) can lead to sudden and dramatic breakdowns. These situations have recently been becoming more likely, and many of these complex risks are now shaping a 'new normal' that in turn might create its own disruptions and spillovers in the years ahead.

Urban resilience has many definitions, most of which take into account the ability to manage the wide range of shocks and stresses that may occur in a city. There is no standard definition. However, this report adopts a multidisciplinary and holistic definition of resilience. It is 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 ([68]).

A resilient city assesses, plans and acts to prepare for and respond to all shocks and stresses, whether expected and unexpected, natural or human made. Building urban resilience requires looking at a city holistically — understanding the systems that make up the city and the interdependencies and risks they may face. By strengthening the underlying fabric of a city and better understanding potential shocks and stresses, a city can improve its development trajectory and the health and well-being of its citizens ([69]).

Why are we dealing with this issue?

Urban resilience has been gaining momentum in the last decade in the political agenda. It has emerged as one of the core principles of sustainable urban development and features as an important theme across five major global agendas: the Sendai Framework for Disaster Risk Reduction 2015-2030, the UN SDG, the Paris Agreement on climate change, the IPPCC Summary for Policymakers on global warming of 1.5°C, the Habitat III New Urban Agenda and the Urban Agenda for the EU. In addition to the explicit mention of resilience as one of the priorities established in SDG 11 'Make cities and human settlements

[68] 100 Resilient Cities http://www.100resilientcities.org/resources/

inclusive, safe, resilient, and sustainable', other relevant international initiatives are currently tackling urban resilience ([70]). Moreover, the urban resilience movement that was spearheaded by non-profit and multi-lateral organisations almost a decade ago now has an ever growing number of global and city actors committed to strengthening its aims around the world, with climate change adaptation, disaster risk reduction, resource efficiency and community development the main entry points to the resilience field.

At an EU level, urban resilience is present in several flagship documents such as the EU Adaptation Strategy for climate change, which encourages national, regional and local adaptation actions to contribute to a climate-resilient Europe, the Urban Agenda for the EU, where resilience is also related to climate-resilience through the Climate Adaptation priority and the EU Sendai Action Plan for disaster risk reduction that translates the Sendai priorities into EU policies. Furthermore, resilience in urban environments has been addressed from several perspectives in H2020 societal challenges (SCs) (SC2, SC5, SC6, SC7), mobilising important EU R&I resources. Especially, ecosystem-based approaches have been developed by a wide range of DGs (DG Environment, DG European Civil Protection and Humanitarian Aid Operations, DG International Cooperation and Development), and through key Europe-wide initiatives such as the creation of the Covenant of Mayors for the EU and the platform for climate adaptation, Climate-ADAPT.

Logic of the intervention

Research, policy decisions and actions are needed to address urban resilience in a focused, comprehensive and systemic way. The typologies of R&I actions span the development of new tools and mechanisms and the assessment of impacts and knowledge transfer as well as experimenting with new solutions on the ground and a deeper understanding of the root causes of resilience. The selection of R&I policy issues and actions should contribute to global and European agreements, to current city resilience commitments and to tackling the top risks and future urban trends. In all these R&I priorities, citizens and cities are at the core, both as active producers of knowledge and as spaces for exploration and research by the academic and innovation communities. However, cities are not only understood as isolated systems; our systemic approach means considering them as embedded in spatial systems. With this approach, the resilience of cities is part of the resilience of their hinterlands, national resilience and even EU-wide resilience.

Since the resilience concept is relatively new, apart from R&I actions, the policy landscape needs to catch up to set the following pre-conditions to build the foundations for resilience.

[70] UNISDR Making Cities Resilient campaign; 100 Resilient Cities, pioneered by the Rockefeller Foundation; UN-Habitat City Resilience Profiling Tool; ICLEI Resilient Cities; OECD Resilient Cities research project; World Bank Cities Resilience Program.

1. **Capacity building**: New methods, tools and processes need to be developed to advance and embed resilience understanding at different city scales, from individual to organisational resilience within cities. Substantial efforts are needed by the municipalities to strengthen the resilience capacity of both city staff and citizens. For example, cities can:
    a. foster exchanges of urban solutions and mutual learning by developing a European network of municipal advisers or officers that work on innovation, science and resilience (e.g. the Chief Resilience Officers in city administrations from 100 Resilient Cities);
    b. design decision-support systems that help cities build internal capacity, such as toolkits focused on developing individual and organisational resilience within the city;
    c. engage citizens in addressing resilience: innovative methods are needed to engage citizens in understanding risks and vulnerabilities and to support them in taking actions to increase their resilience.

2. **Strategies and plans**: Support cities in developing innovative roadmaps to build their urban resilience through inclusive, data driven approaches such as:
    a. developing and testing products to facilitate the preparation and implementation of strategies for adaptation and resilience;
    b. defining and developing different city (or district) vulnerability profiles, which depend on economic, social, geographic, demographic, cultural, institutional, governance and environmental factors.

3. **Financial mechanisms**: Incorporate innovative financial mechanisms to address the lack of money and financial capacity of most cities (especially small and medium-size cities) to adapt buildings and infrastructures to be sustainable, smart and energy efficient.

Above all, urban resilience policies need to be flexible, inclusive, reflective and robust, with policies that work across sectors and scales, empower other actors, develop new processes and strengthen institutional capacity.

Priorities and R&I actions for resilience

R&I priority actions should give answers to the following challenges:

1. advance resilience understanding and the institutional and social capacity of cities and citizens to implement resilience
2. futureproof and enhance the performance of the most vulnerable city systems

3. address the major risks faced by European cities such as climate change, cyber dependency, social conflicts and social inclusion, economic volatility, public health safety and well-being.

Addressing major risks in cities

Resilience of cities to **climate change** will require R&I actions to: map the economic costs and social implications of climate change impacts; support knowledge transfer to further develop and disseminate existing technologies and pilots; integrate innovative and affordable adaptation solutions in urban planning; map social vulnerability to climate change; further develop bio-climatic solutions/materials and spread their application on the ground; develop tools and methods to make cities adapted to higher frequency of extreme weather events.

Cyber dependency increases the vulnerability of cities to cyberattacks. Offensive cyber capabilities are developing more rapidly than cybersecurity. R&I actions are needed to: develop mechanisms to test the cyber defences on cities' critical and strategic infrastructure (public transport, hospitals, energy, water and wastewater, nuclear power); create tools to block cyberattacks and prevent ransomware attacks and data fraud and theft; identify fake news and prevent their spread in society; detect security breaches and associated technological risks. Advances in cybersecurity governance mechanisms and technology need to be provided to mitigate the risk of disruptive attacks.

The functioning of cities is heavily dependent on **energy supply**. Energy ensures vital services in cities: mobility, (tele)communications, healthcare, heating and cooling and lighting. R&I actions are necessary to: address potential blackouts or power shortages; develop protocols for when minimum energy is available; generate alternative sources of production, storage and distribution; develop higher performance and lower CO_2-emitting systems; support the development of strategies to prevent power outages and infrastructure breakdown; understand changes in the way energy is produced and the likelihood of these changes triggering large-scale labour-market disruptions.

Water and food are essential goods for life that are normally not produced in cities. Since both goods rely heavily on the logistics and distribution systems, shortages and disruptions might have devastating effects in city life. Water management remains heavily dominated by traditional, human-built (i.e. 'grey') infrastructure, while the enormous potential for nature-based solutions remains under-used. Moreover, water infrastructures need to be adapted to rising demand by increasing their efficiency, performance and circularity. Innovative urban food-production systems need be explored (vertical and roof farming, indoor agriculture), along with methods to prevent food waste and boost circular approaches and mechanisms to tackle risks of malnutrition and unhealthy diets, especially in disadvantaged people or through contingency plans for food crises (food shortages or embargos, shocks in commodity prices).

A lack of **infrastructure resilience** manifests itself in adverse impacts, such as loss of power supplies or sewer flooding. Such an impact is felt in specific places and communities and therefore infrastructure resilience is context specific. A new generation of infrastructure projects is necessary to achieve development goals, including water security, disaster risk reduction and resilience to climate change. R&I actions should increase the resilience of key urban infrastructures (mobility, energy, water and sewage, waste) by developing new methods of planning and investment that reinforce the capacity of cities to survive, adapt and grow no matter what chronic stresses and acute shocks they face.

The recent financial and migration crises have exacerbated **social conflicts** and increased the polarisation of society. Rising income and wealth disparities together with a labour market characterised by high-quality jobs for (a few) highly skilled people and an increasingly precarious situation for most citizens are creating profound social instability. Socially resilient cities need R&I actions to better understand and address social conflicts, foster inclusion, create employment and integration opportunities, stop the rise of populisms and terrorism attacks derived from social fracture and create opportunities for the most vulnerable groups. Understanding how inequalities in cities create vulnerabilities and additional risks is crucial along with identifying interventions that could serve multiple resilience purposes, from disaster risk reduction to improvements in basic services.

Cities host key value-added activities developed by public and private investments. **Economic unrest** and increasing economic and geopolitical tensions create substantial risks. Political and economic crises cause widespread fear and might have devastating spillover effects. R&I actions should advance knowledge about buffer mechanisms and adaptation measures to address potential market crashes that lead to shortages of essential goods and services, cities shrinking due to the withdrawal of large companies or the decline of economic sectors. R&I actions should also address early-warning detection systems and mitigation measures for economic shocks.

The concentration of people in cities increases vulnerability to **public health** risks. Human pandemics in cities and the increase in chronic and mental diseases due to current lifestyles, ageing and loneliness are hot issues in the management of cities. R&I actions should develop mechanisms to prevent human pandemics and protect cities from the intentional (terrorist attacks) and unintentional (anti-vaccination groups) spread of infectious diseases and to address food-related health risks, such as: resistance to antibiotics transmitted by meat consumption; pesticides, metal, contaminants and bio-plastic accumulation in food; and risks associated with ultra-processed foodstuffs.

Future-proofing our city systems

To increase the resilience of key urban infrastructures (mobility, energy, water and sewage, waste) R&I actions are essential, such as: developing integrated approaches to incorporate analytics to measure the resilience of infrastructure

systems; new methods of planning and investment that reinforce cities' capacity to survive, adapt and grow no matter what chronic stresses and acute shocks they face; and emergency systems in case of shortages or disruptions. Better knowledge is also needed on the methods and potentialities of integrating grey, green and blue infrastructures to tackle city risks, i.e., support cities and service providers in creating new ways to assess their water- and sanitation-related risks and demonstrate how nature-based solutions can increase resilience to water-related hazards while simultaneously delivering additional benefits. In addition, R&I should further investigate mechanisms to prevent potential shocks and the risks faced by cities' cultural heritage. Finally, innovations should investigate how nature-based solutions can future-proof cultural heritage and further develop methods to assess vulnerabilities of assets from both shocks and stresses.

City vulnerability profiles and shock and stresses maps adapted to the different scales of cities need to be developed, together with early warning systems that alert cities to and prevent hazards, and contingency plans. Widely accepted and comparable frameworks, inventories, indexes and scoreboards, audit and benchmarking protocols, risk charts and coordination protocols among service provider tools need to be elaborated. All of these should be sensitive to the size and scale of a city and address the robustness, adaptability and transformability dimensions of resilience. Additionally, R&I actions should provide platforms that gather and make accessible data on existing solutions and practices, along with visual user-friendly tools to deliver information.

It is also critical to understand the interdependencies between the different infrastructure systems and the potential cascading effects. Special attention should be paid to forecasting, buffer systems and mitigation actions for multiple shocks and to innovative financial mechanisms to tackle the necessary actions to increase the resilience of the cities, as well as to creating safeguards against maladaptation.

Foundations for building resilience

Important skills need to be developed to advance resilience understanding at different city scales, from individual to organisational resilience within the cities. Major efforts are needed to strengthen the institutional capacity for resilience by building the capacity of both city staff and citizens.

At the institutional level, resilience-expert staff need to be part of urban planning offices. At the citizen level, innovative methods from behavioural sciences are needed to engage citizens in understanding risks and vulnerabilities and taking action to increase city resilience and to identify the correct incentives (nudges) for people to invest in protecting themselves from 'probabilistic' events and not rely exclusively on city-planner actions ([71, 72, 73, 74])

[71] Da Silva, J., Kernahan, S., Luque, A., 'Systems Approach to meeting the Challenges of Urban Climate Change', *International Journal of Urban Sustainable Development*, Vol. 4 (2), 2012, pp.

125–145 http://www.tandfonline.com/doi/full/10.1080/19463138.2012.718279?scroll=top&needAccess=true

[72] Martin-Breen, P. and Marty Anderies, J., The Bellagio Initiative, Background Paper: *Resilience: A Literature Review*, Institute of Development Studies, The Resource Alliance, The Rockefeller Foundation, 2011. https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/3692/Bellagio-Rockefeller%20bp.pdf?sequence=1

[73] Meerown, S., Newell, J. P., Stults, M., 'Defining Urban Resilience: A Review', *Landsc. Urban Plan.*, 147, 2016, pp. 38–49. http://www.sciencedirect.com/science/article/pii/S0169204615002418

[74] 100 Resilient Cities, http://www.100resilientcities.org

8. CROSS-CUTTING PRIORITY: GOVERNANCE

Urban governance is a complex concept that involves multiple actors. It affects how public, private and civic life, business and markets, sociotechnical systems, and urban ecologies are organised and managed, how city affairs are conducted and how the varying actors behave and interact. Governance is a broader notion than government and refers to the relationship between civil society and the state, between rulers and the ruled, the government and the governed. It includes the many ways individuals and public and private institutions plan and manage the common affairs of the city. The SDG as a whole, and SDG 11 in particular as well as the Urban Agenda for the EU, embed and reflect within them what the global community sees as good and urgent governance — a set of principles that are increasingly etched into proposed policies, strategies, criteria, norms, rules, regulations and laws.

According to UN-Habitat, urban governance is the enabling environment, which requires adequate legal frameworks along with effective political, managerial and administrative processes to enable the local government response to the needs of citizens. It can be defined as the many ways that institutions and individuals organise the day-to-day management of a city, and the processes used for effectively realising the short-term and long-term agenda of a city's development. Urban governance is the software that enables the urban hardware to function. Effective urban governance today is characterised as democratic and inclusive, long-term and integrated, multi-scale and multilevel, territorial, proficient and conscious of the digital age ([75]).

A central principle today is public open governance. This is the practice of facilitating individual and group dialogue along with engagement in collaborative exchanges that enable citizens to initiate and advance discussions and ideas, beyond merely responding to ideas or policies initiated by government. It holds, too, that citizens have the right to access the documents and proceedings of their government to allow effective public oversight, so increasing accountability and transparency. It involves using the potential of open data as well as notions of crowdsourcing ideas, e-governance or testing new forms of decision-making, from citizen juries to liquid democracy.

Why are we dealing with this issue?

Our world is becoming increasingly urban. Cities are identified as a favourable arena for collective decision-making. Local governments have the proximity to translate the principles of good urban governance into effective management, governance and development of a city, and ensure equitable access to citizenship. However, they require adequate legal frameworks and efficient political, managerial and administrative processes, as well as mechanisms, guidelines and tools to respond to citizens' needs. Aspects such as legitimacy,

[75] https://unhabitat.org/governance/

representativeness, accountability and efficiency are typical dimensions of good governance.

The governance of cities is witnessing important challenges in adapting to the current scenario, where more actors and demands than before are present. Among important global trends are economic globalisation, privatisation of traditional state functions, the increasing importance of public-private partnerships as well as greater needs for private capital for urban development due to public budget constraints. These and other trends have leveraged an increasing presence of the private sector in cities' development and the proliferation of public agencies. In parallel, proactive urban governance combines the claims of civil society organisations, community-based organisations and other formal and informal groups to participate in decision-making. Public authorities are giving space to these groups to be involved in policy design and decision-making by co-designing, co-creating and even co-producing policy outcomes.

The watchword is the 'right to the city' movement, which is expressed in the rise of policy labs, new participation platforms and new attempts at collective decision-making, such as citizen juries. The frustrations with the speed of governments in responding to urgent issues is also witnessed by revolts of young people, as in school strikes, or the development of organisations, such as Extinction Rebellion, who stretch the boundaries of legality.

The sources of political power have become more diffuse. New governance arrangements have created new institutions and empowered new actors, while disempowering others. The roles of business and civic leadership in cities rearticulate relationships and create public-private partnerships in a continuing process in which conflicting or diverse interests need to be accommodated.

Urban governance is a critical issue in shaping the future of cities. Policies and decisions affect: urban development — city design and where and how to build, which social and economic activities are boosted and which transport infrastructure developed; the provision of fresh water, energy and food; sewage, recycling and waste collection systems; the connections of a city with its regional hinterland and the rest of the world. These planning and policy interventions have extremely longstanding consequences, linked not only to infrastructure (which can last for decades) but also to potential lock-in effects for the future ([76]). Such decisions are not simply a matter of land use but a matter of redistribution.

Often, most of these decisions are taken in a scenario of uncertainty, political power asymmetries in relations with national states, limited institutional capacities, path and context dependencies, fragility and low levels of autonomy, coalitions with private and civil-society actors, outdated policy silos and other barriers that impede decision-making. Urban governance institutions are required to be equipped to address such risks and challenges.

[76] Burdett, R., Rode, P., Shankar, P., Vahidy, S., *Governing urban futures*, LSE Cities, London School of Economics and Political Science, London, 2014.

The profound transformations that have affected cities in recent decades make urban governance a cross-cutting issue. It is embedded in different EU policies such as the Urban Agenda for the EU and EU regional and urban development ([77]), as well as OECD reports ([78]) and global agendas such as the Habitat III New Urban Agenda ([79]). All of these emphasise the need to reinforce urban governance to address global challenges. Several H2020 research priorities have addressed governance issues, such as the recently launched 'Governance for the Future' programme. However, further R&I actions are expected to be developed to address the governance processes and arrangements needed to govern the innovative cities of the 21st century.

Priorities and R&I actions for governance

These actions can be grouped around the following priorities:

1. defining urban governance
2. understanding the complexities of urban governance
3. governing the cities of the future
4. citizen engagement.

Defining urban governance

The scientific analysis of urban governance has been dominated by case studies and by theoretical claims with little empirical support ([80]). Urban decisions might have long-term implications that not only affect the boundaries of individual cities. However, little information exists on how cities are governed, how governance works in different contexts, what are the dimensions of good governance in the European context, the governance gaps and deficits EU cities face, how policy outcomes can be measured and even the limitations of the governance concept itself. Investigating the different urban governance landscapes is necessary to understand the way cities are governed and how decisions are made (or not made). The differences between cities linked to their different sizes, development patterns or political approaches should be identified and good (and bad) practices examined.

We lack global data and global comparative research on urban governance. Regardless of the ever-increasing availability of information on institutional arrangements in individual cities, knowledge and methodologies to capture and

[77] https://ec.europa.eu/info/eu-regional-and-urban-development_en
[78] Organisation for Economic Co-operation and Development, *Governing the city*, OECD, Paris, 2015.
[79] Habitat III, *Policy Paper 4 — Urban Governance, Capacity and Institutional Development*.
[80] da Cruz, N.F., Rode, P., McQuarrie, M., 'New urban governance: A review of current themes and future priorities', *Journal of Urban Affairs*, Vol. 41, 2019, pp. 1-19.

compare the wide spectrum of urban governance systems are limited. Some efforts have been made, such as the global surveys on urban governance launched by LSE Cities in partnership with UN-Habitat and United Cities and Local Governments but further research is needed.

R&I actions need to develop and nurture a solid and multidisciplinary theoretical field on urban governance and to provide cities with tools to collect, analyse, compare and visualise results to address the challenges faced by their current governance systems. The influence of aspects such as size, development levels, organisational skills and capabilities and the cultural and legal contexts in which urban governance occurs have to be integrated into the frameworks and methods proposed. This knowledge system should not only consider cities and metropolitan regions, but also their complex, evolving connections to their hinterlands, rural-urban interactions and the effects on governance of the networks of collaboration in which cities are involved, together with the influence of urban governance at the global level.

The complexities of urban governance

Urban governance embraces a multitude of aspects that are often in conflict. Cities are confronted with increasing responsibilities, such as addressing some of the most globally relevant challenges such as urbanisation or climate change. The governance of cities and the governance of the planet are intertwined. However, current governance systems do not match the functional scales of today's globalised cities. Present debates gravitate around the 'fit' between the size of the administrative boundary and the extent of the challenges that cities have to address. The absence of directly responsible actors or governing bodies at a global level, cities' limited administrative and jurisdictional scales and national legal and fiscal contexts make it almost impossible to tackle these issues without defining new frameworks that recognise the role that cities can and must play. The existing sectoral divisions of power, together with often relatively short-sighted political cycles and concerns, make it very difficult to manage the large-scale functional connections linking cities to their regions and the Earth system. Low levels of autonomy, fragmented and overlapping jurisdictions and responsibilities, difficulties in working across governance tiers, insufficient public budgets, short-termism, lack of national support for urban agendas and financial deficits are just some of the issues that constrain the regular practice of city governance.

Priority should be given to R&I actions that advance multi-level governance approaches to bridge geographic scales and deliver knowledge on the best scale to address each of the relevant issues faced, along with investigations into innovative financing methods. Further knowledge is needed on the appropriate scales for addressing different problems (global, neighbourhood or even household), the interconnections between scales, the governance arrangements that may align cities' operations, dynamics and processes with the global challenges faced nowadays and the design of national urban policies to fulfil the crucial role cities play.

Urban governance has to include 'stakeholders' in decision-making. But who are these stakeholders and at what level of government should they operate? Inclusivity among multiple stakeholders is a critical issue. We need much more knowledge on how to include a multitude of relatively autonomous actors with limited resources for and interest in collaboration. This is the nudging system to tackle underrepresentation of vulnerable groups in public decision-making.

Mayors and civil servants face powerful business interests, often in a scenario of budget restrictions and difficulties in delivering the increasing quantity of public services that citizens demand. Good practices in good governance need to be explored in different contexts as do the mechanisms through which powerful interests influence the public life of cities.

At the operational level, urban decision-makers are expected to match strategic plans and projects and long-term decisions with four-year political terms, often in contexts of inflexible bureaucracies and rigid rules. Citizens demand improved service delivery, well-functioning infrastructure and economic dynamism but are reluctant to pay more taxes. Some leaders have strong power and are influential at city and higher levels, work in networks, can negotiate and have access to influential boards. Many other city leaders have to develop their work with insufficient formal authority and limited budgets. Furthermore, city mayors often face highly departmentalised governance structures, often leading to fragmented policy initiatives, which might have particularly adverse effects. R&I actions need to test different approaches to breaking silos to link creative bureaucracy ([81]) with accountability and responsibility, replace traditional hierarchical coordination with more networked forms of work and boost inter-disciplinary approaches that enable joint work between the managers and officers of different city departments.

Governing the cities of the future

The governance of the cities of the future faces strong transformations and transitions, such as those linked to the emergence of new technologies in city life, major disruptions that might affect local government operations, the need to lead urban transitions and transformative solutions and new trends in urban commoning.

ICT technologies and the digitising world are considered as key enablers of the urban transformation and are dramatically changing the urban scenario. Smart urbanisation and its sensors, devices, connectivity and cloud services are powering open-innovation systems, evolving co-creative decision-making and increasingly transforming urban governance. Cities are interesting test beds for experimenting with these technologies, but the universe opened by ICT, open access to information and big data might also be viewed as an inherent threat and a source of concern. Data protection, who owns data, for what data is used

[81]Landry, C. and Caust, M., *The Creative Bureaucracy & its Radical Common Sense*. Comedia, Gloucestershire, 2017.

and what control might citizens and local governments exert in the use of the data they produce are distressing issues.

Cities are increasingly affected by external events, which often lead to significant local disruptions. The most recent trends are linked to economic recession, populism and civic unrest, but others might happen in the near future and interfere with urban governance. The phenomenon of populism is linked to the decline in trust in authorities, experts, elites and decision-makers. Rising wealth gaps and increasing inequalities have made lay people feel left outside of growth and well-being dynamics. Public opinion is increasingly led by information shared by popular peers and information sources that are opaque and not independentaly evaluated. City officials are expected to lead transitions, innovations and transformative solutions. R&I should provide them with mechanisms to cope with disorders and address change and uncertainty.

Urban commoning is a rising movement in Europe ([82]) and beyond that considers urban space as a space of social interactions where resources are collectively owned and shared. It emerged as a reaction to the retreat of the welfare state and its defence of public goods, and to the increasing privatisation of places and issues that used to be in the public sphere: public services, social housing and public lands. It aims to empower citizens and defend their right to the city, developing direct democracy mechanisms, new modes of access and management of urban resources and more active participation in urban issues relevant to citizenship. Different goods and services are now considered as urban (or global) commons, such as public spaces, housing, energy, food, clean air or even health and well-being, and citizenship dynamics have been activated. R&I actions should explore how innovative institutional arrangements and responsibilities might enable and control the expansion of urban commoning.

Citizen engagement

Engaging citizens in urban governance is a priority. Cities are testing new ways of working with citizens, including new forms of deliberative democracy in multilevel governance. With national governments and the EU in need of better tools for listening to and engaging with its citizens, cities might be at the forefront of participatory approaches and inspire all levels of government.

Citizen engagement ranges from civic engagement and public participation, to citizen science and do-it-yourself practices, offering an effective way to connect citizens, experts and policymakers ([83]). Different initiatives in Europe aim to involve citizens in a dialogue about how to govern the cities, to work closely with citizens and civil society to address key problems and reinforce trust and

[82] Bologna Regulation for the Care and Regeneration of Urban Commons, 2014.

[83] Figueiredo Nascimento, S., Cuccillato, E., Schade, S., Guimarães Pereira, A., *Citizen Engagement in Science and Policy-Making*, JRC Science for Policy Report, 2016 doi: 10.2788/40563.

ownership of public policies. One example is the EUROCITIES Campaign, 'Cities4Europe — Europe for citizens' that showed how working directly with citizens can help develop better urban and European solutions.

Citizen engagement might contribute to research, accelerate market creation and facilitate closure of ethical debates on science and technology-related issues. Citizens are increasingly demanding to be engaged with scientific and technological issues and to have a voice on R&I decisions and actions since they place high hopes and expectations on what science and technology might deliver for the future. Citizen-science actions are increasingly present in the European research scenario.

R&I actions are needed to inspire all levels of government to build societies where people come first, making a positive impact on the way decisions are taken in Europe and to promote a new sense of ownership through new forms of citizen engagement. Working with cities is an opportunity for Europe to reconnect with its citizens and, therefore, successfully tackle today's challenges. To make the most of opportunities, we need to work together across all levels of government and with our citizens.

9. CROSS-CUTTING PRIORITY: MEASURING INNOVATIVE CITIES

Measurement is central to achieving the goal of sustainable innovative cities. The development of suitable metrics makes it possible to assess initial conditions, set credible goals and objectives, monitor progress and evaluate the impact (and value added) of public policies from a local, national and international comparative perspective. Measurement, monitoring and evaluation are now common practice (and binding requirements) in virtually all fields of EU policymaking, including innovation and urban policies. However, a siloed approach has so far dominated existing metrics of innovation, social and economic well-being and prosperity in cities. Conversely, the measurement, monitoring and evaluation of the interventions proposed in the four dimensions of this report call for a fully integrated and systemic approach to measurement. Dealing with human-centred innovative cities means developing new integrated metrics able to capture inter-connections and feedback loops between people, place, prosperity and resilience. This, in its turn, calls for a new innovative systemic approach to measurement, monitoring and evaluation that needs to build upon existing data and methods to combine them in innovative ways.

This cross-cutting dimension aims to support cities in addressing emerging urban challenges by means of such approaches for an inclusive and cross-sectorial 'urban ecosystem' framework. R&I actions within this cross-cutting dimension aim to advance existing knowledge on innovative urban ecosystems by defining new frameworks for the collection of city-level data to combine these into a systemic framework of indicators and measures and elaborate them to monitor both city-level evolutionary trajectories and policy actions as well as to evaluate impact. R&I actions aim to advance our understanding of how cities work in practice, where they stand in terms of people, place, prosperity and resilience and how their position in this space evolves over time and in response to policies in both developed and less-developed regions of Europe. This contributes to accomplishing the overall mission of SDG 11 in a fully integrated and systemic manner.

Why are we dealing with this issue?

The definition of the SDG has been accompanied by identifying a set of widely available indicators to measure the position and advancement of countries towards their achievement. Currently 232 indicators ([84]) are part of the global indicator framework for the SDG and targets of the 2030 Agenda for Sustainable Development. They effectively map all dimensions of the full set of SDG and their evolution. In 2017, the European Commission developed a reference

[84] https://unstats.un.org/sdgs/indicators/indicators-list/

indicator framework to monitor the SDGs in the EU ([85]), aligned with high-level scoreboards for EU policies. This has been coupled with an annual review conducted by Eurostat on the evolution of this set of indicators ([86]).

The sub-national and city-level component of this measurement framework remains significantly under-developed. This is in sharp contrast with paragraph 45 of Transforming Our World: the 2030 Agenda for Sustainable Development ([87]), which commits UN Member States to 'work closely on implementation with regional and local authorities' and assigns a central role to cites in the implementation of the entire 2030 Agenda. UN-Habitat suggests that approximately one in three of all SDG indicators have a local or urban component ([88]).

'The absence of disaggregated results for each individual EU Member State and subnational entities (regions, cities) is […] an important limitation of the current monitoring of the SDGs in the EU since national, regional and local policies and reforms are crucial to achieving the goals by 2030' ([89]). Conversely, the UN Sustainable Development Solutions Network regularly offers city-level indices for the USA ([90]).

This significant knowledge gap has also been highlighted by the UN Statistical Commission:
'The group agreed that territorial/spatial disaggregation is fundamental for most of the indicators. In particular, the use of geospatial information for the development of some of the indicators (for instance in the case of cities) was stressed. In this context, the need to increase the utilization of data at the lowest geographical sub-national level was highlighted — as it was also a recommendation by the IEAG report on the Data Revolution ([91]).

Even if they lack the systematic time and spatial coverage needed to monitor and evaluate SDGs, there is a vast array of measurement systems coming out of the public arena as well as private sources covering a variety of fields affecting urban life. These range from the state of the environment — globally, nationally or locally — to the economic vigour, social dynamics or liveability and quality of life. Among these systems are the Innovation Cities™ Index, the world's largest global city ranking, with 500 benchmark cities, which focuses on human

[85] European Commission, *Next steps for a sustainable European future*, Communication COM(2016) 739 final.
[86] https://ec.europa.eu/eurostat/documents/276524/9479054/2019-01-08_EU_SDG_indicator_set_2019_review_final_report.pdf/7234d06f-4fd5-40ce-8071-7bcddc4013c2
[87] United Nations, *Transforming our world: the 2030 Agenda for Sustainable Development*, 2015 https://sustainabledevelopment.un.org/post2015/transformingourworld
[88] https://unhabitat.org/un-habitat-for-the-sustainable-development-goals/
[89] European Economic and Social Committee, *Exposing EU policy gaps to address the Sustainable Development Goals*, 2019, p.25, https://www.eesc.europa.eu/en/our-work/publications-other-work/publications/exposing-eu-policy-gaps-address-sustainable-development-goals-study
[90] http://unsdsn.org/resources/publications/leaving-no-u-s-city-behind-the-2018-u-s-cities-sdgs-index/
[91] United Nations, Informal Note for UN Statistical Commission agenda, Expert Group Meeting on the Indicator Framework for the Post-2015 Development Agenda, 2015, p.7, https://unstats.un.org/unsd/statcom/doc15/BG-EGM-SDG-summary1.pdf

infrastructures, cultural assets and networked markets, or the Economist Intelligence Unit's Global Liveability Ranking, which ranks 140 cities, its Democracy Index, Mercer's Quality of Living Index, which includes 231 cities and the Monocle Quality of Life index. However, all these collections of indicators cannot cover the full spectrum of information needed to assess progress on SDGs at the city level and they lack the geographical coverage that is needed to monitor and measure the entire EU urban hierarchy. In addition, existing metrics fail to capture broader outcomes that involve social value judgements or the assessment of public value in a variety of areas (from culture to childcare) involving citizens in new, innovative ways ([92]).

Logic of the intervention

To address the fundamental need to assess the contribution of cities to accomplishing SDG through innovative sustainable solutions, R&I actions in this area need to adopt a different logic and move beyond the state of the art discussed above.

First, R&I actions should support the collection of data with a granularity that fully reflects the urban nature of the sustainability challenge. Cities (with their functional metro area) should be the relevant spatial unit for collecting and processing data. Indicators at a finer spatial scale and on network connectivity, such as input/output matrices, are also central to the strategy in order to look at trends and dynamics within and between cities. There are both technical and financial challenges, linked to costs and associated with more granular data on social, economic and environmental dynamics, that R&I actions should address in innovative ways.

Second, measurement goes beyond quantitative indicators. Most cities have a vision or aims, and these will increasingly include the SDG agenda and issues such as inclusivity as well as other dimensions that are specific to their own goals. Inevitably, they include local liveability or quality-of-life targets, including availability of health facilities or parks, and targets for cultural participation as well as those related to education or innovation. The assessment of these key urban dimensions has as much to do with qualitative assessment as with quantifiable facts. The assessment of the performance of cities has often to do with expectations, feelings and perceptions. For instance, whilst a city may objectively do well economically, it may become less competitive due to weaker institutional, social or other soft factors. Cities, therefore, need to measure themselves both subjectively and more objectively. This reminds us what David Yankelovich said: 'The first step is to measure whatever

[92] NESTA, *Public Value. How can it be measured, managed and grown?*, 2019.

can be easily measured. This is okay as far as it goes. The second step is to disregard that which cannot be measured or give it an arbitrary value. This is artificial and misleading. The third step is to presume what can't be measured isn't really important. This is blindness. The fourth step is to say that what can't be easily measured really doesn't exist. This is suicide!' ([93]).

Third, the measurement problem (both qualitative and quantitative) goes beyond 'cities' as administrative, economic or purely physical entities. Coherently with the approach that underpins this report, measurement should be targeting cities as dynamic integrated ecosystems that simultaneously involve multiple layers: people, place, prosperity and resilience. To achieve a fully systemic approach to measurement, indicators are not only developed and collected for each 'pillar' of the system but are dynamically inter-connected to reflect or capture: evolutionary trajectories over time, e.g. bouncing back of the system after a shock and development of resilience through path generation; feedback loops between indicators; expenditure and policy data, with all public influences on the system being carefully monitored — e-government and open data are central to this process; and diversity in the relevant spatial scale to capture different types of phenomena.

Fourth, the measurement problem involves the assessment of value in a variety of activities and policy areas that are central to sustainable innovative cities and their provision of key services, such as childcare and health, and amenities, such as green spaces and museums. Capturing value in these areas is of key importance to making key policy decisions and comparing alternative projects by means of cost-benefit analysis and/or cost-effectiveness ratios.

Fifth, measurement cannot be disjoined from modelling. Indeed, a feedback loop between use and production of information is central to the process. Indicators need to be linked into a theory-driven model of the urban system to: capture trade-offs between goals, for example if achievements in one area happen at the expenses of other — also desirable — objectives; identify spatial spillovers and their spatial extents; identify threshold values to assess success and failure in public policies.

Sixth, measurement and modelling cannot become part of a policy-learning process if they are not part of a rigorous policy-evaluation process that is able to capture impacts and value added of key urban policies and decisions and form the basis of evidence-based decision-making. Indicators are brought into life by their use in suitably designed analysis and evaluation models based on suitable counterfactuals (what

[93] https://www.publicagenda.org/pages/remembering-dan-yankelovich

would have happened in the absence of a certain policy or incentive or decision).

Finally, continuous training and learning are an integral part of the measurement cross-cutting pillar. Civil servants and key decision-makers should be constantly trained (and re-trained with an appropriate system of monetary and non-monetary incentives) in order to contribute actively to both the generation and the use of new data that becomes available.

All this needs to be embedded into appropriate governance systems for the collection and protection of data at all levels, from the individual level to the city and national levels, and feed, by means of appropriate governance arrangements, into an evidence-based decision-making process.

Priorities and R&I actions for measurement

The intervention logic discussed above offers the foundations to identify priority R&I actions for Horizon Europe to support the measurement of innovative urban ecosystems in Europe.

To reflect the intervention logic discussed above, cross-cutting R&I actions are organised around three key priority areas:

1. data collection and quali-quanti integration
2. modelling, benchmarking and evaluating
3. education, training and culture of measurement and evaluation for citizens.

Data collection and quali-quanti integration

R&I actions in this priority area will target the systematic and timely **collection** of quantitative and qualitative data on the four key dimensions of human-centred innovative cities outlined in this report. R&I actions will deal with the conceptual justification and collection of indicators based on but not limited to SDG indicators at the city as well as sub-city level to capture inter-city and intra-city phenomena and dynamics. R&I actions will also explore how 'big data' and artificial intelligence can be used to collect and process new real-time information on cities and their citizens in ways that are compatible with privacy, safety and public value.

R&I actions will also advance the measurement of the city as an integrated ecosystem (people, place, prosperity and resilience) by involving not only topic-specific objectifiable indicators such as measures of inclusion, trend data on levels of crime or measures on the adoption of circular processes but also other (mostly qualitative) frameworks to assess city-level innovative capacity and progress. R&I actions on the integration between quantitative and qualitative, objective and subjective information could include four clusters, all of which can be assessed by a combination of qualitative and quantitative measures. The first is how a city nurtures and identifies its creative potential, where issues such as openness, trust, tolerance and accessibility are assessed as well as the talent and learning landscape. The second is how innovative capacity is enabled and supported through the political and public framework, the strategic leadership, its agility and vision and its professionalism and effectiveness. The third is how a place exploits and harnesses its expertise, talents and aspirations through its entrepreneurship, its communication, connectivity and networking. The final is how the innovative actions based on our proposed four pillars are expressed in the lived experience of the city. This focuses on how the city's place-making is evolving in terms of SDGs as well as how it fosters distinctiveness, diversity and vitality, so enhancing overall liveability and well-being in all types of regions ([94]).

Modelling, benchmarking and evaluating

If data and indicators are not incorporated into models of analysis and interpretation that reflect the live functioning (in technical, social and economic terms) of the city, they cannot inform policy decisions. R&I actions in this area will assess through suitable models both the direction of change of urban systems as well as uncover trade-offs — for example between SDGs or across cities — and synergies. R&I actions will also develop and implement suitable methodologies to benchmark EU urban ecosystems from a global comparative perspective. Finally, R&I actions will involve the counterfactual evaluation of city-level policies as well as key R&I actions implemented in the intervention framework outlined in this report. R&I actions will explore how evaluation of all urban policies can feed into evidence-based city-making capable of avoiding the replication of mistakes in different cities and based on practical learning. Finally, R&I actions will evaluate the value for money as well as the returns in terms of public value from resources invested in new urban initiatives.

[94] Hyams, J. and Landry, C., *The Creative City Index: Measuring the pulse of your city*, Comedia, Gloucestershire, 2012.

Education, training and culture of measurement and evaluation for citizens

The measurement of the city as an integrated ecosystem and the integration between qualitative and quantitative data can only be meaningful if supported by the active involvement and participation of citizens. Citizens need to be generators and validators as well as users of their own city-level data. Measurement as well as evaluation should become part of daily civic life. To achieve this objective, R&I actions will investigate new ways to foster the participation of citizens into the measurement of urban ecosystems and the evaluation of urban policies, including through living labs and demonstration projects. R&I actions will identify new cost-effective ways to mobilise all citizens around the measurement and evaluation theme. R&I actions will also investigate the institutional and organisation arrangements and incentives to foster a culture of measurement and evaluation of the public administration at all levels but especially the city level, including the study of early childhood interventions.

10. SUCCESSFUL CITIES: LEARNING FROM THE BEST

What is success?

The idea of a successful city has changed, and with it the criteria for assessing progress. In the past, we thought physical infrastructures were the basis of success upon whose foundations economic prosperity could grow. A reliable job and income were mostly seen as enough. Now we realise there is more to success. Success now means being a city that is just, equitable and fair. It includes creating a positive physical environment, the ability to move towards carbon neutrality and to make a circular economy and cradle-to-cradle thinking a reality. Cities become prosperous when they mobilise all human, technological, economic and financial resources in new and innovative ways and operate within planetary boundaries. They invest in resilience now, rather than waiting until disaster strikes, and respond in a way that makes the city grow and thrive afterwards. Their governance arrangements balance top-down and bottom-up well and within these arrangements, the subsidiarity principle of making decisions at the lowest appropriate level is key.

How do successful cities operate?

Successful innovative cities recognise how their context and operating conditions have dramatically changed. They conclude that a business-as-usual approach will not get them to where they want to be. The **best cities start with values** about what is important to them and the world. They establish principles that guide their actions, such as being citizen-centric and fostering sustainable development. They assess their situation honestly and overcome the power of denial. They understand their position and resources and seek help from the best people they can find. They tackle difficult problems head-on. They are willing to be unpopular to achieve global goals. They involve the people, organisations and sectors in their city and listen to their constituencies, especially trusting their youth and going with their enthusiasms. The bigger-picture view they paint is open so that everyone can find a place in it, creating widespread ownership and commitment. Such a grand picture is broad enough to inspire but narrow enough to enable practical tasks to happen. This develops a mood of success and involvement.

Leaders explain the direction of travel, but with flexibility in the plan so that space is opened for dialogue. This fosters a shared sense of identity to allow different voices to thrive. They build a team and set of networks around themselves. This establishes a widespread leadership grouping. Together they discuss and identify catalysts and game changers. They have the confidence to challenge the accepted canon and the inevitable inertia in many spheres. Their open, flexible approach dares to risk uncertainty or failure as they know that

without experimenting and testing out ideas and projects, bigger gains or successes will be more difficult to achieve. They create conditions where people and organisations can think, plan and act with imagination.

They learn by doing, they rethink processes and procedures and so gently persuade using good examples to overcome organisational rigidities. They realise that getting things done involves partnering. The **public administration becomes less controlling** and more enabling and the private organisations understand that fostering the public interest helps them in the longer term as both profit and public good can be combined. Good places find room for community or activist groups and critics to bring ideas and solutions to the joint city-making endeavour.

To become effective, the best cities **think big and start small**, as being incremental allows flexibility to be built in. Confident cities go with the grain of their local culture — they start with themselves and build from that.

They build a **strong evidence base** to create legitimacy — a vital ingredient in the process of change. They have a trajectory to move forward anchored by a paced and purposeful approach that helps gain credibility.

Leading players possess and express passion as this keeps up energy and motivation. Narrating a story of the benefits of what can be builds emotion. Innovative places try to communicate well with a real simplicity of message and clarity of purpose and identify meaningful catalysts. They get the many to own the transformation. Ambitious places instigate quadruple-helix linkages between the public sectors, the private sectors, universities and wider communities of interest. This helps convince governments to assist. **Orchestration is the watchword** as good city-making is complex and needs to bring the disparate elements together.

People

The human-centred city looks at itself from a 360º perspective. It is welcoming to people from all backgrounds, diversities and age groups. It guarantees equal rights, opportunities and respect to all gender groups.

Here, people are shapers, makers and co-creators of their evolving city. There is a strong discussion culture. People participate and are more at the centre of decision-making, which is transparent, and so people do not feel diminished. Opportunities for face-to-face interaction abound in public places, while digital possibilities are used to help people become smart citizens. There is not only planning for the built and natural environments but also for social stability and equity, providing educational opportunity and cultural, entertainment and recreation possibilities all anchored in economic opportunity.

This city takes care of the fragile or vulnerable, be they children, the elderly or those with mental health issues or lifestyle diseases. They develop strategies

and mechanisms to avoid social isolation. By nurturing and empowering its citizens through an attractive, appealing and desirable environment, it helps physical and mental well-being and health.

This city provides a sense of anchorage, familiarity and solidity, of possibility, choices and opportunity, of connection, bonds and solidarity where divides between rich and poor are mitigated. It is a place of caring and welcome where differences can meet, and somewhere that provides the ability to self-improve and grow, as well as a sense of inspiration. This city then able to retain its talented people to attract others from outside to come to it.

Place

The task of planning for the built city, its infrastructures and its activity programmes is to communicate well and visibly the collective intent to be sustainable and inclusive. Innumerable messages express this, from bike- and car-sharing stations to green facades and living walls that benefit the environment, buildings and human welfare, or co-working spaces that bring people together. Its well-designed public realm communicates generosity and accessibility, and attention to heritage helps generate civic pride.

A successful place seeks to engage its citizens and organisations in taking responsibility for its continuing social and economic development and environmental requirements. In so doing, it pays attention to the need to protect, enhance and restore its natural capital and resources sustainably and to focus on circular economic processes that help sustainability goals, such as decarbonising the city, or managing waste processes effectively. This city aims to be restorative, self-healing and regenerative, so creating the conditions for it to become resilient.

Its urban planning regime and focus is tightly bound to sustainability objectives and is environmentally conscious. Citizens safeguard resources. In so doing, it encourages high-density communities to avoid sprawl and to use fewer resources. Its design of public space, such as parks, gardens, green facades or green architecture, makes the best use of wind and shade and uses of renewable energy. In building infrastructure, from housing to public facilities, it leverages numerous prefabricated solutions, advanced building materials and efficient construction techniques. It creates positive-energy districts or neighbourhoods and encourages citizens to be urban farmers. Zero to limited traffic congestion is achieved by new approaches to work and working hours, sharing mobility, walking and cycling, and a conscious design of both materials and goods flows.

Its integrated systems approach involves installing sensors in the city to achieve real-time feedback loops where automated systems can bring positive benefits. These climate sensors or core city-infrastructure systems help safeguard cities from natural disasters and infrastructure failures.

This place addresses key dilemmas of urban development, such as maintaining affordability, especially in housing, and it counteracts the negative aspects of gentrification.

The impact of these approaches can be strong. A grid mix of 50-70 % renewable energy by 2030 can be achieved ([95]) and this can contribute to addressing energy poverty. Optimising the energy efficiency in buildings can close 20-55 % of the gap between current emissions trends and 2030 abatement targets. Next-generation mobility thinking can reduce emissions equal to 20-45 % of 2030 targets ([96]). Managing waste better can achieve up to 10 % of the emissions reductions needed by 2030 ([97]). Adopting circular-economy principles could generate a net economic benefit of €1.8 trillion by 2030 its social benefits aside.

Across the three sectors of mobility, food, and the built environment, carbon emissions would drop by as much as 48 % by 2030 (31 % on current development paths) and 83 % by 2050 (61 % currently), compared with 2012 levels. Disruptive technologies could improve resource productivity in the EU and reduce costs by €0.9 trillion in 2030. In a circular scenario, primary-material consumption could drop as much as 32 % by 2030 and 53 % by 2050. The average cost per car-kilometer could drop as much as 75 %, thanks to car-sharing, autonomous and driverless driving, electric vehicles and better materials. In buildings, industrial and modular processes could lower construction costs by 50 % compared with on-site traditional construction. Passive houses could reduce energy consumption by 90 % ([98]).

Prosperity

Prosperous cities deal with human-driven economic development and finance to the benefit of citizens within planetary boundaries. They mobilise human, technological, economic and financial resources in new and innovative ways in order to be 'inclusive, safe, resilient and sustainable' (SDG 11).

Prosperous cities are innovative urban ecosystems that generate new sustainable solutions to new global urban challenges. They combine capital, skills and ideas in new ways, generating opportunities for all in an inclusive, equitable and cohesive urban economy. They leverage urbanisation economies, the mixity and diversity present to generate jobs, growth and well-being for their citizens. They are globally connected and are active open nodes of global networks of skills, knowledge, investments and people.

Prosperous cities are the sustainable engines of economic development, job creation and prosperity for Europe, its Member States and beyond. They thrive

[95] https://ec.europa.eu/commission/sites/beta-political/files/report-progress-renewable-energy-april2019_en.pdf

[96] *A strategic approach to climate action in cities-focused acceleration*, C40 and McKinsey, 2017 https://www.mckinsey.com/business-functions/sustainability/our-insights/a-strategic-approach-to-climate-action-in-cities-focused-acceleration

[97] Understanding Energy Poverty in Europe Forum, EU Energy Poverty Observatory https://www.energypoverty.eu/

[98] *Europe's circular-economy opportunity*, McKinsey, 2015.

in both developed and less-developed countries and regions of the EU and offer opportunities for learning for other cities and countries on a global scale. They 'support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning' (SDG11).

They can thrive in both developed and less-developed countries and regions of the EU and offer opportunities for learning for other cities and countries on a global scale. They support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning.

Prosperous cities benefit from well-designed, dynamically evolving and cohesive urban institutions and governance arrangements that shape and coordinate the behaviour and interactions of all local stakeholders, with a focus on planetary boundaries.

These prosperous cities succeed and remain sustainable by mobilising — in new and innovative ways — public and private finance. The public policies that work are carefully monitored and evaluated and so act as multipliers for public and private funds to achieve the goals of SDG 11.

Resilience

A resilient city is not only prepared to survive the shocks and stresses that might occur over time but is also able to respond in a way that makes the city grow and thrive afterwards. By investing in resilience now, rather than waiting until disaster strikes, cities stand to benefit from the investment in good times as well as bad.

A resilient city is a city where there is minimal human vulnerability, a diversity of livelihoods and employment opportunities, where adequate safeguards to human life and health are present and where collective identity, cultural recognition and mutual support is fostered, which helps social stability and security as does reduced physical exposure and vulnerability along with the continuity of critical services. Additionally, financial resources are available as are communications and reliable mobility. Effective leadership and management, empowered stakeholders and integrated development planning complete the cycle of the resilient city ([99]).

11. KEY PERFORMANCE INDICATORS

The key performance indicators (KPIs) to be considered for Horizon Europe's R&I on innovative cities should relate to the key factors for urban success described above and the mission for 'Climate-neutral and Smart Cities'. That agreed mission is the overarching KPI that should target 2030 as its delivery date. Any KPI suggested is ultimately a political choice decided either at the EU, national, regional or city level. Many city-level KPIs will also depend on local ambitions

[99] The Rockefeller Foundation | Arup, *City Resilience Framework*, 2014.

and visions. For many aspirations, it is difficult to attach a precise KPI figure. However, an aspiration, such as to involve communities in any decision that affects them, can become general common sense and a default position. A danger is that figures are picked out of the air without sufficient information or evidence as to how they can be achieved. The type of targets suggested should have relevance to all the dimensions discussed in this report and might include 'to reduce levels of inequality by 15 %' by 2030. This KPI, from the **people** dimension of the report, implies growing prosperity. It will have implications for the quality of place and create more resilience. An alternative KPI is 'to create 300 000 new jobs in European cities by 2026 through the application of sustainable innovation'. This KPI comes from the **prosperity** dimension but its achievement depends on the **place** and **people** dimensions while its capacity to survive shocks of all sorts rests on the R&I outlined in the **resilience** dimension. Other KPI will be of a binary nature. 'To ensure every city of scale has an intercultural city strategy', implies a reduction in prejudice and increased sensitivity to how places are shaped and built as well as creating job opportunities. Another KPI, 'to reduce by 20 % the percentage of the time CO_2 exceeds the prescribed limit', would imply taking serious measures to decarbonise and to foster circular economies, while 'to increase the proportion of waste recycled by 25 %' would also help.