EEA Report | No 06/2022

Urban sustainability in Europe — Post-pandemic drivers of environmental transitions

European Environment Agency

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Post-pandemic drivers of environmental transitions

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Executive summary

Background and policy context

It is becoming increasingly clear that the complex and interrelated challenges of climate change, environmental degradation and rising inequality will not be solved without a fundamental transformation of our societies. Many systemic environmental and social challenges are felt acutely in cities, and the COVID-19 pandemic showed the vulnerability of cities and the need for urban resilience. Yet cities can play a key role in the transition to sustainability. They can provide a fertile space for transformative innovations to emerge and flourish and, as centres of population and economic activity, they can provide opportunities for new ways of living and doing that are more resource efficient and help decouple social and economic well-being from material consumption.

The EU has a central role in supporting cities and accelerating urban sustainability transformations. This includes through supportive legislative frameworks and facilitating research and funding opportunities. Alongside the 2016 urban agenda for the EU and the New Leipzig Charter (2020), key initiatives included under the European Green Deal have a strong urban dimension, such as the circular economy action plan, the EU biodiversity strategy and the Renovation Wave. EU research and regional financial support is also important.

Given the renewed urgency of decarbonising urban areas as part of ambitious EU goals to reduce emissions, the new adaptation mission and the climate-neutral and smart cities missions of the Horizon Europe research and innovation programme will support cities in their systemic transition towards climate neutrality by 2050. They will foster innovation and engagement with a wider range of European, national, regional and local actors, while prioritising the demonstration of results.

The EU cohesion policy will play a major role in sustainable urban development, mainly supported by the European urban initiative, which will encompass previous instruments dedicated to cities in a joined-up way when it is rolled out by 2027.

Complementary to this, the sustainable and smart mobility strategy and the REPowerEU plan will bring about huge transformations in the EU transport and energy systems with implications for resilient urban living, as major infrastructure changes will be needed to save energy, produce clean energy and diversify suppliers.

Research approach

The research approach used in the preparation of this report was based on that used in the previous report *Urban sustainability in Europe — what is driving cities' environmental change?* (EEA Report No 16/2020). A mixed method approach was used including:

- a survey of European cities — representatives from 56 cities completed the survey;
- in-depth interviews with European city representatives — 27 city authorities were interviewed;
- qualitative and quantitative analysis of the data collected.

The purpose of the updated research was to understand if and how drivers and barriers of urban environmental sustainability transitions in European cities have changed since the COVID-19 pandemic. The research also explored in more detail the role of EU initiatives and legislation (including the European Green Deal) in cities' environmental transitions.

Key lessons emerging from this research

A summary of some of the most interesting and relevant lessons from the research in both this and the previous study is provided below. These lessons may help policymakers at all levels identify levers of change that can help to accelerate environmental sustainability transitions in European cities. They also provide insights that may be relevant to other urban stakeholders, including citizens, non-governmental organisations and the research community.

- **In the context of environmental sustainability efforts, the COVID-19 pandemic has mostly had a positive impact on cities.** This includes through recognising that change can happen quickly in confronting urgent societal and environmental crises; through accelerating sustainability initiatives, particularly around low-carbon mobility, more equitable access to green and public spaces, and rethinking how we live, work and travel; and through enabling transferable lessons to be learned both within city governments and across society.

- **These benefits could easily be eroded if the recovery from the pandemic is not inclusive.** Compared with the findings of the previous study, cities showed a heightened awareness of the role of tackling social and economic inequalities to effectively advance sustainability transitions and the importance of a just transition. COVID-19 highlighted the fundamental inequities in urban society and at times exacerbated polarisation around issues from vaccines to climate change. Cities will therefore need to ensure that new green policies do not further alienate certain social groups.

- **Cities need to work in their existing context but also to accept that they are evolving systems.** What emerges clearly from the research is that a good understanding of a city's context, and its constantly evolving nature, are prerequisites to successful sustainability planning. COVID-19 acted as an important reminder that cities are living and constantly evolving systems and that urban policymaking must remain agile in order to respond to emerging challenges and new realities.

- **Transition pathways need to be tailored to individual cities and their unique qualities.** There is wide variation in European cities' views on what are the most important drivers and barriers shaping their sustainability transitions, and solutions will have to be tailored to respond to these unique conditions.

- **There are certain recurrent themes and challenges that are common to all cities.** Rethinking existing urban infrastructure (both grey and blue/green) appears to be a unifying theme across European cities, regardless of their size, wealth or location. In this context, tackling issues of urban sprawl and breaking with decades of 'car-centric' urban planning emerged as one of the most frequently cited barriers to environmental sustainability transitions. While this was already an important theme in the previous study, the pandemic appears to have created a sense of heightened urgency around this topic.

- **Strategic planning and a clear vision are important, but once established the focus needs to shift to implementation.** All cities highlighted the importance of having well-thought-out plans that set out a clear trajectory and can act as a baseline for their sustainability transitions, as well as committed leadership to drive progress towards that vision. But there needs to be greater emphasis on measurable targets, clear accountability mechanisms, dedicated funding, and support to move from planning to actual implementation.

- **Mainstreaming climate and sustainability considerations across all government departments is increasingly recognised as a priority.** While the effective horizontal integration of policy priorities across departments continues to be a challenge for most cities, a growing number seem to be making progress when it comes to ensuring that climate and sustainability objectives are effectively mainstreamed across most of their policies and decision-making processes.

- **Cities need to be empowered, both politically and financially, for real change to take place.** The importance of both fiscal and political decentralisation emerged repeatedly during this research. Many cities felt that they had demonstrated through the pandemic that they could be trusted with this responsibility and that their proximity to the concerns of residents made them well placed to tackle complex emergencies and challenges. A lack of fiscal autonomy was frequently highlighted as a barrier that constrains cities from accelerating their sustainability transitions.

- **EU laws and policy frameworks matter — as does creating a shared identity.** Cities are strongly incentivised, supported and even inspired by EU legislation and strategies, such as the European Green Deal, the EU urban agenda and various EU directives. The EU also plays a clear role in shaping a new narrative about the role of cities in the green and just recovery from the pandemic, in the wider future of Europe and in creating a shared European identity and ensuring that cities feel part of a collective effort to bring about lasting change.

- **National and supranational governments can facilitate, and inhibit, systemic change.** National and supranational governments and European research initiatives can accelerate systemic change by facilitating knowledge exchange and supporting networks (such as the EU's 100 climate-neutral and smart cities) that enable peer-to-peer learning. Some cities highlighted that a lack of alignment between local, national and supranational priorities and objectives can undermine progress. An example is the NextGenerationEU recovery instrument, which cities reported as having a lack of consultation mechanisms.

- **Knowledge sharing between cities and with other stakeholders is critical to learning.** All cities identified the role of collaborative networks in enabling the sharing of knowledge and experiences, enabling them to co-create solutions to shared sustainability challenges. COVID-19 has shown the importance of city networks in information sharing and enabling cities to raise their collective profile in important policy conversations. Recent examples of this include the C40 Global Mayors COVID-19 Recovery Task Force and explicit calls by the Global Covenant of Mayors and Eurocities for a green recovery and cross-border solidarity.

- **Local research and experimentation can accelerate innovation.** Urban sustainability transitions are inherently complex. Research and experimentation help to identify locally appropriate solutions. Using the city as a test bed can accelerate innovation because it ensures that new

approaches and technologies are appropriate for the local context. EU and national research can also reinforce efforts by individual cities and provide insight into issues that are shared by a range of cities. Increasingly, cities seem to recognise the value of citizen-based innovation, knowledge generation and learning.

- **Involving various stakeholders and supporting effective public engagement in decision-making processes leads to better outcomes.** Achieving sustainability transitions requires all stakeholders to take ownership of and shared responsibility for the process. Public engagement in defining a city's visions and pathways can bring buy-in and participation. Without this, it can be difficult to achieve positive change. Educational and information campaigns can equip citizens to ask municipalities to act, while also empowering communities to take meaningful action. Having an engaged and empowered population can facilitate the implementation of more transformational changes.

- **Young people are increasingly important agents of change across European cities.** Public attitudes to environmental sustainability may be shifting, with greater public engagement in sustainability issues such as climate change, including through young people and youth movements such as Fridays for Future. In cities across Europe, young people are becoming increasingly vocal and engaged in holding their governments accountable. Cities can build on this by investing in educational initiatives and involving young people in decision-making processes.

- **New technologies can play an important role but need to be inclusive and fit for purpose.** Innovation can play a role in creating liveable and sustainable cities and addressing environmental challenges. However, care must be taken to avoid these having unintended consequences or side effects (e.g. social exclusion and inequality in access to goods and services). COVID-19 accelerated the adoption of new technologies to facilitate remote working, for example. Although remote working has the potential to reduce the demand for travel, and many cities saw a temporary drop in emissions as a result, such benefits may be offset by higher energy use and people moving to more remote locations.

- **Updated and accessible data and information are needed to monitor progress.** Data and information can improve environmental management, making it easier to demonstrate progress towards specific goals. National legislation and EU directives, and membership of EU networks can help cities to identify and improve data and information collection needs and processes. However, many city authorities may lack the skills needed to analyse and work with large datasets, and capacity building is therefore essential. The provision of timely, relevant and accessible European-level data and information on environmental issues (such as that provided by the EEA) remains important for cities.

- **Communicating information effectively and innovatively is an important part of engaging the public.** Innovative communication, such as qualitative storytelling and accessible data visualisation, can ensure that the public is clear about what a city is aiming to achieve and how people can be part of the sustainability transition. Other ideas mentioned by cities include 'champions' who promote sustainable behaviours; involving the public and private sectors through competitions; events where the public can try out new technologies; and regular town hall meetings to enable dialogue with citizens and the development of shared sustainability objectives.

- **Accessing EU, national and private funding plays a key role.** Wealthier cities may be able to independently invest in sustainability initiatives and to upgrade their urban infrastructure. However, for cities with smaller revenues, knowing how to access EU and national funding can play a key role in overcoming this barrier. Because of the time and skills required for the application process, access to EU funding is not equally distributed across Europe, and funds may not always reach the cities that need them most. Successful collaboration with the private sector can also help meet sustainability objectives, although city authorities need to ensure that they remain the main 'problem owner'.

- **Cities need more support to decouple growth from resource consumption.** Although cities are often at the forefront of circular innovation, decoupling economic growth from resource consumption remains elusive. While national and supranational policy and regulation will play a role, there are many policy levers available to cities that can drive more sustainable outcomes across all levels of society and the economy. Cities should not underestimate their role in changing behaviours and fostering a shared sense that radical transformation is both achievable and inevitable. To do this will require cities to remove perverse financial and policy incentives that lead to unsustainable outcomes (e.g. subsidies that indirectly promote urban sprawl and car ownership).

Future research opportunities

Opportunities to both deepen and broaden this research in the future include:

- **Tracking the impact of recent EU policy changes and the pandemic on urban environmental sustainability:** a number of EU policy initiatives have emerged in recent years as corollaries of the European Green Deal, such as a renewed EU urban agenda, the New European Bauhaus, the new EU research mission on adaptation and the climate-neutral and smart cities missions, the REPowerEU and the NextGenerationEU instruments. Additional research could explore and track how and to what extent EU initiatives are shaping urban environmental sustainability and better understanding of cities' role as key actors in Europe's transition.

- **Exploring in more detail themes that may be driving the sustainability transition:** the breadth of the current research means that, while it represents a valuable addition to the knowledge base on urban sustainability, the individual themes that have emerged could not be explored in greater depth. Further research could seek to explore individual priority themes/enabling factors or barriers in more detail, such as urban infrastructure financing to support transitions; metropolitan governance systems in the context of effective urban and territorial planning; governance of innovation in cities; and/or the interlinkages and interactions, lock-ins and path dependencies between enabling factors and barriers. This last example could involve more in-depth analysis of the actions of particular cities to gain insight into how particular issues have been approached and solutions developed.
- **Expanding the sample size to include more cities and enable more comparative analysis:** while the survey and interview samples were expanded compared with the previous study, they remain relatively small. Expanding the number of cities (through survey and/or interviews) could support more detailed assessment including, for example, exploring drivers and barriers across different types/sizes of city, or supplementing the qualitative assessment of city officials' views with a more quantitative analysis of drivers and barriers. A pulse check on the 2022 Russian invasion of Ukraine would also be of relevance. This unexpected non-environmental crisis might actually trigger changes in energy and food policy that could have far-reaching consequences for sustainability transitions.

1 Introduction

1.1 Background

It is becoming increasingly clear that the complex and interrelated challenges of climate change, environmental degradation and rising inequality will not be solved without a fundamental transformation of our societies. Far-reaching changes are needed in our technologies and infrastructures, cultures and lifestyles, which will in turn require adaptation of existing governance and institutional frameworks. Around the world, these important system innovations are converging in cities. Yet the COVID-19 pandemic has shown us that cities can also be particularly vulnerable to unexpected shocks and disruptions. In an increasingly interconnected, complex and uncertain world, the capacity of cities to remain resilient and adapt quickly to emerging challenges will become more important in the years and decades to come (Hamilton, 2020).

We have now entered a critical decade ([1]) during which we must intensify our efforts to ensure a good quality of life for future generations by protecting the environment, biodiversity and ecosystems, by mitigating the impacts of climate change and by radically reducing our consumption of natural resources. The good news is that we already have a lot of the knowledge, technology and tools we need for sustainability transitions to take place — the question now is how to accelerate and scale up this process (EEA, 2019a).

Box 1.1 Understanding urban sustainability transitions

Research into sustainability transitions aims to understand the long-term, multidimensional and fundamental transformation processes through which established socio-technical systems may begin to shift towards more sustainable modes of production and consumption. Understanding how such transformations can be accelerated in cities will help to ensure that we are able to address the climate and ecological emergency.

The term transition is commonly used in scientific disciplines (e.g. ecology, psychology and physics) and 'refers to a nonlinear shift from one dynamic equilibrium to another' (Loorbach et al., 2017). Sustainability transition can be defined as a 'radical transformation towards a sustainable society as a response to a number of persistent problems confronting contemporary modern societies' (Grin et al., 2010). Loorbach et al. (2017) describe transitions to sustainability as large-scale disruptive changes in societal systems that emerge over a long period of time and present opportunities for more radical, systemic and accelerated change.

Urban sustainability transitions can thus be seen as fundamental and structural changes in urban systems through which persistent environmental and societal challenges are addressed. Such urban transitions are enabled through a growing trend related to the empowerment of city governments and other urban stakeholders, with cities increasingly at the forefront of innovation and experimentation around sustainable forms of living and cities and city networks becoming important actors in shaping global climate and sustainability agreements and debates (EEA, 2020).

Given the EEA's remit and interests, the focus of this research remains on urban environmental sustainability transitions. Throughout the report, where the term 'sustainability transitions' is used, the principal focus is on the environmental dimension of transitions within an urban context. This is not to say that sustainability transitions do not also require corresponding social, economic and political transformations, but just that the current report and underlying research was framed in the context of environmental sustainability.

([1]) The Intergovernmental Panel on Climate Change (IPCC) has made clear that we need to halve global greenhouse gas emissions by 2030 to limit global warming to below 1.5°C and calls the 2020s 'a decisive decade' for transformative change to take place (Roy et al., 2021). At the same time the UN has proclaimed the 2020s 'the decade of action' to deliver the Sustainable Development Goals and the 2030 agenda (Mohammed, 2020).

Even before the COVID-19 pandemic it was clear that cities are places where the need for sustainability transitions is increasingly urgent and where transformative innovations can be created, tested and scaled (Frantzeskaki et al., 2017). Many systemic environmental and socio-economic challenges are felt most acutely in cities. Although they occupy only 3% of the Earth's land surface, they account for an estimated two thirds of global energy demand and 70% of CO_2 emissions (WEF, 2020a). At the same time, many of the most important innovations designed to counteract unsustainable behaviours and practices originate in cities (GCEC, 2014). These include emerging social innovations such as those in the sharing economy, slow-food movements and community-oriented ways of living, as well as opportunities for the circular economy, shifts to sustainable mobility systems, energy-efficient housing, renewable decentralised energy systems, and urban food production (Frantzeskaki et al., 2017; EEA, 2020). The density and agglomeration effect of cities can also facilitate more efficient use of resources, creating opportunities to decouple social and economic well-being from resource and material consumption.

Box 1.2 Distinguishing the current report from the previous report

For clarity, from here onwards the report *Urban sustainability in Europe — what is driving cities' environmental change?*, published in 2021, is referred to as the 'previous' report and the research (including survey and interviews) conducted for and presented in that report is referred to as the 'previous' research/study/survey/interviews. The report at hand, i.e. *Urban sustainability in Europe — post-pandemic drivers of environmental transitions*, is from here onwards referred to as the 'current' report and the research (including survey and interviews) conducted for and presented in this report is referred to as the 'current' research/study/survey/interviews.

1.1.1 Purpose and objectives of this research

At the end of 2017, the EEA launched a work stream on understanding and assessing urban environmental sustainability. Through this work the EEA has developed a considerable body of knowledge on urban sustainability in Europe. This important thematic focus is based on a growing recognition that many interrelated environmental and social challenges converge in cities, and that urban areas will have a central role in achieving the EU climate and sustainability goals set out in flagship initiatives such as the European Green Deal. The COVID-19 pandemic has further highlighted the central role cities play in responding to complex crises but also demonstrated that Europe's cities need to be supported in building long-term resilience.

The EEA has played a central role in championing the importance of the urban environment in Europe, including through its flagship state of the environment report, *The European environment — state and outlook 2020* (SOER 2020), which highlighted the need for 'enabling transformative change [that] will require that all areas and levels of government work together and harness the ambition, creativity and power of citizens, businesses and communities'. The report also emphasised that there is a rapidly closing window of opportunity for such transformative change to take place and that cities are a vital resource in this context (EEA, 2019a).

Building on the outcomes of the SOER 2020, a series of EEA reports and other outputs focusing specifically on the important role of cities in wider urban environmental sustainability transitions was published in 2020 and 2021. The first publication in this series was *Urban sustainability in Europe — what is driving cities' environmental change?* (EEA, 2021a). That 'first' report presents a prototype and a methodological foundation for this updated and expanded report: *Urban sustainability in Europe — post-pandemic drivers of environmental transitions*.

The previous report explored the key factors driving environmental sustainability transitions in a selection of European cities that had either won or been selected as finalists in the European Green Capital or Green Leaf Awards, considered 'frontrunners' in urban sustainability.

The research completed for the previous report was an important proof of concept. However, the fact that the focus was on a limited number of 'frontrunner' cities perhaps limited its relevance to more diverse urban contexts. Since the research was completed before March 2020, the previous report was also written during a time when the COVID-19 pandemic was still very much an acute and evolving concern in Europe and European cities. This meant that the report was not able to capture all the implications of the pandemic and its wider environmental and socio-economic ramifications.

Although the long-term implications will continue to emerge over the coming years and decades, this current, expanded and updated report seeks to compare the experiences of cities immediately before the pandemic and as they emerge from it and to assess whether there are areas where the pandemic has already led to changes in the key drivers of and barriers to environmental sustainability transitions in European cities.

The main objectives of the current report are to:

- generate new in-depth knowledge about the drivers of and barriers to environmental sustainability transitions in European cities;
- involve a larger and more representative sample of European cities (beyond the frontrunners) to enable comparative insights and to identify different patterns and trends across the continent;
- Explore how these drivers and barriers may have been affected by the COVID-19 pandemic, ongoing and planned European recovery efforts, and shifts in the wider policy context (e.g. NextGenerationEU, European Green Deal, EU urban agenda).

Understanding the factors that have enabled some European cities to address complex environmental and social challenges, even in the face of a major health emergency, has relevance far beyond the case of individual cities. As noted, cities in Europe have an important role to play in accelerating progress on environmental sustainability and resilience. Yet, there is insufficient information about why some cities have more actively engaged in transformative change. Understanding the enabling conditions and drivers of these changes is important, as is a clearer sense of the barriers that may be preventing some cities from reaching their sustainability potential or overcoming long-standing economic, institutional and cultural challenges that can prevent more radical change from taking place.

1.1.2 The EEA's previous work on urban sustainability

The current report builds directly on a series of EEA reports and outputs focusing on the topic of urban environmental sustainability transitions that was published in 2020 and 2021. All of these can be accessed on the EEA's website ([2]). An overview of all recent EEA outputs on urban environmental sustainability can be found in Annex 1.

In collaboration with stakeholders, the EEA has developed an overarching conceptual framework for urban environmental sustainability (see Figure 1.1) to provide the basis for its assessments. This framework is based on four main components:

1. **Lenses:** a range of perspectives on urban environmental sustainability that represent priority issues and concerns reflecting the EEA's environmental remit and that can be used to guide or focus assessment and analysis.
2. **Context:** the range of current and historical, physical, social and institutional characteristics that create and shape the setting in which a specific city exists, develops and functions. Each city's context will have a considerable influence on its transition to urban environmental sustainability.
3. **Enabling factors:** relatively high-level forces that can facilitate (drivers) or hinder (barriers) the transition to urban environmental sustainability.
4. **Building blocks:** key qualities that contribute to urban environmental sustainability. Depending on the context and enabling factors, different building blocks will be required to transition towards urban environmental sustainability.

The conceptual framework can be operationalised using different forms of analysis to assess urban environmental sustainability transitions. The analysis presented in this report focuses on drivers of and barriers to supporting transitions to urban environmental sustainability, using the concepts of enabling factors and context to frame the analysis and discussion.

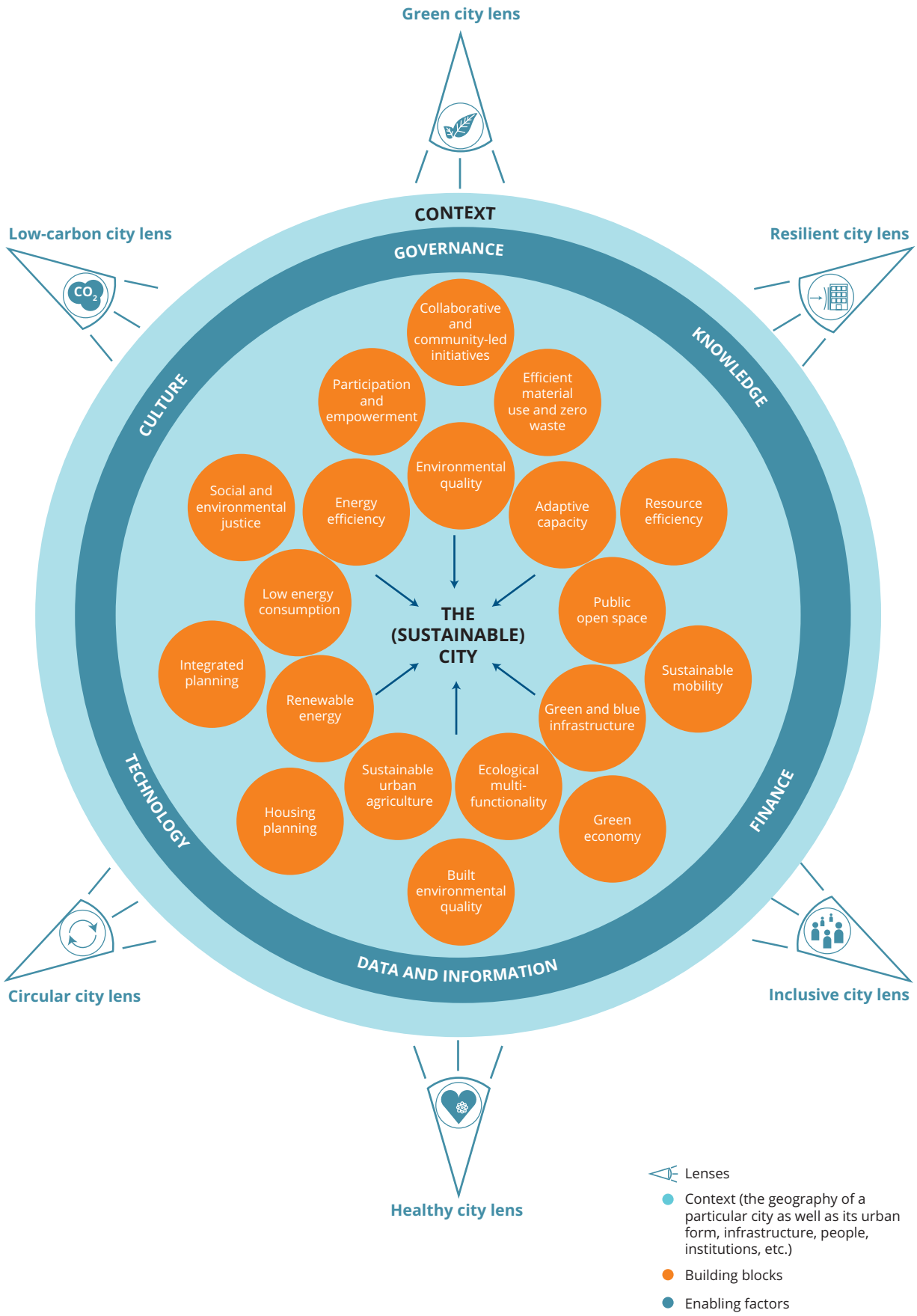
1.1.3 The impact of the COVID-19 pandemic on European cities

The COVID-19 pandemic has had wide-ranging impacts on cities. It may influence the transition to more environmentally sustainable urbanisation patterns for years to come. The pandemic is not the only event that is shaping the urban agenda: there are also new policy imperatives in the EU and at national and sub-national levels and major geopolitical upheavals such as the 2022 war in Ukraine. As a result, there will be new drivers that are contributing to accelerated action but also new barriers that will have to be overcome to ensure that ambitious urban sustainability targets stay on track.

Cities have been at the forefront of many of the social and economic consequences of the COVID-19 pandemic and of the responses to this health crisis. While European cities are likely to face many challenges in the years ahead, there is also a unique opportunity to align the recovery with the urgent transition to more sustainable cities. In fact, some cities have been seeking a more active role in shaping recovery efforts and leading calls for a recovery that will enable them to rebuild their economies, address complex social issues and tackle the climate and ecological crisis at the same time (Eurocities, 2020).

([2]) https://www.eea.europa.eu/themes/sustainability-transitions/urban-environment

Figure 1.1 Conceptual framework for urban environmental sustainability



Source: EEA, 2021a.

The pandemic has also increased awareness of the direct and immediate link between human activity and environmental impacts. For example, mandatory lockdowns and the corresponding temporary reductions in traffic led to rapid improvements in air quality and enabled wildlife to return to cities (Bil et al., 2021.; Schneider et al., 2022), although for many cities traffic volumes have now returned largely to pre-pandemic levels since restrictions have been lifted. At the same time, there is mounting evidence that human activities that encroach on natural areas and continued ecosystem degradation are linked to a proliferation of zoonotic diseases, highlighting the need for a fundamental rethink of our relationship with the natural world (Tollefson, 2020).

In this context, a growing agenda of issues is emerging that will profoundly reshape the urban environment. This includes questions about how a transformative green recovery can be achieved in different urban contexts and how it can contribute to building environmental, social and economic resilience and accelerate transformative change. This could include a rethink of existing land use and mobility patterns, new rules for the design of the public realm and green spaces, the emergence of new production and value chains, and asking questions about the role of technology and digital futures and their impact on urban equality.

One important legacy of this crisis is likely to be the realisation that behaviours, institutions and even infrastructure can be changed a lot faster than we may have previously assumed. We are not as 'locked in' to certain ways of doing things as we thought and, if necessary, we can radically transform how our cities operate and how we work within them. This has important implications for cities when it comes to the transformation of systems that will be needed to tackle the climate and ecological crisis in the years to come.

1.1.4 The EU policy context shaping urban sustainability transitions

The previous report found that the EU has a central role to play when it comes to accelerating urban sustainability transitions, including through the development of supportive legislative frameworks and providing new funding opportunities for cities to address sustainability challenges. These can act as drivers for sustainability transitions in cities or prevent necessary changes if not considered carefully. The EU also plays an important role when it comes to investing in cutting edge urban research, promoting experimentation through living labs in cities and facilitating partnerships across scales and sectors.

The cycle that started in 2016, when the EU ministers responsible for urban matters reached an agreement on the establishment of the urban agenda for the EU, as set out in the Pact of Amsterdam (EU Ministers, 2016), has been reinforced. This initiative introduced a new form of multi-level, bottom-up cooperation between all urban stakeholders to jointly develop innovative solutions across the (initially) 12 urban priority themes (e.g. air quality, urban mobility, housing). Partnerships tested ways to drive transformative change (European Commission, 2019), and since then another four new themes and partnerships have emerged. Recently, the New Leipzig Charter was adopted at informal ministerial meetings to provide a key policy framework document for sustainable urban development in Europe. The charter reaffirmed 'support for transformation through integrated urban development, with a place-based, multi-level and participatory approach' to advance urban sustainability after the COVID-19 pandemic (EU Ministers, 2020). In addition, the European Green Deal includes a strong urban dimension as highlighted by its various initiatives (e.g. circular economy action plan, EU biodiversity strategy, EU Renovation Wave, European Climate Law) that also acknowledge the need and potential for cities to achieve the sustainability transition (European Commission, 2020a, 2020b, 2020c).

There is a renewed urgency to decarbonise urban areas as part of ambitious EU goals to reduce emissions. The new adaptation and the climate-neutral and smart cities missions of the Horizon Europe research and innovation programme will support cities in their systemic transition towards climate neutrality by 2050 (European Commission, 2022a).

The main goal of the mission on adaptation to climate change, a direct contribution to the European Climate Law, is to support at least 150 European regions and communities towards achieving climate resilience in 2030 through innovative solutions leading to societal transformations. The mission aims to engage with a wider range of regional and local actors.

The 100 cities mission focuses on ensuring that by 2030, 100 European cities are climate neutral and smart and that these cities act as experimentation and innovation hubs to inspire and enable all European cities to follow suit by 2050, as a demonstration that rapid urban transformation is possible.

The 100 cities were selected at the end of April 2022 and have been invited to develop climate city contracts to implement overall climate neutrality measures with sectors including energy, buildings, waste management and transport. These contracts will be co-created in a participatory way involving a range of stakeholders at different governance levels and including citizens. A mission platform is being prepared to provide assistance to the cities and around EUR360 million — in mobility, energy, urban planning projects — is expected to be invested until 2023 (European Commission, 2022a).

Complementarily, the Joint Programming Initiative Urban Europe and the European Commission have earmarked approximately EUR18 million to support research and innovation projects and building a critical mass of urban transitions through joint research, innovation and actions. This call offers decision-makers in municipalities, companies and society the means to build

capacity and to enable the necessary urban sustainability transitions and contribute to the climate-neutral and smart cities mission (JPI Urban Europe, 2021).

Under the EU cohesion policy a significant percentage of each national share of the European Regional Development Fund will be dedicated to sustainable urban development, mainly supported by the European urban initiative ([3]), which will encompass previous instruments dedicated to cities in a joined-up way when it is rolled out by 2027.

The Commission Communication on the urban mobility framework ([4]) is an enabling instrument that, together with the sustainable and smart mobility strategy ([5]) and the Guidelines for sustainable Urban Mobility Planning ([6]), aim to achieve a green and digital transformation of the EU transport system and fund inclusive and resilient urban mobility.

In response to the disruption caused by the invasion of Ukraine the EU launched the REPowerEU plan ([7]). This plan contains financial and legal measures to build a new energy infrastructure and aims to save energy, produce clean energy and diversify energy supplies.

EU financial instruments have a key role in accelerating urban sustainability transitions. The EU's EUR800 million COVID-19 recovery instrument, NextGenerationEU, together with its long-term budget will be the largest stimulus package ever made available in Europe. One of the aims of this instrument is to make EU economies and societies more sustainable, resilient and better prepared for the challenges and opportunities of the green and digital transitions (European Commission, 2021). This provides a once-in-a-generation opportunity to accelerate major change in cities to address sustainability issues. However, if the instrument is not carefully managed, there is a risk of cities being left out, of inefficient spending that does not fully consider synergies and trade-offs, or of cities remaining locked in to certain unsustainable patterns (e.g. air pollution from private car use).

The survey and interviews conducted in the research for the current report aimed to understand how cities are affected by these important EU policy frameworks and instruments. The research directly asked to what extent cities perceive existing EU initiatives and funding opportunities as effective drivers of urban transformation, to what extent they feel that their voices are being heard in shaping these initiatives, where there are tensions and trade-offs, and which obstacles might need to be removed to enable cities to more fully align their ambitions with these EU-wide agendas.

1.2 Methodological approach

The methodology used was based on that used for the previous report (EEA, 2021a). The mixed method approach used included:

- developing a new, revised and adapted survey (based on the previous survey of drivers of sustainability in cities, conducted in 2020) to consider changes since the COVID-19 pandemic and changes in EU policy;
- disseminating and implementing the current survey;
- developing and conducting interviews with city authorities (running in parallel with the current survey);
- analysing the results of the current survey and interview data (including comparison with the results of the previous research), using qualitative ([8]) and quantitative techniques.

1.2.1 Identifying relevant themes tested via the survey

The previous report (EEA, 2021a) identified drivers of (and barriers to) urban environmental sustainability transitions in European cities. The purpose of the current updated research was to understand if and how these have changed since the COVID-19 pandemic. As the previous findings indicated that EU policies can be an important driver, the current research also explored in more detail the role of existing EU initiatives and legislation (e.g. the renewed EU urban agenda and the policy instruments implemented under the European Green Deal) in cities' environmental transitions.

To aid comparison with the previous research and ensure that the current survey was still aligned with the EEA's conceptual framework for urban environmental sustainability, it followed a similar structure to the previous one. This involved grouping survey questions on drivers and barriers under 'context' and enabling factors defined within the conceptual framework (i.e. governance, culture, finance, knowledge, data and information, and technology) (see Figure 1.1). However, the

([3]) https://www.uia-initiative.eu/en/eui/european-urban-initiative
([4]) https://transport.ec.europa.eu/system/files/2021-12/com_2021_811_the-new-eu-urban-mobility.pdf
([5]) https://transport.ec.europa.eu/transport-themes/mobility-strategy_en
([6]) https://transport.ec.europa.eu/news/new-guidelines-sustainable-urban-mobility-planning-2019-10-02_en
([7]) https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en
([8]) The qualitative analysis software Dedoose was used: https://www.dedoose.com

current survey also sought to capture and address how drivers and barriers may have changed since the COVID-19 pandemic and to explore the impacts of the ambitious current cycle of EU policies on environmental (and climate) sustainability transitions in European cities.

The current survey was revised based on the outcomes of the previous research and updated with information on the following: (1) emerging phenomena relevant for cities' environmental transitions (e.g. climate and ecological emergency, green recovery, resilience, social innovation); (2) relevant EU policy frameworks (the instruments under the European Green Deal, EU recovery and resilience facility and related national resilience and recovery plans, the New Leipzig Charter and the renewed EU urban agenda, cohesion policy and research policies); and (3) other policies and initiatives (e.g. UN Sustainable Development Goals). In revising the current survey, reference was also made to other relevant surveys, including the European Committee of the Regions and the Organisation for Economic Co-operation and Development survey on the Sustainable Development Goals. The full current survey questionnaire is included in Annex 3. As shown in the annex, respondents were asked to select from three and up to five factors that they considered most important in supporting or inhibiting environmental sustainability transitions in their city.

1.2.2 Selecting case-study cities for the current survey

Four hundred cities across Europe from all EEA member countries and cooperating countries were contacted and invited to complete the current survey. Responses were received from 56 cities, representing a response rate of 14%. Annex 3 presents the criteria used to select the cities. A list of cities that took part in the current survey is presented in Annex 2. While striving for balance in terms of cities' geography and size, having the largest possible sample was seen as a priority. The geographical spread and size of the cities that responded to the current and previous survey is discussed in Annex 2.

1.2.3 Survey implementation and dissemination

The current survey was targeted to ensure that it was directed to the most relevant city officials and to try to avoid possible duplication of responses for individual cities. A phased approach to dissemination of the survey was adopted with 200 city officials initially contacted. A total of nearly 400 cities were contacted by the end of dissemination period.

Despite efforts of the research team (including email reminders and targeted phone calls as well as extending the response deadline), the response rate was significantly lower (14%) than for the previous survey (65%). While a lower response rate was expected for a larger sample (ten times more cities were targeted than in the previous survey), this might also be linked to the fact that current research was aimed at a much wider selection of cities and not only the frontrunners of urban sustainability transitions (i.e. EGCA and EGLA winners and finalists). The response rates may also have been affected by COVID-19 pandemic-related survey and research fatigue (e.g. de Koning et al., 2021; Patel et al., 2020).

1.2.4 Interviews

In parallel with the current survey, 27 in-depth interviews were carried out with selected city authorities to develop a more nuanced understanding. This included discussing concrete examples of key drivers of and barriers to environmental sustainability transitions in European cities.

Interviews were predominantly carried out with one city official, although in seven cities multiple individuals participated in the interview (Brussels, Gabrovo, Larnaka, Oulu, Stockholm, Tallinn, Zurich). Cities that took part in the interviews are listed in Annex 2. The interview questions build on the previous research outcomes and are presented in Annex 3.

1.2.5 Limitations of the methodological approach

Ideally, all the cities that have taken part in the interviews would have also completed the survey. However, practicalities (e.g. low survey response rate, availability of city officials) meant that some cities were not able to take part in both. This resulted in some cities being interviewed without completing the survey.

The level of engagement with the current research (i.e. survey and interviews) might have been affected by survey and research fatigue related to the COVID-19 pandemic.

Prioritising the size of the sample in the current research meant that the intended balance in terms of geographical distribution and size of participating cities was not achieved. Cities from eastern Europe are more often represented than those from other regions. This was partly driven by the fact that the previous research was biased towards western and northern European cities, which have traditionally dominated the European Green Capital and Green Leaf Awards. However, one could argue that the results of both the current and the previous research together should provide a fairly balanced view of drivers and barriers across different European regions.

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2
About the cities that took part in the research

2.1 The participating cities

This section provides a brief overview of the cities that participated in the current research (including the survey or interviews or both). This includes an overview of the environmental and socio-economic challenges cities are facing, the key triggers of greater environmental sustainability and the impact of the COVID-19 pandemic on cities.

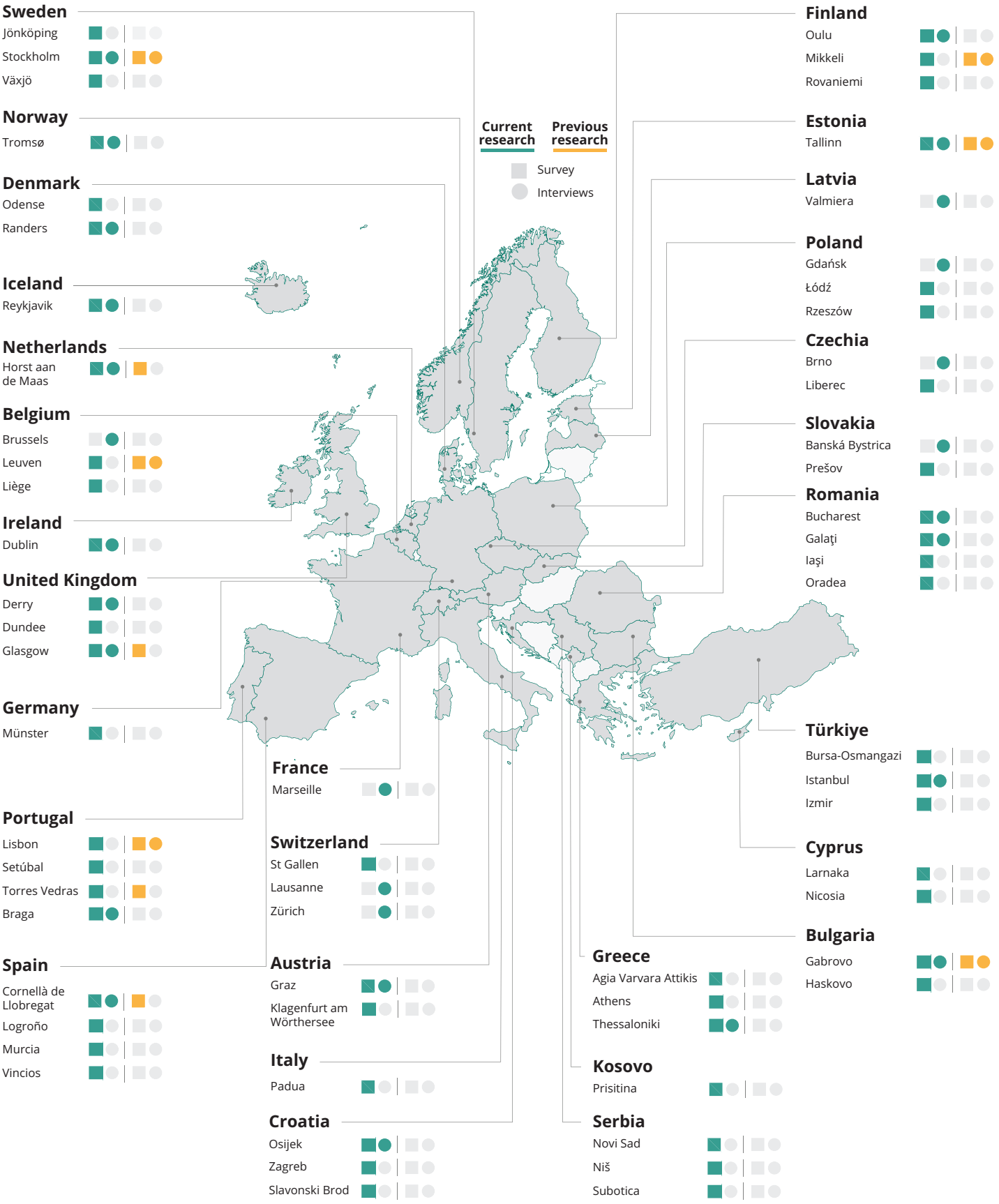
Note that cities participating in the current research also took part in the previous research (i.e. survey, or both survey and interviews). Annex 2 lists the cities and shows which parts of the research each city participated in.

To ensure sufficient participation, the current survey and interviews were conducted in parallel. In total 56 cities took part in the current survey, and 27 cities participated in the interviews. Of all the cities interviewed, 19 also completed the survey. All cities that took part in the current research (survey or interviews) are shown in Map 2.1.

Summary of key facts and findings — about the cities

- **56 cities completed the current survey, and 27 cities took part in the interviews, of which 19 also completed the survey.**
- **Most respondents to the current survey were from eastern (32%) and southern Europe (31%).**
- **Of all the cities that participated in the current survey, 36% were classified as larger cities, and 64% were classified as smaller cities.**
- **The six most important environmental challenges faced by cities and their regions pre-pandemic were (1) air pollution, (2) traffic congestion, (3) lack/loss of green space, (4) severe storms and flooding, (5) stormwater management and (6) noise pollution. With a few minor exceptions, these remained the same post pandemic.**
- **The six most important socio-economic challenges faced by cities and their regions identified by the current research were (1) the COVID-19 pandemic and other communicable diseases, (2) lack of affordable housing, (3) urban sprawl, (4) road congestion, (5) demographic change and (6) social exclusion. Unsurprisingly, the COVID-19 pandemic and other communicable diseases was not identified as a significant factor pre-pandemic.**
- **The three most significant triggers for making environmental sustainability transitions a political priority identified in the current survey were (1) EU funding mechanisms, followed by (2) a specific environmental crisis and (3) the COVID-19 pandemic. These were considered either very significant or somewhat significant by most respondents.**
- **When it comes to the impact of COVID-19, more than one third of survey respondents felt that the pandemic's overall impact on their sustainability efforts had been neutral, with a further one third assessing it as having had either a somewhat positive or even a strongly positive impact. This result was broadly mirrored by the interview findings, where the majority of city participants stated that they felt that the pandemic had either affected their sustainability efforts in only a minor way or felt that it had actually accelerated positive changes.**

Map 2.1 **Cities that participated in the current research**

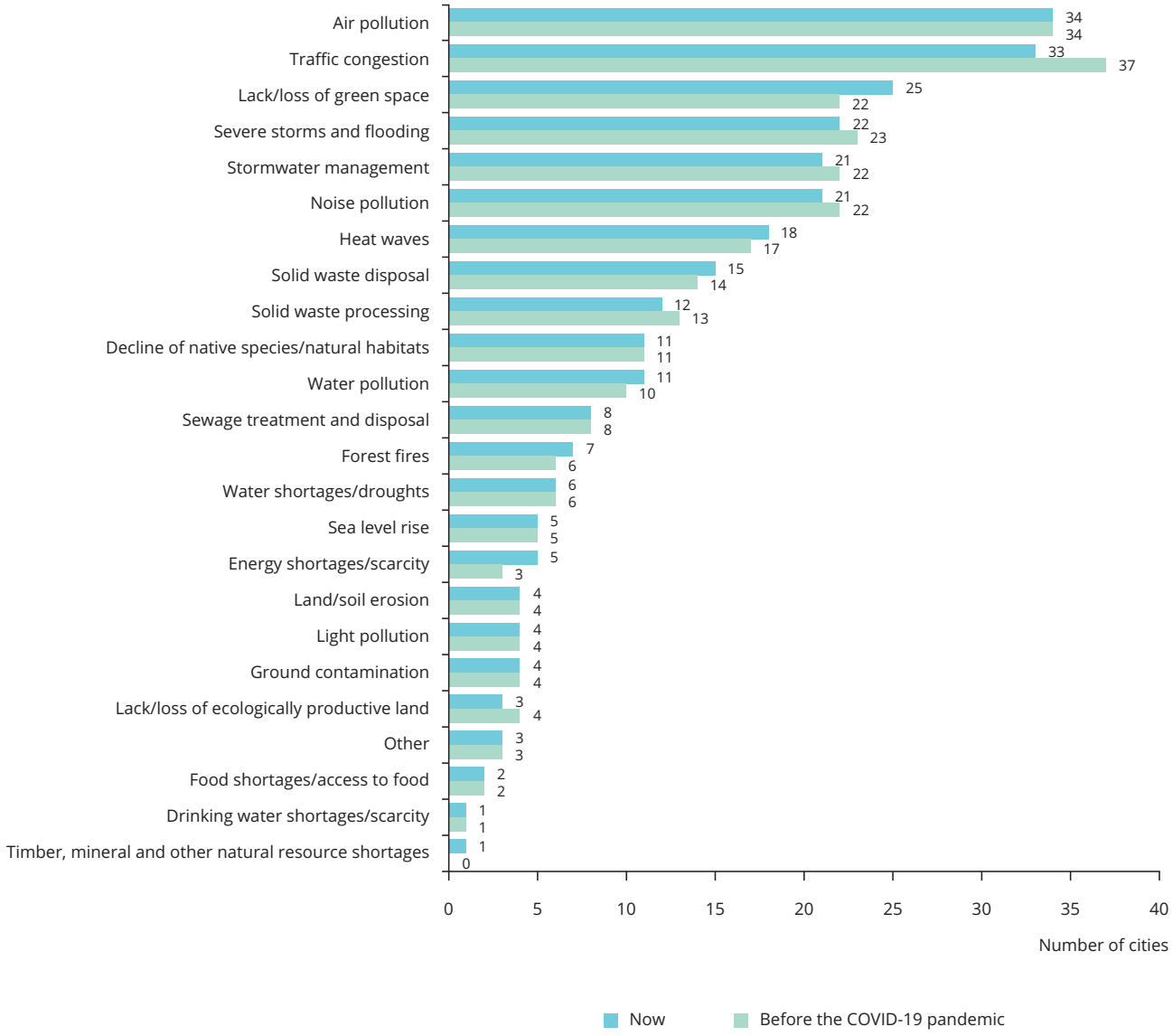


2.2 Environmental challenges

Cities are facing a wide variety of environmental challenges. Understanding which are important for a city plays a key role in designing successful urban strategies. Figure 2.1 shows the results of this year's survey, with the environmental challenges most frequently cited as significant for the cities and their regions 'now', and also before the COVID-19 pandemic:

- The six most important challenges (in descending order) 'now' are (1) air pollution, (2) traffic congestion, (3) lack/loss of green space, (4) severe storms and flooding, (5) stormwater management and (6) noise pollution.
- The six most important challenges (in descending order) faced pre-pandemic were (1) traffic congestion, (2) air pollution, (3) severe storms and flooding, (4) stormwater management, (5) noise pollution and (6) lack of green space.
- Most of the challenges were cited by a similar number of cities before the pandemic compared with now. Of the most frequently cited challenges, four more cities cited traffic congestion before the pandemic compared with now; and three fewer cities cited lack of green space before the pandemic compared with now.
- Additional environmental challenges frequently cited as important for cities included severe storms and flooding and stormwater management, both of which were seen as slightly more important by cities pre-pandemic than when the current survey was conducted.

Figure 2.1 Environmental challenges faced by cities and their regions



- Heat waves, solid waste disposal, solid waste processing, decline of native habitats and water pollution also pose significant challenges for a number of cities (these were cited between 11 and 18 times by the 57 cities surveyed). While these issues are no doubt important to cities, they did not arise often in the interviews.

- It is important to note that some of the challenges identified largely lie outside the city government's remit or direct control, being shaped by external factors such as natural hazards or higher tiers of government.

- Two cities indicated that they face food-related challenges, and one city that it faces drinking water scarcity. The previous report (EEA, 2021a) assumed that these issues may have risen up the agendas because of the pandemic. The results of the survey for this report do not bear this out.

- Although the challenge of energy shortages/scarcity was felt to be important by a relatively small number of cities (cited by five and three cities, now and pre-pandemic, respectively), it is important to remember that this survey was conducted before the Ukraine-Russia conflict, which has been a major driver of energy price hikes as well as increasing uncertainty over food security In the interviews, which were conducted slightly after the survey, a few cities mentioned a worsening energy crisis and how costs were affecting vulnerable households (e.g. Derry, Gabrovo).

2.3 Socio-economic challenges

Cities are also facing a wide range of socio-economic challenges. Figure 2.2 shows the socio-economic challenges most frequently identified in the current survey as significant for the cities and their regions 'now' and before the COVID-19 pandemic.

- The six most important challenges (in descending order) 'now' are (1) the COVID-19 pandemic and other communicable diseases, (2) lack of affordable housing, (3) urban sprawl, (4) road congestion, (5) demographic change and (6) social exclusion.

- These were also cited as the most important challenges pre-pandemic, with the notable exception of the COVID-19 pandemic and other communicable diseases. This was cited by just two cities as being important before the pandemic and by 30 cities at the time that the survey was conducted.

- Chapter 3 presents a range of analyses of the impacts of the COVID-19 pandemic in relation to various enabling factors such as knowledge and culture (see Sections 3.3 and 3.4).

- The COVID-19 pandemic and other communicable diseases was cited most frequently as an important socio-economic challenge, but it was cited less frequently than the two most frequently cited environmental challenges, air pollution and traffic congestion — both challenges associated with high densities of vehicles. However, it is also worth noting that these issues have a strong social dimension as well, affecting as they do health, well-being and economic productivity, which may explain why they score so highly.

- Lack of affordable housing and urban sprawl were identified as being the second and third most frequently cited socio-economic challenges and there was negligible change between before the pandemic and when the current survey was run.

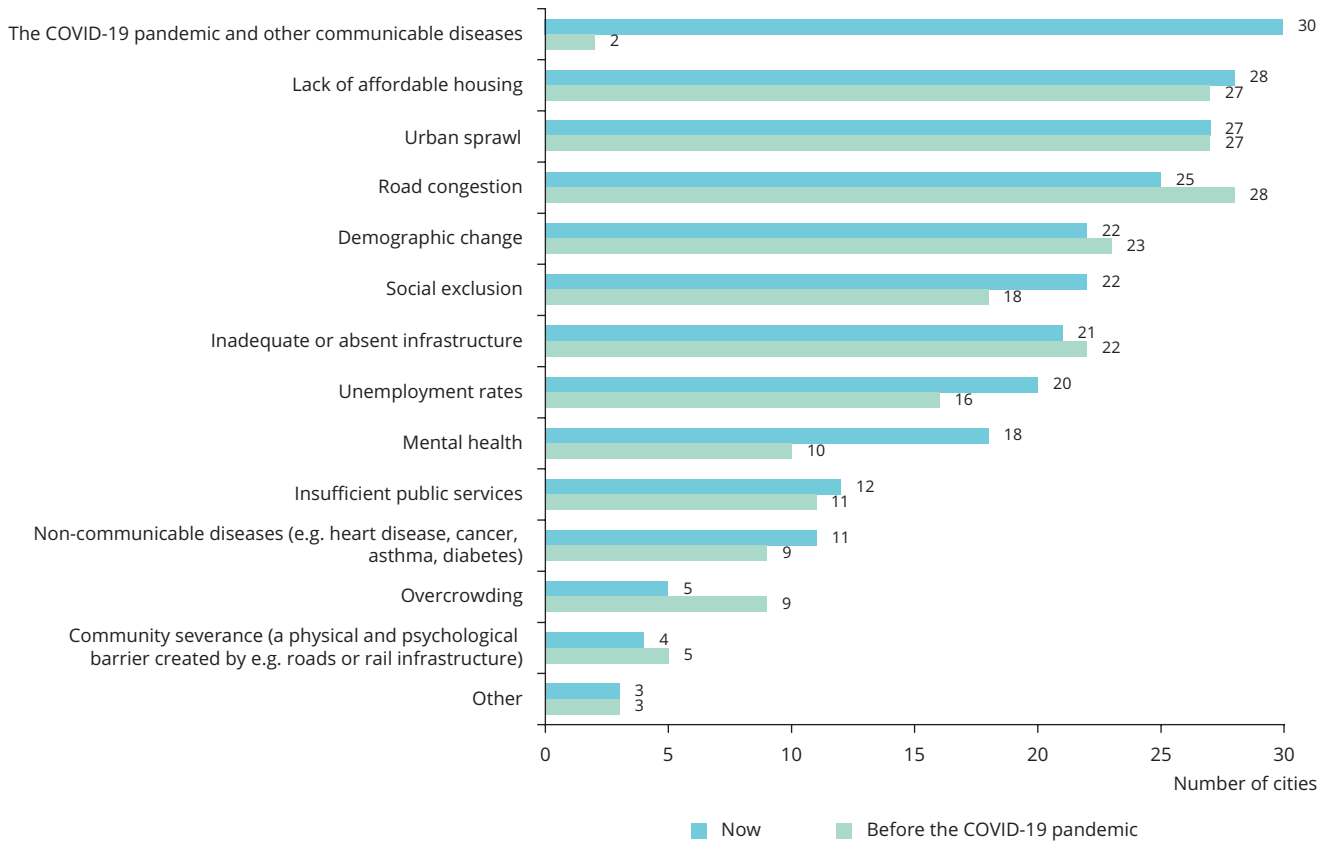
- Road congestion was cited as an important socio-economic challenge before the pandemic by three more cities than cited it 'now'.

- Social exclusion was identified as a serious socio-economic challenge by four more cities 'now' than before the pandemic. Relatedly, mental health was reported as a significant challenge eight more times 'now', than before the pandemic.

Just as with the environmental challenges, most of the socio-economic challenges are interrelated and potentially compound one another, and likewise many environmental challenges and socio-economic challenges are also related. An analysis of the interactions between socio-economic and environmental challenges could be an important area of future research. The Stockholm Environment Institute's recent report for the EEA looked at what trade-offs and synergies with other UN Sustainable Development Goals could result from progress in environmental targets in the EU (Weitz et al., 2019).

The nexus between socio-economic and environmental concerns is especially important today, as municipalities' environmental plans increasingly incorporate multiple strands of sustainability, including socio-economic issues. Identifying the wider sustainability co-benefits of interventions to tackle either a socio-economic or an environmental issue would endorse such interventions being supported through policy and with funding. For example, cities are increasingly seeking to integrate nature-based solutions into policy and apply them in practice, because of their capacity to deliver a host of co-benefits. The EEA's recent analysis of eight urban sustainability nexuses is the kind of approach that can help understand the complexity of urban systems, as well as identify potential co-benefits and opportunities to maximise them (EEA, 2021b).

Figure 2.2 Socio-economic challenges faced by your cities and their regions



2.4 Triggers of greater environmental sustainability

For the purposes of this research, 'triggers' are defined as specific, identifiable events or circumstances that can set a particular action or series of events in motion, in this case a transition towards greater environmental sustainability. Most of the triggers included in the survey were considered either very significant or somewhat significant by most respondents (see Figure 2.3). Although the previous survey did not ask explicitly about EU funding mechanisms and programmes as 'triggers' for environmental sustainability transitions in cities, the results of the previous study indicated that they might play an important role. They were therefore included as one of the options this time, and the results of the survey show that this was considered the single most significant trigger.

Other significant triggers citied by cities in the current survey included:

- a specific environmental crisis (likely to be the climate crisis, although this was not specified);
- the COVID-19 pandemic (a new option not included in the previous survey);
- pressure from national government.

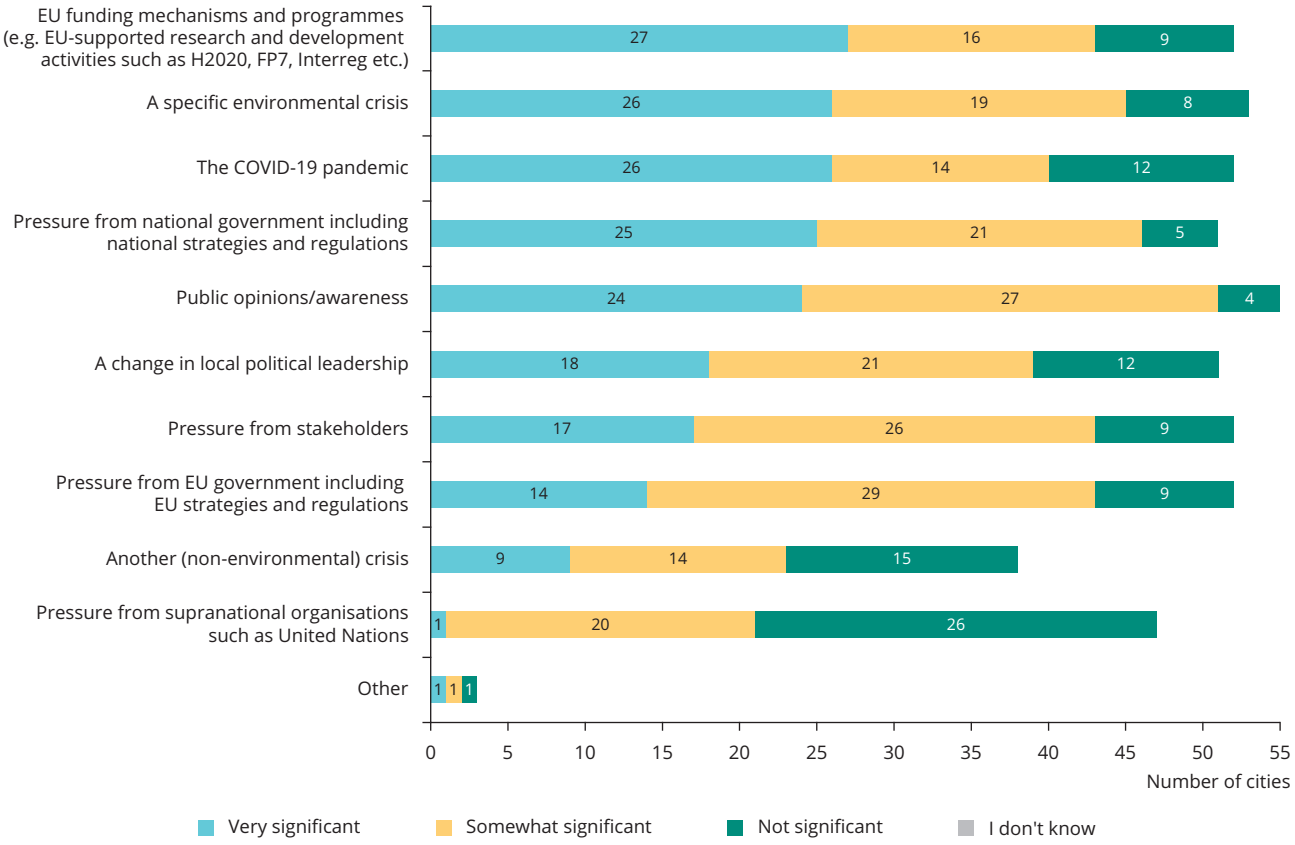
In the study, one of the hypotheses was that COVID-19 might act as a significant trigger for environmental sustainability efforts. This was borne out by the results of both the survey and the interviews. There has been something of a paradigm shift since the pandemic, particularly around issues of sustainable mobility and green space. Related to this, public opinion/awareness seems to be an important trigger (considered either very or somewhat significant by nearly all the survey respondents). This was confirmed by the interview findings, with many of the interviewees explicitly mentioning the importance of public awareness of environmental challenges. A change in local political leadership, pressure from stakeholders and pressure from the EU were also identified as being important triggers, each cited as very significant or somewhat significant by around 50 out of 57 respondents. This was confirmed in the interviews, where the political vision of individual leaders was repeatedly highlighted as crucial to driving sustainability transitions (e.g. Braga, Gabrovo, Istanbul, Tromsø).

Overall, survey respondents did not feel that another (non-environmental) crisis or pressure from supranational organisations such as the UN were a very significant trigger (selected just nine times and once respectively). However, the survey and almost all of the interviews were completed before the 2022 Russian invasion of Ukraine, and it is likely that this

unexpected non-environmental crisis might actually trigger changes in energy and food policy that could have far-reaching consequences for sustainability transitions (either positive or negative) in the years ahead.

Running the survey again now may yield different results in relation to the importance of a non-environmental crisis in the context of sustainability transitions. Some of the interviewees did begin to engage with this topic, speculating that rising energy prices and a desire across many European countries to rapidly reduce their reliance on fossil fuel imports from Russia could accelerate investment in renewable energy and new policies on energy efficiency retrofits. However, it was also mentioned that this could potentially herald a return to or cause a delay in phasing out non-renewable sources of domestic energy, including coal, natural gas and nuclear power.

Figure 2.3 The significance of triggers in making environmental sustainability objectives an important part of cities' political agendas



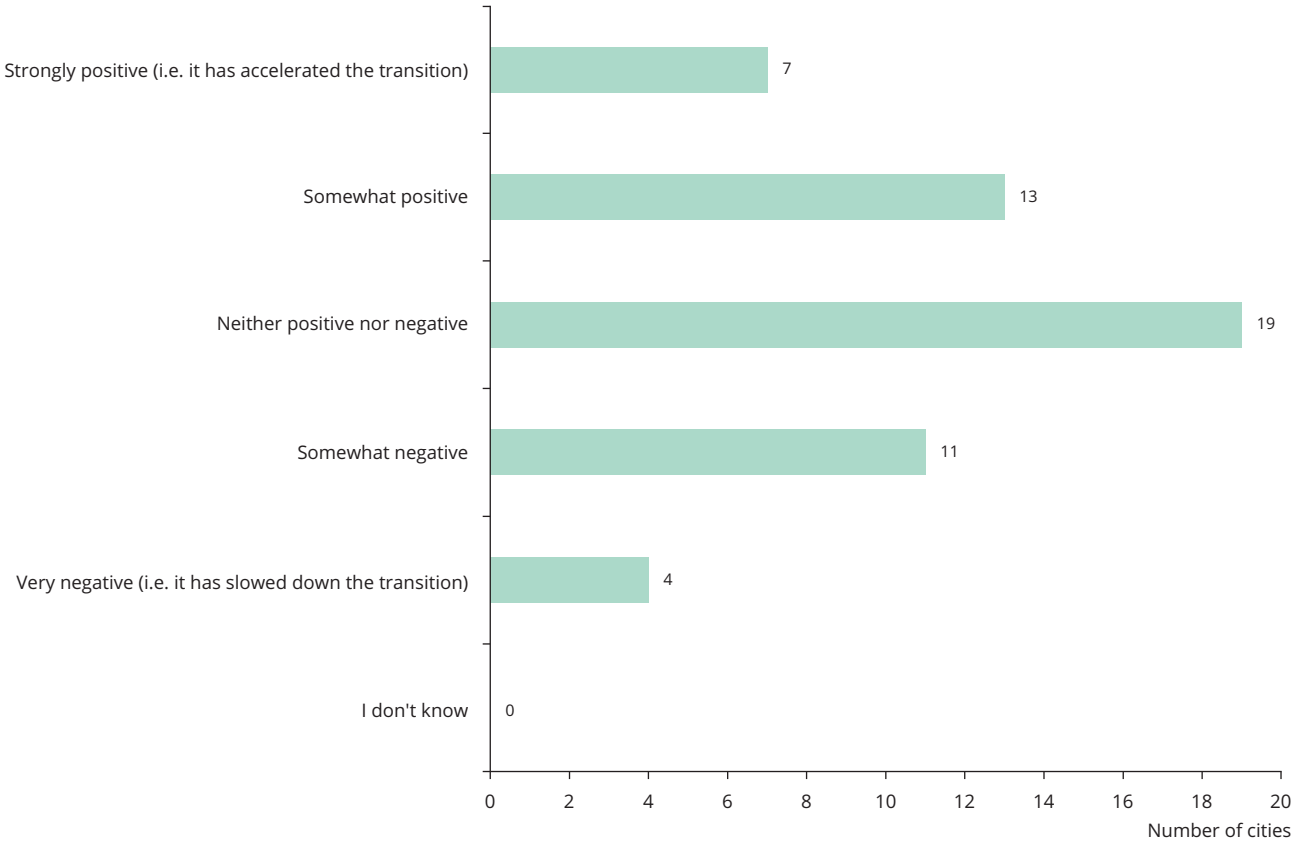
Note: FP7, Seventh Framework Programme for Research; H2020, Horizon 2020.

2.5 The impact of COVID-19 on cities

In both the survey and in the interviews, respondents were asked to reflect on the importance of different enabling factors, both before and since the COVID-19 pandemic, to explore whether there were any factors that have been particularly affected by the health emergency. While there were a few noticeable shifts where the pandemic had amplified certain issues, in general it does not appear that COVID-19 has had a major impact on how cities perceive the relative importance of specific drivers of and barriers to environmental sustainability.

Figure 2.4 demonstrates that more than one third (19 out of 54) of all survey respondents felt that the pandemic's overall impact on their sustainability efforts had been neutral, with a further 20 assessing it as having had either a somewhat positive or even a strongly positive impact. A further 11 respondents judged it to have had a somewhat negative impact and only four felt that it had been very negative. This result was broadly mirrored by the interview findings, in which most cities confirmed that they felt that the pandemic had either affected their sustainability efforts in only a minor way or actually accelerated positive changes.

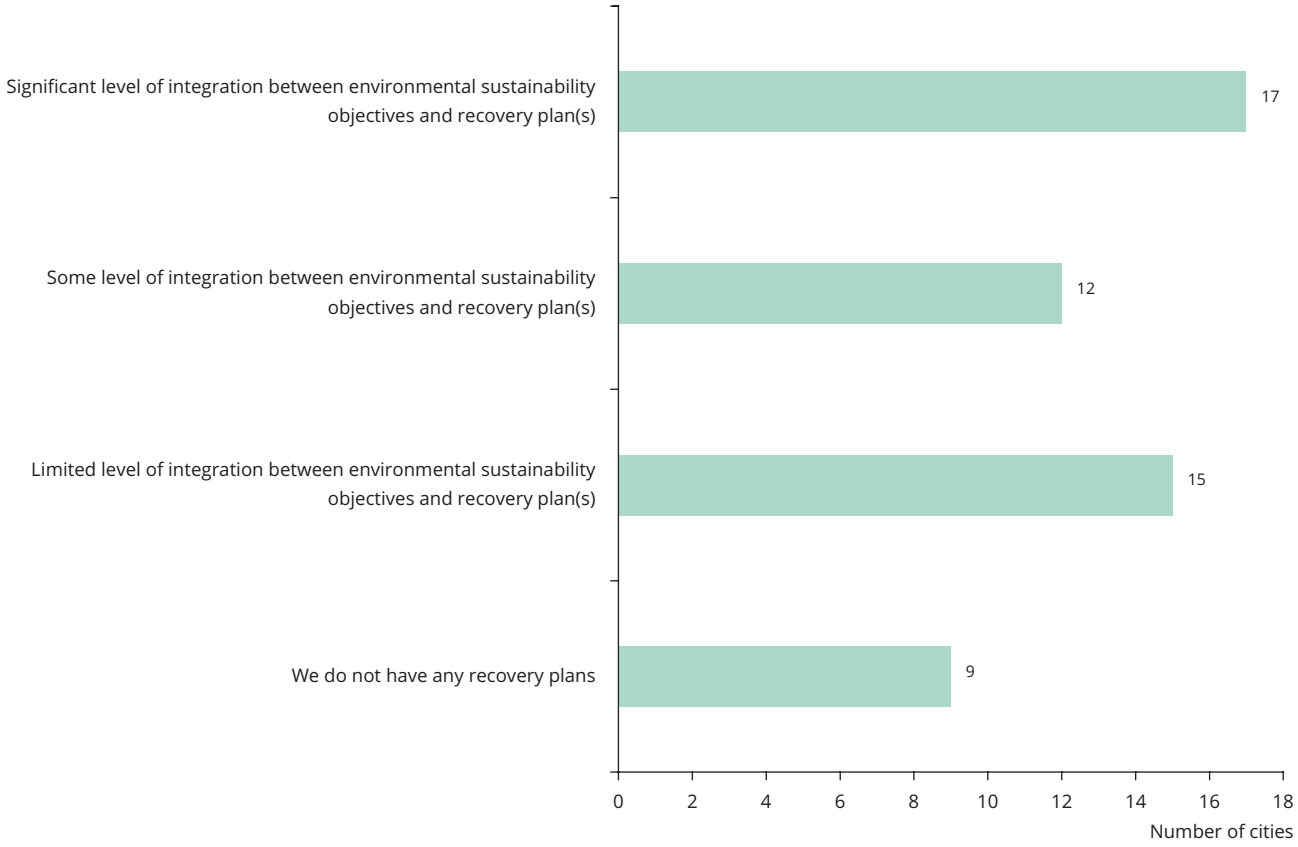
Figure 2.4 The impact of the COVID-19 pandemic on cities' environmental sustainability transitions



In part these results may reflect the fact that the city representatives participating in the research overwhelmingly work in environment and climate change departments and for the most part do not appear to have experienced significant negative impacts on their budgets or their day-to-day responsibilities and policy priorities (for additional survey results discussing the impact of COVID-19 on city budgets and spending priorities, see Section 3.7). Regardless of potential sampling biases, these results are encouraging, suggesting that cities across Europe are forging ahead and embracing a green and just transition despite the major upheaval brought about by COVID-19 over the past 2 years.

As Figure 2.5 shows, the vast majority of survey respondents indicated that there is at least some level of integration between environmental sustainability objectives and their city's wider recovery plans, although the picture is mixed in terms of the degree of integration. This was confirmed by the interview findings in that there was a split between respondents who felt that their cities had been able to develop recovery strategies that actively set them on a course for long-term transformation and those that felt that it was either an afterthought or there was no formal recovery plan or strategy. Some cities indicated that they were still too invested in fighting the impacts of the pandemic and responding to continuing high infection rates to plan for the longer term future. In other cities, recovery planning was predominantly seen as the task of national government, which may also explain why nine cities in the survey indicated that they do not have a local-level recovery plan in place.

Figure 2.5 Extent to which environmental sustainability objectives are integrated into cities COVID-19 recovery plan(s)



The interviewers also asked respondents what, if anything, their city had learned from the response to COVID-19 that might help them to tackle other complex challenges, such as climate action and environmental sustainability.

Certain themes emerged repeatedly, many of which were broadly linked to a shift in government culture and attitudes and to a wider shift in public perceptions that may remain relevant far beyond the immediate COVID-19 response phase. The pandemic showed that change is possible in a very short timespan, including the adoption of new technologies and ways of working that seemed unthinkable just a few years ago. Some city respondents expressed the hope that this could accelerate action around environmental sustainability, given that we now understand the risks that come from delaying action in the face of a major crisis (e.g. Tallinn, Tromsø). Many saw the parallels between the current health crisis and the climate and ecological crisis, and stressed that more rapid action and bold policymaking were needed alongside a willingness by the public to embrace more radical changes and trust in science (e.g. Dublin, Reykjavik, Zurich).

One of the key lessons from the pandemic seems to be a growing recognition that the local government level is able to innovate under pressure, and it often has the capacity to work more flexibly to respond to a rapidly changing context by embracing experimentation (e.g. Galaţi, Lausanne, Larnaka, Reykjavik, Tromsø). The Banská Bystrica respondent emphasised that the pandemic had shown that even very small cities have a key role to play in confronting challenges on the ground and should be empowered to respond effectively to emergency situations, including climate change. The Thessaloniki respondent highlighted that this will require a simplification of decision-making processes to ensure that the local level is able to move swiftly from planning to implementation.

City responses also repeatedly stressed the power of storytelling and developing a positive narrative that can prevent people from feeling helpless. This does not mean minimising the legitimate challenges that exist, but balancing this by emphasising that, through collective commitment, there is a path out of the crisis that can actually lead to a better future (e.g. Istanbul, Lausanne). This requires committed local leadership that communicates clearly and transparently with the public and builds networks of trust between key local stakeholders (e.g. Banská Bystrica, Dublin, Tallinn, Thessaloniki). Related to this, the Glasgow respondent also stressed that there was now much greater awareness of inequalities and differing vulnerabilities in society, which may lead to greater empathy and a recognition of the value of solidarity and community. The Braga and Istanbul respondents also felt that the pandemic had shaken people out of their myopic thinking and helped citizens to see the bigger picture, but warned that, if people struggling economically, it may be difficult for them to take action on environmental sustainability.

Not all cities felt equally hopeful that the lessons from COVID-19 would lead to accelerated climate action, with respondents from Horst aan de Maas emphasising that it really takes an urgent and clear threat to human life to motivate action, while those from Dublin stressed that the drastic changes to respond to the pandemic were often sold to the public as being temporary, whereas the changes needed to respond to climate change will be radical and permanent.

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3 Understanding the factors that shape urban environmental sustainability transitions

The following sections explore some of the key drivers of and barriers to urban environmental sustainability in European cities, following the same structure as the previous report (EEA, 2021a). In line with the conceptual framework for urban environmental sustainability (see Section 1.1), the drivers and barriers investigated are structured under city context (see Section 3.1) and a set of six 'enabling factors': governance, knowledge, culture, technology, data and information, and finance. To allow a more detailed analysis of how the enabling factors might act as either drivers or barriers, they were disaggregated into more specific sub-factors in the survey ([9]).

While many of these factors were discussed during the interviews, the analysis focused on the most salient points emerging from those conversations, highlighting instances where the interviews either confirmed or contradicted the survey findings. The analysis was based on the findings of the survey and the perspectives of individual interviewees in the case study cities.

It is important to note that a factor might be seen as a driver by one city and a barrier by another, which may also change depending on the specific context. This analysis does not explicitly explore how different drivers and barriers relate to each other. However, interlinkages and tensions between various supporting and inhibiting factors are areas that require further research, with drivers and barriers potentially combining to create either virtuous or vicious cycles in relation to a city's progress towards greater environmental sustainability.

([9]) These factors were defined during the previous survey based on an extensive literature review and multiple rounds of consultation with the EEA urban stakeholder group. They were further refined for this survey to reflect the findings of the previous interviews and to ensure that they captured the new COVID-19 reality. Please see Section 1.2 on methodology for a fuller discussion.

3.1 Context

Summary of findings — context

- A diverse range of contextual factors appears to be shaping urban sustainability transitions. The factors considered most important in the current survey included natural assets, air, water and soil quality, city size and climatic conditions.
- Existing infrastructure was the inhibiting factor most frequently selected in the survey. This is in contrast to the previous survey, where this was considered the most important supporting factor. While this is likely to be a direct result of COVID-19, the pandemic does not appear to have had a big influence on the importance of most other contextual factors. Other factors considered important barriers included the structure of the economy, existing urban form and gross domestic product per capita.
- Cities need to embrace fixed contextual factors to find solutions that work for them. Contextual factors that cities are less able to influence (e.g. climate, geography, topography) can, depending how a city responds to them, restrict sustainable policy options and create barriers that are at times difficult to overcome.
- Many interviewees confirmed that factors such as the presence of green and blue spaces within and immediately surrounding the city can play an important positive role in encouraging more sustainable outcomes. A focus on improving and expanding green spaces, both to meet a growing recreational demand and in recognition of their significant value in mitigating and adapting to climate change and restoring biodiversity, seems to be an enduring legacy of the pandemic.
- Demographic change can be both a challenge and an opportunity. The survey results indicated that demographics is one of the most polarising contextual factors. The interviews further revealed that the way in which demographics acts as an inhibiting factor varies across cities and reflects differences in trends across Europe. While the generational divide can be a barrier, the importance of young people in driving more radical action on climate change and the environment was repeatedly highlighted.
- Existing infrastructure and urban form can lock cities into unsustainable pathways. The pandemic has put a particular spotlight on urban infrastructure and kick-started a renewed debate about the importance of making the existing urban fabric more resilient and adaptable to deal with sudden shocks, as well as more conducive to residents' health and well-being.
- Infrastructure improvements are implicitly or explicitly linked to historical developments that created urban environments and systems now requiring significant changes to align them with sustainability objectives. Nearly all the city respondents interviewed mentioned urban sprawl as a challenge they were facing.

Every city has its own distinct context that will influence the nature of its urban sustainability transition. Contextual factors could affect a city's potential for change and options when it comes to environmental transformations. As part of the EEA conceptual framework for urban environmental sustainability (see Chapter 1, Figure 1.1), context refers to the range of current and historical physical (e.g. geographical, environmental), cultural and institutional characteristics that create and shape the setting in which a specific city exists, develops and functions (EEA, 2021a).

These characteristics may be relatively stable and slow to alter but can also be dynamic, especially in the face of sudden changes such as the COVID-19 pandemic. While factors such as natural assets tend to be relatively fixed, others such as existing infrastructure and demographics are more variable. In addition, a contextual factor that is a key driver in one city may be less relevant in another. Even within a specific city, contexts may vary depending on the specific neighbourhood (e.g. inner city versus suburb). Cities therefore need to carefully consider their unique contexts to understand how they may influence their urban sustainability transition and what types of policy interventions are likely to be most successful.

Figure 3.1 Contextual factors that have supported environmental sustainability transitions in cities

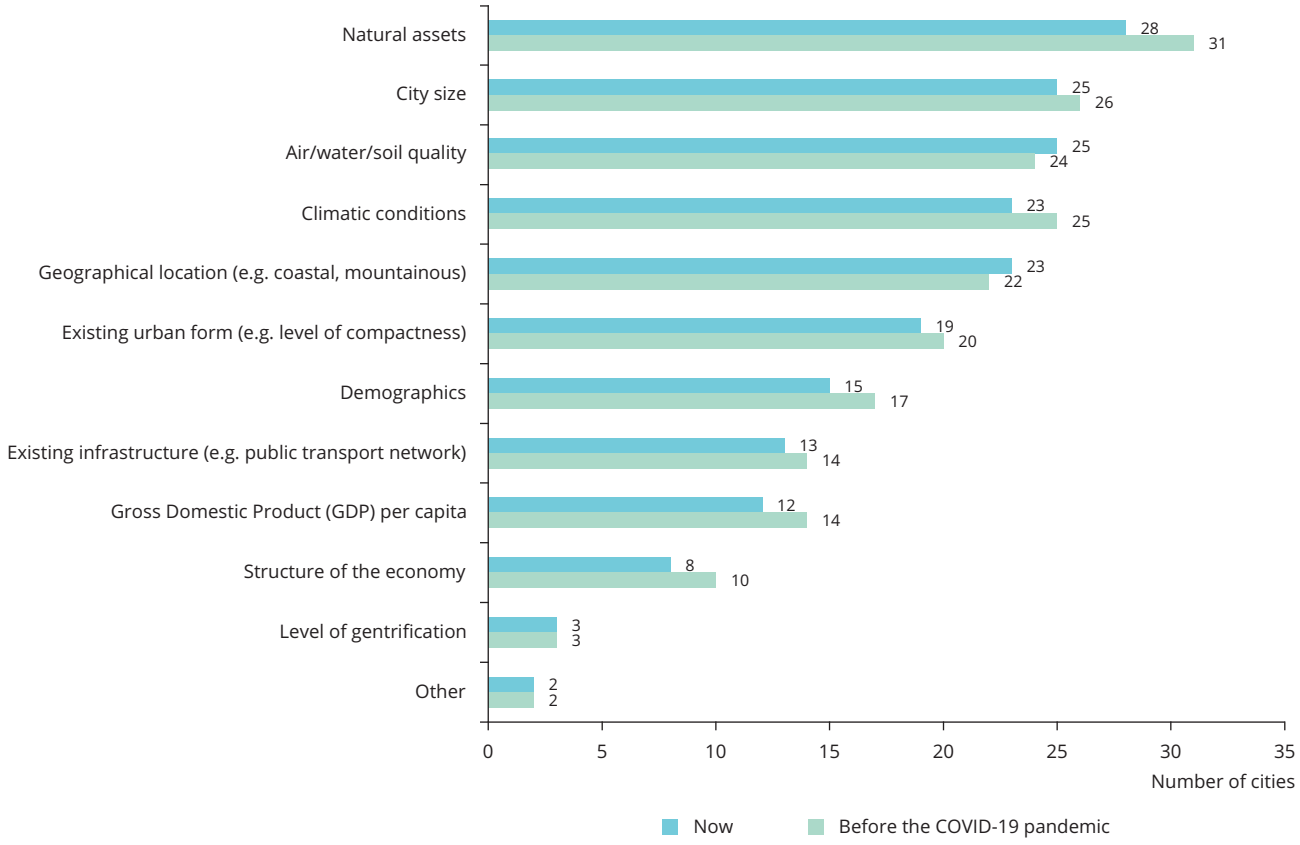
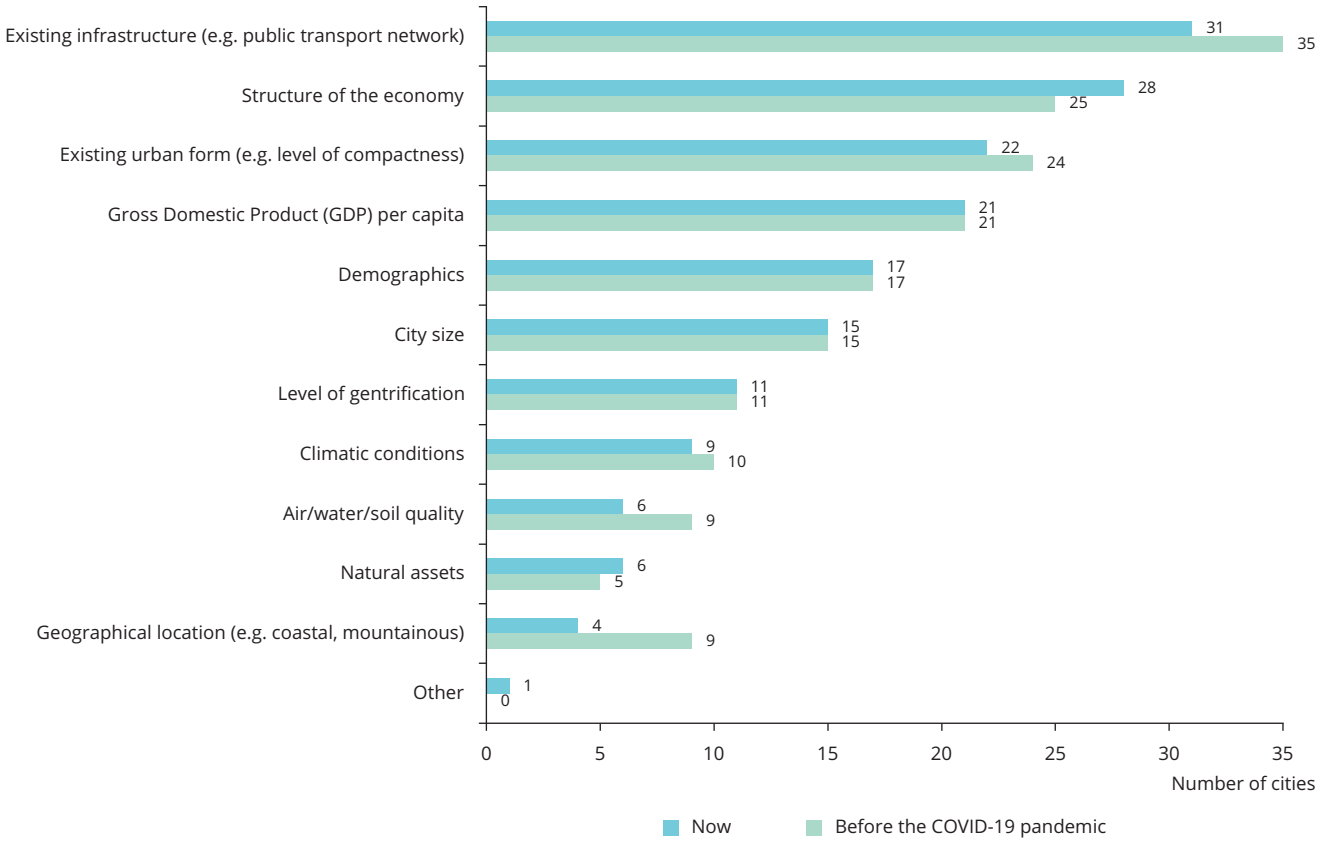


Figure 3.2 Contextual factors that have inhibited environmental sustainability transitions in cities



A diverse array of contextual factors drives urban sustainability transitions

As shown by the previous study, contextual factors influence what kinds of sustainability issues are prioritised by a city and provide insight into the motivations that drive specific actions. For example, factors such as geographical location and climatic conditions can shape to what extent a city engages in proactive planning for climate change mitigation and adaptation (Reckien et al., 2015). At the same time, the literature suggests that factors related to the socio-economic context can equally play a role in shaping sustainability actions in cities (Joss et al., 2011), something that was again supported by the findings of both the survey and the interviews.

Overall, contextual factors were rated similarly before the COVID-19 pandemic compared with 'now', although there was a noticeable change in some areas, which is discussed further below. From the survey, the contextual factors considered most important in supporting sustainability transitions were natural assets and air, water and soil quality, followed by city size, climatic conditions and geographical location (see Figure 3.1). This differs from the previous survey, where existing infrastructure was considered the most significant supporting factor. In this survey, existing infrastructure was most frequently selected as an inhibiting factor (see Figure 3.2), although there was a slight decrease in the number of respondents that identified it as a an inhibiting factor 'now' compared with before the pandemic (possibly in part be because of recent investments in walking and cycling infrastructure in many cities (Lyu, 2022)). In addition to the larger sample size, there are at least two other plausible explanations for this shift. The first is that on average the cities included in this survey are slightly less affluent than those in the previous survey and may therefore be experiencing an infrastructure deficit. Another reason might be that COVID-19 forced cities to explore if and how their infrastructure was serving their population and to recognise that it might not always have adapted well to the changing requirements brought about by the health crisis.

Other factors considered as important barriers included structure of the economy, existing urban form and gross domestic product (GDP) per capita, demonstrating again how inextricably environmental performance seems to be linked to the economy and the built environment in cities. As seen in the first survey results, some factors can be supporting and inhibiting at the same time. For example, factors such as existing urban form (e.g. compactness) or geographical location may support some environmental initiatives (e.g. promotion of sustainable mobility)

but may negatively impact other objectives (e.g. improving air quality, increasing the share of accessible green areas). These mixed and at times contradictory responses demonstrate that a wide range of contextual factors can drive urban sustainability in different ways and that this varies from city to city.

Cities need to embrace fixed contextual factors to find solutions that work for them

Contextual factors that cities are less able to influence than others (e.g. climate, geography, topography) can restrict sustainable policy options and create barriers that are at times difficult to overcome. For example, Tromsø's remote location in the Arctic Circle and lack of a rail link with the rest of Norway has led to an extremely high reliance on air travel, while the Marseille metropolitan area sprawls across a mountainous terrain of 200km^2, which has contributed to locking its dispersed population into car dependency. By contrast, Larnaka cited its extremely flat topography as one of the key drivers of a greater uptake of walking and cycling compared with other cities in Cyprus.

Although such factors themselves are essentially fixed, whether they support or inhibit urban sustainability transitions also depends on how a city responds to these challenges. While cities may be dealing with a wide range of contextual factors that could initially be seen as presenting a major barrier to progress on sustainability, many cities have demonstrated that such obstacles can successfully be overcome through clear political commitments and decisive policy interventions. For example, some interview respondents emphasised the importance of geography in triggering a drive to reduce pollution levels, with Graz experiencing major air pollution challenges because of its valley location and limited airflow and, like many regions in the Netherlands, Horst aan de Maas grappling with high levels of nitrogen in water sources arising from intensive livestock farming in its rural hinterland. In both cases, these contextual factors played an important role in focusing minds and sustaining a political commitment to improving environmental governance. In this context, the role of peer-to-peer learning and the sharing of best practice examples can also play a role, ensuring that city authorities are able to find creative solutions that have worked for other cities facing similar challenges (see Section 3.3, Knowledge).

Climatic conditions, although hard for cities to directly influence, can also act as an important driver of change, with respondents from Thessaloniki emphasising that the 2021 Greek wildfires had increased pressure from the population to take decisive climate action, with those from Dublin and Istanbul highlighting how concerns around more frequent flooding events and exposure to rising sea levels in coastal areas are an important motivating factor for more ambitious sustainability strategies. Other city respondents that mentioned that the direct experience of the impacts of a changing climate was driving change included Brussels, Horst aan de Maas, Reykjavik and Tromsø.

Two other factors that tend to be relatively fixed are natural assets and city size. Natural assets emerged as the most important supporting factor in the survey, and many interview respondents confirmed that factors such as the presence of green and blue spaces within and immediately surrounding the city can play an important positive role in encouraging more sustainable outcomes. For example, efforts over the past decades to improve the water quality of Lake Zurich have meant that the water is now clean enough to drink and the lake acts as both a key water reservoir and an important recreation area for the residents of Zurich. The importance of proximity to natural assets was mentioned slightly more frequently as a positive driver by respondents from smaller cities in the interviews, which also links to the role of city size. It is suggested that the compact size of smaller cities such as Gabrovo makes it easier for residents to feel close to nature and value its protection. A smaller city can have other benefits, such as by creating a stronger sense of community cohesion that can be harnessed to advance shared sustainability objectives (e.g. Cornellà de Llobregat, Gabrovo, Tromsø), fostering a stronger connection with the rural and peri-urban hinterland (e.g. Gabrovo, Randers), making it easier to walk and cycle (e.g. Graz, Larnaka), and by reducing other pressures that larger cities grapple with, including housing unaffordability, urban sprawl and high levels of traffic congestion (e.g. Istanbul, Marseille, Stockholm, Thessaloniki). On the whole, small and medium-sized cities make up the backbone of urban Europe and are where 40% of the EU's population live (Urbact, 2019). Of the more than 800 cities in the EU with more that 50,000 inhabitants, nearly 700 have a population below 250,000 (Nabielek et al., 2016).

Demographic change can be both a challenge and an opportunity

Europe faces issues related to both ageing and declining populations, and these impacts are unevenly distributed across European cities (EEA, 2019a). Although, globally, urban populations are continuing to grow, in Europe, urbanisation rates have slowed considerably and growth tends to be concentrated in larger cities and metropolitan areas, with many smaller cities and rural areas experiencing or projected to experience a contraction in their population of up to 30% by 2050 (Vandecasteele et al., 2019; EEA, 2020). Interestingly, the long-term impacts of the COVID-19 pandemic on factors such as remote working (also accelerated by digitalisation) and the value people put on outdoor space and access to nature may alter these projections somewhat, although once again these impacts are likely to vary significantly between different cities, countries and regions.

The survey results indicate that demographics is one of the most polarising contextual factors, chosen as both the seventh most important supporting factor and the fifth most important inhibiting factor. The interviews revealed that the way in which demographics acts as an inhibiting factor varies across cities and reflects differences in trends across Europe. Some cities,

such as Stockholm, Tallinn and Tromsø, are growing rapidly, with a major influx of young workers, while others, such as Braga, Derry, Gabrovo and Osijek, are experiencing an exodus of young people leaving to pursue education and employment opportunities elsewhere. Smaller cities and cities in eastern and southern Europe appear more seriously affected by this sort of 'brain drain', which in turn has repercussions for a city's tax base and economic vitality. This of course also affects the structure of the economy, which was cited as the third most important inhibiting factor in the survey.

While a growing population often suggests that a city may be offering economic opportunities, the interviews also showed that urbanisation and population pressures intensified environmental challenges in cities by increasing housing and infrastructure needs and putting green spaces at risk. Pressure on green areas in particular appears to have been exacerbated by an increased demand for access to these spaces during the pandemic (e.g. Cornellà de Llobregat, Gdańsk, Istanbul, Marseille, Tallinn, Valmiera). The pandemic also affected population movements in and out of cities, with some reporting either a reduction in new arrivals (e.g. Istanbul, Tromsø) or a sudden 'urban flight' as people moved away from the city in search of more space in suburban areas (e.g. Thessaloniki, Zurich).

The generational divide between old and young also emerged repeatedly as a demographic challenge, with respondents from cities such as Reykjavik mentioning the difficulties in ensuring that the priorities and demands of the younger generation were met without older generations feeling left behind. At the same time, the role of younger generations as a positive driver of climate change and environmental action surfaced in nearly half of the interviews, with respondents mentioning the important contribution of Fridays for Future and the youth climate movement in shaping the political agenda and inspiring change over the past 2 years (e.g. Gabrovo, Istanbul, Lausanne, Reykjavik, Stockholm, Zurich) (see Section 3.4, Culture).

Existing infrastructure and urban form can lock cities into unsustainable pathways

Like demographics, existing (grey) infrastructure and existing urban form are more dynamic than stable contextual factors such as geographical location. Of course, even natural assets, such as forests, rivers, arable land and public green spaces, are changeable to an extent, given that blue and green infrastructure is also shaped by human decisions and land use changes. Understanding what can and cannot be changed, and how to tailor policies to take advantage of and adapt current infrastructure, is a powerful tool that cities should not underestimate. The pandemic has put a particular spotlight on urban infrastructure and kick-started a renewed debate about the importance of making the existing urban fabric more resilient and adaptable, so that it can deal with sudden shocks, as well as more conducive to residents' health and well-being.

Box 3.1 Towards the compact city — combating urban sprawl seen as a key priority for European cities

Across Europe, urban sprawl continues to be a major challenge, even in countries with declining populations and with housing, industry and infrastructure development continuing to put pressure on peri-urban land (EEA, 2016). As the recently adopted Eighth Environmental Action Programme (8th EAP) highlights, land is a finite resource and the way it is used is one of the principal drivers of environmental change. Despite this, over 500km^2 of agricultural or natural land disappear every year in the EU by being converted into artificial areas (European Commission, 2022b). In response to this serious environmental threat, the 7th EAP and the EU Roadmap to a resource-efficient Europe have suggested a goal of 'No net land take' in the EU by 2050, aiming to mitigate the effect of urban sprawl (EEA, 2019b). However, as the EEA's 2020 state of the environment report, *The European environment — state and outlook 2020*, notes, there is still no comprehensive and coherent policy framework for protecting Europe's land and soil resources (EEA, 2019a).

Nearly all the city respondents interviewed mentioned urban sprawl as a challenge they were facing, which would explain why both existing infrastructure and existing urban form were cited as important inhibiting contextual factors in the survey. Urban sprawl has negative consequences that not only undermine efforts to protect fragile ecosystems, biodiversity and soil health and mitigate and adapt to climate change but also have a significant impact on the ability of cities to meet their sustainability and liveability objectives.

Interestingly, city size or location in Europe seems to have had no major bearing on the importance of tackling this issue. Even small and medium-sized cities, including Gdańsk, Reykjavik and Zurich, are pursuing ambitious densification strategies aiming to create more compact city centres and reducing pressure on green spaces and peri-urban areas. The importance of breaking decades of car-centric planning to reduce consistently high emissions from transport and other negative externalities was also mentioned by almost all respondents, highlighting the close link between motorisation and urban sprawl that persists in Europe.

Generally, cities identified existing (grey) infrastructure as the most important inhibiting factor they are trying to tackle. This demonstrates that contemporary urban environments often include infrastructure that was created as a result of policies, plans, models and traditions that differ from the sustainability principles that may guide decision-making today. In the interviews, most respondents spoke about grey infrastructure in the context of improvement plans and local government visions for the creation of a more sustainable city.

Some of the initiatives most frequently mentioned included adding cycling infrastructure and pedestrianising streets; investing in and electrifying public transport systems; decarbonising the energy system (e.g. through district heating); and retrofitting the existing building stock.

Infrastructure improvements were implicitly or explicitly linked to historical developments that created urban environments and systems now requiring significant changes to align them with sustainability objectives. These included a poorly insulated building stock (e.g. Dublin, Valmiera), decades of car-centric planning (e.g. Brussels, Graz, Marseille), insufficient public transport provision (Banská Bystrica, Derry, Istanbul, Osijek), urban sprawl (e.g. Gdańsk, Stockholm, Tallinn) and the absence of adequate green and blue infrastructure (e.g. Brno, Istanbul, Thessaloniki).

Understanding the complex causal relationships between context and sustainability efforts can help cities prioritise the most appropriate environmental policies for their individual circumstances. The survey tested only a small number of the potentially myriad contextual factors. Although a contextual factor that acts as a major barrier in one city may be largely irrelevant in another, what emerged clearly from the research is that a good understanding of a city's context is a prerequisite to successful sustainability planning. Knowing that most aspects of a city's context are changeable (either through targeted policy intervention or by means of more large-scale external forces such as climate change) is also an important reminder that cities are living systems, constantly evolving and in a state of flux, and that policymaking must remain agile to respond to future challenges.

Box 3.2 How COVID-19 has affected contextual drivers and barriers

Both existing infrastructure and current urban form have been shaped significantly by the COVID-19 pandemic, driven by a mix of a change in people's habits and active government interventions. This explains the importance of these contextual factors both in the survey and in the interview findings. Huge reductions in public transport use were observed in most European cities, as many people shifted to working from home. Almost all the cities' authorities interviewed emphasised the major impact these new patterns of working and travelling have had, with a lot of uncertainty remaining over how a shift to more flexible and remote working will affect infrastructure requirements in the future.

While many cities reported temporary reductions in car use at the height of the pandemic, in most cities traffic and associated congestion levels have returned to pre-pandemic levels or close to them (TomTom, 2022). At the same time, public transport use has still not returned to pre-pandemic levels, with many European metropolitan areas recording a ridership level of just 60-70% compared with pre-pandemic levels by the end of 2021 (Lozzi et al., 2022). However, the reduction in public transport use in many cities has been partially offset by investments in the walking and cycling infrastructure and the resurgence of the debate about the value of compact planning, accessibility and the '15-minute city'.

Going against this trend, the preference for single-family detached houses with private gardens persists in many European cities. Several city respondents expressed concern that a desire for more space and greater home working may perpetuate this more sprawling urbanisation pattern, with potentially significant implications for environmental sustainability and land use change. It is slightly too early to know to what extent such trends will play out in different cities, but cities will need to continue to invest in the expansion of multifunctional and high-quality green and blue infrastructure and rethink the importance of inclusive public spaces in the inner city.

Air quality is another contextual factor that has been considerably impacted by the pandemic, with many cities experiencing significant, if temporary, reductions in air pollution because of lockdown restrictions. While pollution has rebounded as cities have opened up again, there has been a shift in public perception and awareness of the importance of improving environmental quality and protecting natural assets, which was frequently cited in interviews. Similarly, a focus on improving and expanding green spaces, both to meet a growing recreational demand and in recognition of their significant value in mitigating and adapting to climate change and restoring biodiversity seems to be an enduring legacy of the pandemic.

3.2 Governance

Summary of findings — governance

EU governance

- EU legislation (EU laws, standards and regulations) remains a key driving mechanism of environmental sustainability transitions in European cites, contributing to improving water and land quality and significantly affecting the waste and water management, energy, transport, and construction sectors in terms of encouraging better environmental practices.
- EU initiatives such as the European Green Deal, the climate-neutral and smart cities mission, and NextGenerationEU (the EU plan for recovery from the COVID-19 pandemic) strongly influence the visions, aims and objectives of cities' local policies, plans and programmes.
- Intranational sustainability initiatives also significantly affect cities' plans and policies from both the environmental and the social sustainability perspectives. The UN Sustainable Development Goals (SDGs) are being used as a platform for cities' sustainability agendas. The influence of the SDGs on local policies was not as obvious as this in the previous research.

National and regional governance

- National government actions significantly affect the ability of cities to achieve environmental sustainability. While national governments support cities' sustainability ambitions (e.g. through shared goals and cooperation, funding, better environmental laws and regulations), national laws, standards and regulations can also be a barrier. While national governments have become more flexible since the COVID-19 pandemic, their inflexibility and lack of will can sometimes still conflict with the urgency to address environmental changes and challenges that cities feel.
- In terms of the distribution of power among levels of government, the extent of political decentralisation is perceived as one of the factors most inhibiting European cities' environmental sustainability transitions. This contradicts the findings of the previous research, where this factor was seen as one of the most supporting. Since the COVID-19 pandemic, with cities on the forefront of managing the crisis, the issue of distribution of power has become even more pressing for local governments.

Local governance

- European cities' sustainability journeys start with strategic thinking and planning. Local governments' overall vision and strategic plans, often inspired by EU and other international initiatives, remain one of the most important mechanisms for progressing environmental sustainability transitions in European cities.
- Inspirational leaders are essential in driving the positive change needed to achieve sustainability transitions in European cities. In addition to influencing political will, they can also create momentum for significant changes in vision, strategic thinking and planning within and beyond city governance institutions.
- Public participation is required to empower the general public and foster the feeling of ownership of cities' policies, to build trust and to continually improve communication between citizens and city governments, leading to better understanding of each other's views, aims and intentions. Digital engagement practices, evolving as a consequence of the COVID-19 pandemic, seem to be positive for public participation (e.g. more accessible and inclusive and attracting more and different people and stakeholders).
- Socio-economic challenges aggravated by the COVID-19 pandemic might be hindering public participation and engagement processes in European cities. These include rising social inequalities and people's increasingly polarised (political, religious and ideological) views and their everyday struggles (e.g. worrying about the future, finance, health and well-being) taking priority over environmental concerns. It can be difficult to make participation truly 'inclusive'.
- Despite the expectations that in the light of the COVID-19 pandemic cities will shift their focus to socio-economic struggles, environmental actions remain high on cities' political agendas and continue to be supported by national governments and the EU. Environmental sustainability transitions are seen as part of a successful recovery and a way towards a more resilient future.

For the purpose of this report, governance refers to the structures and processes, as well as the norms, values and rules through which affairs are conducted by political, business or community leaders exercising their power of authority.

The role cities play in achieving sustainability transitions has been increasingly acknowledged over the last 20 years and is now at the forefront of political and academic discourse in Europe and beyond (OECD, 2013; EEA, 2015, 2019, 2020; UN, 2020). Complex challenges, such as efficient land use, water and waste management, climate adaptation and resilience, and social inequalities, are often more acute in urban areas, often requiring city governments to innovate and find solutions. This notion of cities as key actors in dealing with large environmental, health and economic issues was also seen following the outbreak of the COVID-19 pandemic (UN, 2020). Although their role is important, they often lack the legislative, political and financial power to act, and therefore rely on support from mainly national and supranational governments. Academia, businesses, the general public and other stakeholders will also need to take part in shaping cities' sustainability policies and actions if they are to be successful.

3.2.1 EU governance

The previous research revealed that EU governance mechanisms, including its institutions, legislation, initiatives, and research and innovation funding programmes (e.g. FP7 (EU Seventh Framework Programme), Horizon 2020, Horizon Europe, LIFE, European Regional Development Fund), and city networks (e.g. Eurocities, Covenant of Mayors for Climate and Energy, ICLEI (Local Governments for Sustainability)) play a key role in supporting and progressing sustainability transitions in European cities. This was confirmed and further explored in the current research. The role of city networks is further discussed in Section 3.3, Knowledge.

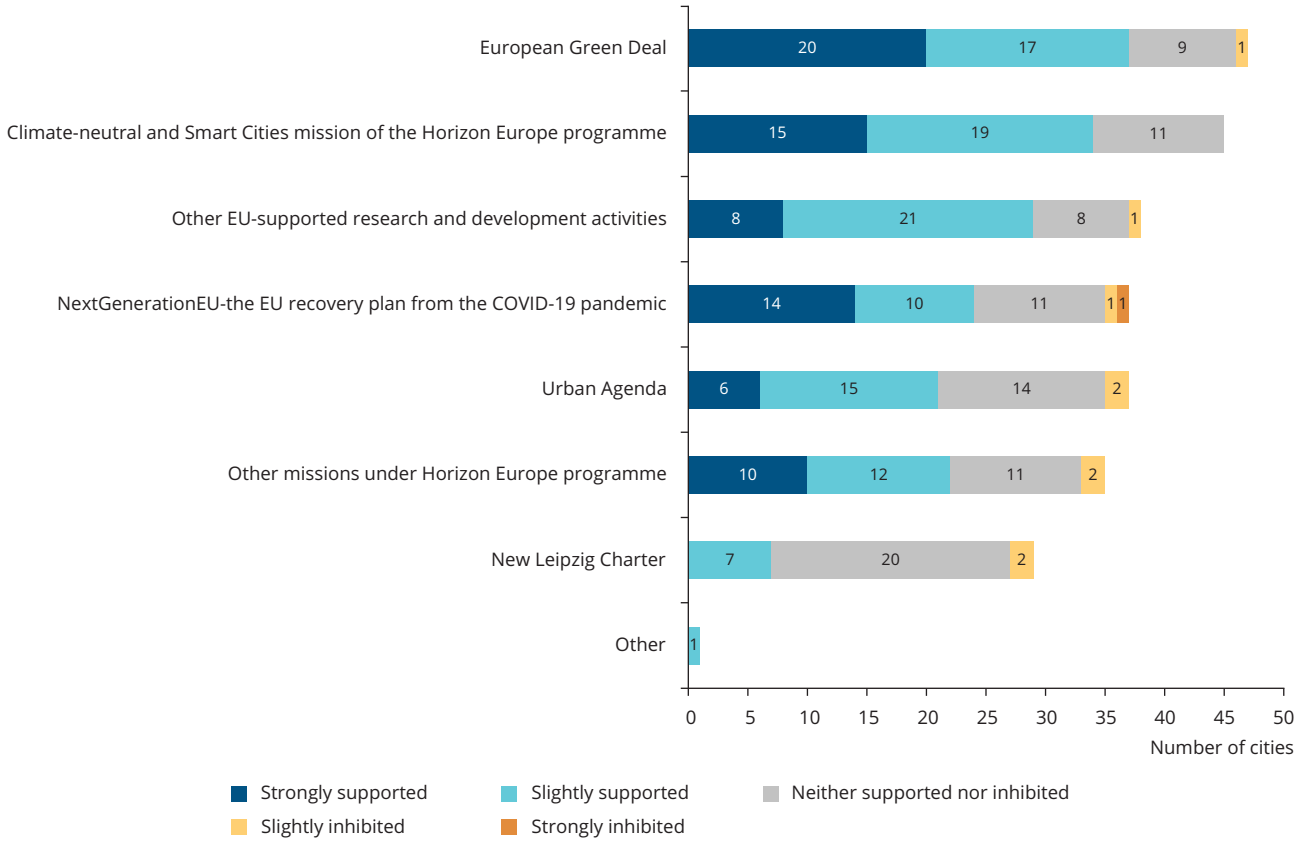
EU legislation remains a key driving mechanism

The current survey results showed that, while they were considered slightly more influential pre-pandemic, EU laws, standards and regulations remained the most important factor driving sustainability transitions in European cities. The importance of EU legislation was also reflected in the interview results, showing that compliance with EU standards significantly contributes to better enforcement of environmental laws in cities (e.g. Galaţi, Horst aan de Maas, Thessaloniki, Valmiera). While cities commonly mentioned improved air quality (air quality is one of the most acute environmental concerns for cities across Europe), the interview results indicated that EU regulations also play a role in improving water and land quality and are an important influence on the waste and water management, energy, transport and construction sectors in terms of encouraging better environmental practices.

Strong influence of EU initiatives on local policies, plans and programmes

The current survey results showed that in general cities think of EU policy initiatives as supporting their environmental sustainability transitions (see Figure 3.3). The European Green Deal was deemed (either strongly or slightly) as supporting by two thirds of the cities. This was followed by the EU mission on climate-neutral and smart cities under the Horizon Europe programme, which was considered as supporting by nearly the same number of respondents. EU-supported research and development activities also play an important role (about half of the cities recognised them as supporting). NextGenerationEU (the EU plan for recovery from the COVID 19 pandemic), while seen as supporting by almost half of the cities, was considered the third most 'strongly supporting' of all the EU initiatives listed in the survey.

Figure 3.3 The effect of international and EU policy initiatives on environmental sustainability transitions in cities



The European Green Deal

The interview results confirmed the survey results: aspirations to align cities' strategies, policies, plans and programmes with the ambitions of the European Green Deal emerged strongly in the interviews. For example, prompted by new national legislation for industrial parks, the authorities of Gabrovo, as one of the most industrial municipalities in Bulgaria, were looking for ways of integrating the objectives the European Green Deal into the planning, design and operation of industrial zones in their city. Tallinn's sustainable energy and climate action plan (2021) is based on the European Green Deal and the EU's long-term vision 'A clean planet for all'. Brussel's Shifting Economy strategy, aiming for a carbon-free, regenerative, circular, social, democratic and digital economy, makes explicit references to European Green Deal environmental goals (e.g. carbon neutrality by 2050) (innoviris. brussels, 2022).

Box 3.3 Tallinn's sustainable energy and climate action plan

Following the Tallinn 2035 development strategy (Tallinn, 2021), the city issued a cross-sectoral sustainable energy and climate action plan 2030 setting out its climate-neutral goals. The plan is based on the European Green Deal and the EU's long-term vision 'A clean planet for all'.

It aims to achieve climate neutrality by 2050 and fulfil the commitment set out by the Covenant of Mayors to reduce greenhouse gas emissions by 40% by the end of 2030. The climate action plan looks to simultaneously reduce the impact of urban living on climate change (e.g. with measures to reduce the greenhouse gas emissions from buildings, transport and the energy sector) and prepare the city for increased climatic instability and uncertainty.

The plan also aims to increase awareness of climate challenges, encouraging sustainable behaviours and supporting a bottom-up and more participatory and reflective forms of city governance.

NextGenerationEU

The NextGenerationEU recovery budget was frequently mentioned by the city respondents interviewed as an important funding mechanism of their environmental sustainability ambitions. For example, Cornellà de Llobregat applied for the NextGenerationEU funding to renovate its bus fleet. Stockholm is planning to spend the money from the NextGenerationEU fund on green retrofitting its housing and building stock. The Larnaka authorities hope that the money from the fund will help them support the implementation of their sustainable urban mobility plan (in-cyprus, 2020), specifically the construction of new cycle routes within and around the city. As shown in the previous research and confirmed by current research, EU funding initiatives in general, such as research and innovation funding programmes (e.g. FP7, Horizon 2020, Horizon Europe, LIFE), the European Regional Development Fund and Cohesion Fund, are important mechanisms in terms of supporting green and sustainable development in European cities (see Section 3.3, Finance).

EU mission: climate-neutral and smart cities

Several city respondents interviewed also mentioned the EU mission on climate-neutral and smart cities as a driver of their sustainability ambitions. The mission is aiming to deliver 100 climate-neutral cities by 2030, which will act as experimental and innovation hubs to enable all European cities to follow suit by 2050 (European Commission, 2022a). Among the 100 cities selected by the Commission in April 2022, many took part in the current or previous research or both (e.g. Brussels, Dublin, Lahti, Leuven, Lisbon, Marseille, Stockholm, Thessaloniki, Zagreb) (European Commission, 2022c).

Sustainable Development Goals — a platform for cities' sustainability agendas

In terms of international initiatives, almost half of the cities taking part in the current survey recognised the UN urban agenda as supporting. With regard to the influence of international initiatives on cities' actions, plans and policies from environmental and social sustainability perspectives, the city respondents interviewed most frequently mentioned the UN Sustainable Development Goals (SDGs). The significance of the SDGs for cities' sustainability agendas and their influence on local policies was not as obvious as this in the previous research.

For example, Cornellà de Llobregat's urban and social agenda 'Auseco', containing Cornellà Natura and Cornellà Urbana and integrating all major strategic and long-term plans, is strongly linked to the SDGs. Similarly, Tallinn's 2035 development strategy (Tallinn, 2021) vison and strategic goals are based on the SGDs and the European Green Deal.

Glasgow is working on a programme related to 'SDG5, Gender equality' and climate in partnership with C40 ([10]). Oulu organised 'Eco-support' for its workers, which is a training programme that started 10 years ago and is led by the Helsinki authorities. The programme aims to educate employees (e.g. in care homes, schools) how to implement more sustainable practices through their day-to-day work. In 2021 the programme focused specifically on the implementation of the SDGs.

When taking office last year, Tromsø's city government build its new political manifesto on the SDGs framework, aiming to break down siloed funding and institutional structures and to encourage communication, collaboration and knowledge sharing. Political will and commitment to the new integrated SGD approach has been an important driving force for the city's urban sustainability transitions.

3.2.2 National and regional governance

The results of the previous survey showed that national laws, standards and regulations were the second most important supporting national governance factor after international treaties, EU laws standards, and regulations (see Section 3.2.1, EU governance). The results of the current research confirm this (see Figure 3.4). Selected by nearly half of the cities, the current survey results show that the significance of national laws, standards and regulations has increased since the COVID-19 pandemic.

National taxes, subsidies or other economic instruments were considered to be both supporting and inhibiting in the previous research. The current survey results show the same picture, with approximately one third of cities considering them to be supporting and a similar proportion as inhibiting their environmental sustainability ambitions.

The factor most often considered as inhibiting (by nearly half of the cities) in the current survey was 'distribution of power among levels of government: the extent of political decentralisation' (see Figure 3.5). This differs from the results of the previous survey, where this factor was seen as one of the three most supporting.

([10]) The C40 Cities Climate Leadership Group is a group of 97 cities around the world that represents about 8% of the world's population and 25% of the global economy. Although Glasgow is not a member of C40, the 2021 UN Climate Change Conference (COP26), hosted in Glasgow, gave the city the opportunity to join this programme.

Figure 3.4 Factors related to national governance that supported environmental sustainability transitions in cities

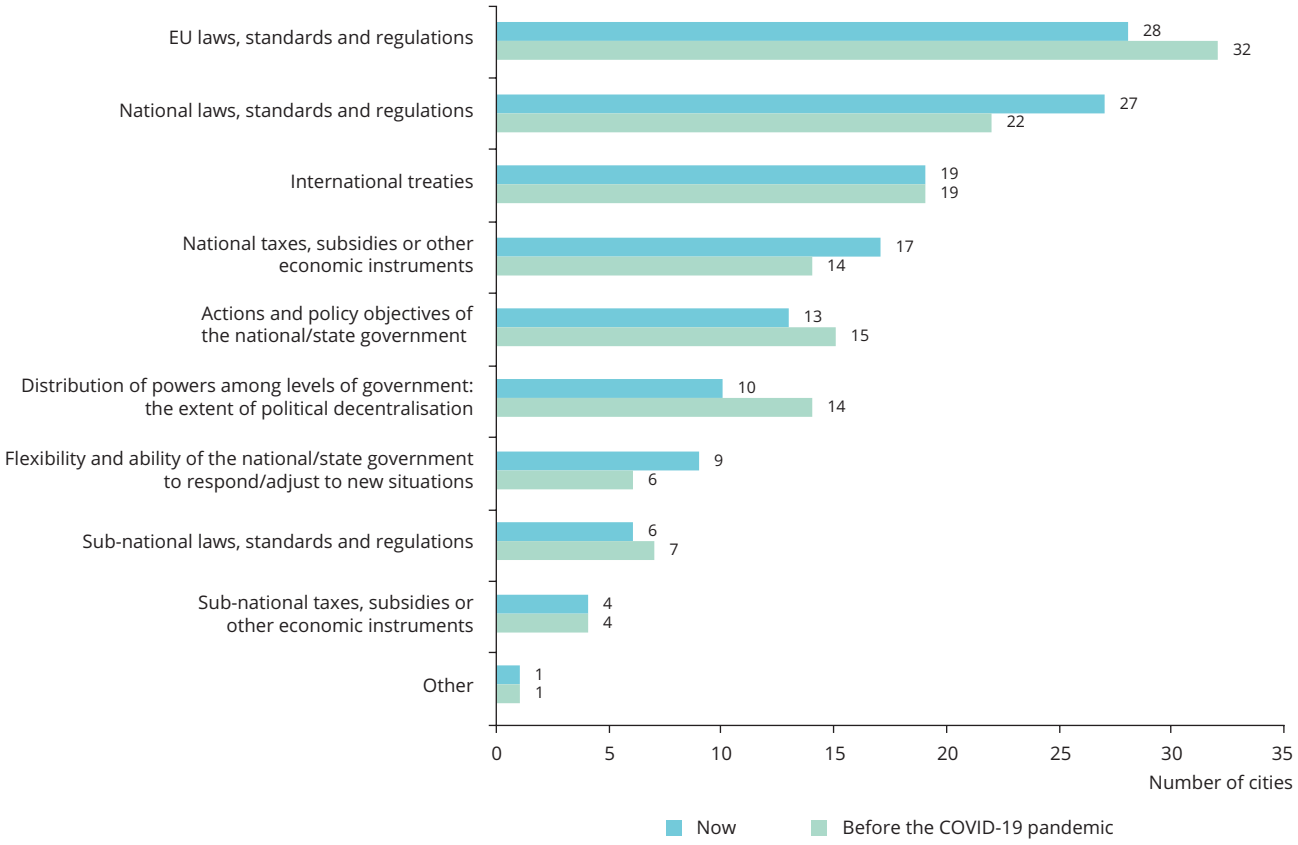
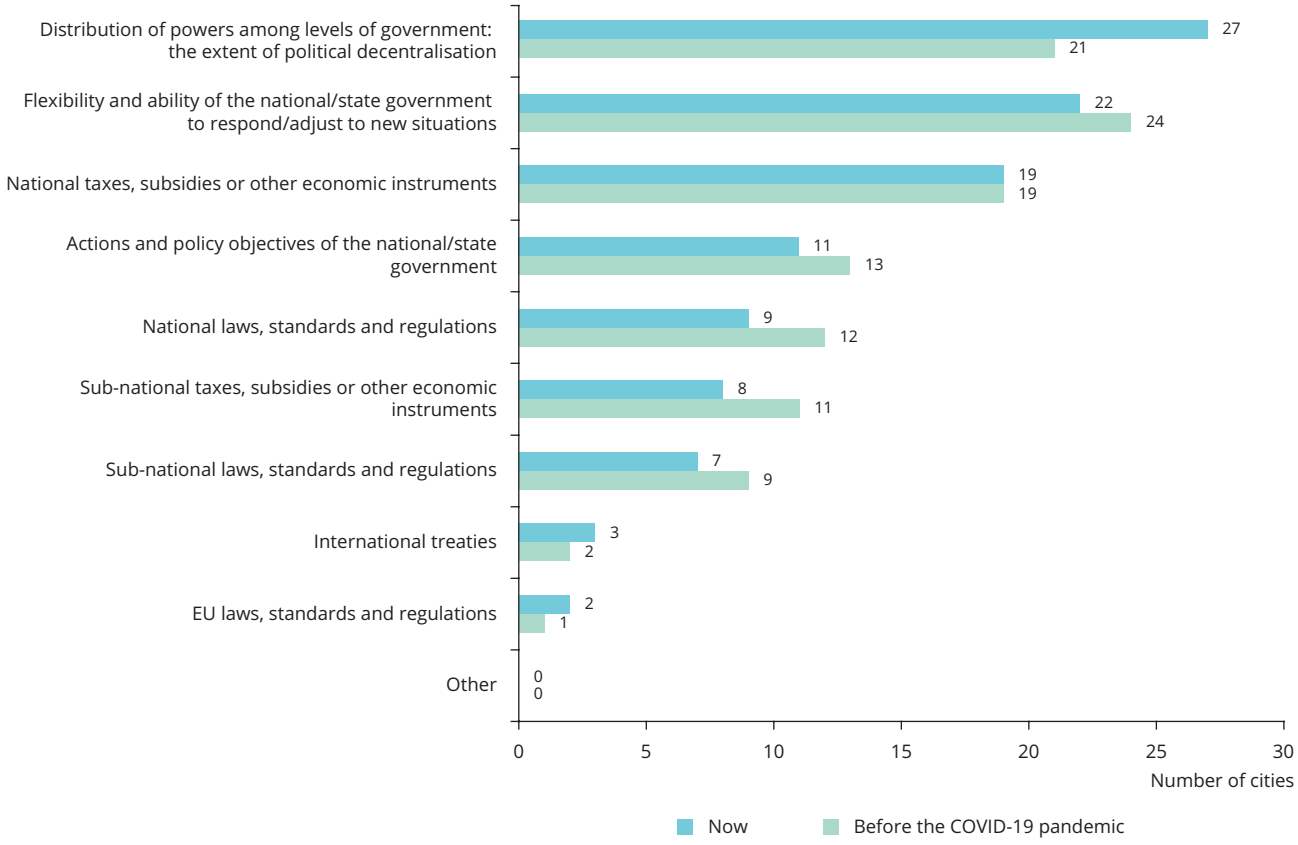


Figure 3.5 Factors related to national governance that inhibited environmental sustainability transitions in cities



National government action affects the ability of cities to achieve environmental sustainability

In line with the previous study, the current research results highlighted that national legislation and national government action significantly affect cities' abilities to pursue their environmental agendas. While the city respondents interviewed gave several examples of how national governments were supporting their sustainability ambitions, quite a few mentioned that national laws, standards and regulations can also be a barrier. This could be due to a certain rigidity and inertia at the national level, which can conflict with the urgency to address environmental changes and challenges that cities feel. This was supported by the current survey results, which showed that flexibility and ability of the national/state government to respond/adjust to new situations was still a significant barrier, although it had improved slightly since the COVID-19 pandemic ([11]).

The COVID-19 pandemic has highlighted the interdependence of different levels of government, and the importance of working in a coherent way towards shared sustainability goals. For example, the interviewees from Galaţi, Gdańsk and Graz all mentioned that national resilience and recovery plans that explicitly incorporate green transition concepts, together with allocated funding, are playing an important role in supporting their environmental sustainability objectives.

Respondents from Brno, Derry, Dublin, Glasgow, Larnaka and Osijek also highlighted the importance and benefits of close cooperation with national government on their sustainability journey. The Scottish government, for example, set up a Just Transition Commission that explicitly links justice and equality considerations to the sustainability agenda. This is helping Glasgow to consider how social challenges aggravated by the COVID-19 pandemic can be included in its sustainability ambitions. To achieve the targets of its sustainable energy and climate action plan, Brno is collaborating with the Czech government to adapt national legislation on energy distribution and supply, in particular regarding 'community energy'. The interviewees from Gdańsk, Osijek, Tromsø and Valmiera pointed out that growing national political will to achieve sustainability and better environmental legislation is supporting sustainability transitions in their cities. However, not all cities benefit from such national-level support, which can be a particular challenge in contexts of low political and fiscal autonomy. For Istanbul's government, political and ideological differences from the ruling party in Türkiye have led to considerable conflict, leaving the city feeling unsupported in its efforts to expand public transport provision and advance its ambitious climate agenda.

The interview results showed that existing national laws, standards and regulations can also present a significant barrier for cities aiming to transition to more sustainable practices. Respondents from various cities (e.g. Brussels, Gabrovo, Graz, Istanbul, Lausanne, Osijek, Thessaloniki, Tromsø) mentioned that they face regulatory difficulties in relation to:

- transport (e.g. provision and management of public transport, need for different speed limits in city centres);
- procurement (e.g. national laws mainly support the linear and not the circular economy, cities have no influence on product and service standards);
- construction (e.g. lack of regulations to encourage the use/production of renewable energy and the use of recycled materials in new builds);
- energy (e.g. lack of regulations on alternative energy provision and supply).

An interviewee from Lausanne pointed out that their sustainability policy was focused on changing the habits of citizens (e.g. what/how much you buy, what you eat, how you commute/travel). But there are limits to this approach, with citizens starting to resist this narrative and demanding that the responsibility for change is transferred from them to producers, industries, service providers and suppliers, ideally in the form of stricter national regulations.

The views of city representatives (taking part in the current and the previous research) on whether national taxes, subsidies or other economic instruments support or hinder urban sustainability transitions remain divided. The current and previous research indicated that legislative barriers include taxation systems and related levels of fiscal decentralisation. The current interview outcomes revealed that cities often have limited powers to effectively tax unsustainable practices (e.g. in the transport, construction, energy, production and consumption sectors). This means that an important lever that could support sustainability transitions remains beyond their reach, particularly in countries with low rates of fiscal decentralisation. On the other hand, national economic instruments (e.g. funding, subsidies, support to apply for and receive EU funding) were mentioned by the interviewees as supporting their environmental ambitions.

([11]) This factor was not considered in the previous survey, as its potential significance for environmental sustainability transitions in European cities was much less obvious before the COVID-19 pandemic.

Lack of 'supra-' and 'inter-municipal' governance structures is hindering cities' environmental sustainability transitions

The current research results showed that 'distribution of power among levels of government: the extent of political decentralisation' was perceived as one of the factors most inhibiting the environmental sustainability transitions of European cities. This contradicts the findings of the previous research, in which this factor was seen as one of the most supporting. Most of the cities interviewed in the current research recognised the influence that the 'distribution of power among levels of government: the extent of political decentralisation' has on their ability to pursue sustainability ambitions. The previous research also found that this can affect fiscal decentralisation as well as legislation and management practices of sectors with substantial environmental impacts (e.g. housing, urban development, public transport, energy, water and waste).

The current interview results suggest that the negative perception of power distribution and decentralisation is mainly related to a lack of 'supra-municipal', 'inter-municipal' or metropolitan governing bodies (i.e. bodies below regional and above municipal administrations) with sufficient administrative, legislative, decision-making and political powers. Cities including Gabrovo, Graz, Thessaloniki and Zurich recognised the need for such bodies. Joining together smaller cities and municipalities under larger supra- or inter-municipal governments is thought to help support cities to deal efficiently with complex, large-scale environmental urban sustainability challenges (e.g.-climate change, pollution, waste management, energy supply, public transport). While interviewees said that cities have great ambitions to tackle these challenges, dealing with such issues often exceeds their jurisdictional and resource capacity. For similar reasons, since the COVID-19 pandemic when cities were at the forefront of managing the crisis, the issues related to 'distribution of power among levels of government: the extent of political decentralisation' became even more pressing for local governments.

Generally, the administrative arrangements and devolution of (legislative, decision-making and political) powers below national level vary widely across Europe. While regional coordination and governance bodies are common, the continent has very few examples of what could be considered a true supra-municipal, inter-municipal or metropolitan administration. One example of metropolitan administration is the French Aix-Marseille-Provence Metropolis, an 'intercommunal' structure including 92 communes and centred on the cities of Marseille and Aix-en-Provence. It was created in 2016 with the aim of enabling more effective integration of policy and governance within the metropolitan area of Marseille.

Another example is the Barcelona Metropolitan Area (Area Metropolitana de Barcelona, AMB) in Spain, which was discussed in the previous report. The AMB is a supra-municipal authority established in 2010 to help coordinate urban planning, mobility and environment efforts. An interviewee from Cornellà de Llobregat, which is part of AMB, emphasised the benefits of metropolitan governance in pursuing sustainability in these areas. Most recent support from AMB included the management and coordination of applications to access EU funds (from NextGenrationEU) for all municipalities within the AMB.

While important for successful governing practices at supra-municipal, inter-municipal or metropolitan scale, achieving agreement between various local governance actors (cities, municipalities, districts, etc.) can be challenging. For example, the interviewee from Marseille explained that local autonomy of decision-making bodies (i.e. communes) within the Marseille metropolitan area is very strong. This can lead to competition between diverse political and other interests as well as for resources. For example, a reduction in alignment between Marseille's and Aix-en-Provence's (political) ambitions since the last local elections was noted, which may present a challenge for the effective running of the Aix-Marseille-Provence Metropolis.

Box 3.4 Aix-Marseille-Provence Metropolis

Aix-Marseille-Provence Metropolis, an 'intercommunal' structure including 92 communes and centred on the cities of Marseille and Aix-en-Provence was created in 2016 to enable more effective integration of policy and governance within the 3,000km² metropolitan area of Marseille.

The accord came about as a result of national government's fiscal changes, which encouraged municipalities to merge budgets and cooperate, and therefore more adeptly respond to issues (e.g. urban sprawl, public transport, waste management) that cover large areas. For Marseille, having an administration covering the whole metropolitan area is beneficial and helps the city to better manage urban sprawl and public transport, moving away from high levels of car dependency.

The COVID-19 pandemic also appeared to accelerate the integration of governance structures, leading to greater dialogue and more cohesive action between the metropolitan body, Marseille city council and the communes, especially on the environmental agenda. They began to work collectively on introducing schemes such as providing EUR5,000 subsidies for households to buy electric cars and to supply over 20,000 e-bikes.

Source: Eurocities, 2022.

3.2.3 Local governance

In both the previous and current surveys, 'local government overall vision and strategic plans' was identified as the most important supporting factor for environmental sustainability transitions in European cites (selected by two thirds of the respondents in the current survey) (Figure 3.6). This was followed by 'individual political leadership' and 'level of civic engagement and public participation' (both selected by about one third of current survey respondents). However, the latter was named as an inhibiting factor by as many respondents as thought it supporting.

The current survey found that 'election cycles/term times' remains the most significant inhibiting factor for the environmental sustainability transitions of European cities (selected by over one third of the current survey respondents) (Figure 3.7). This is followed by 'level of civic engagement and public participation' (selected by just under one quarter of cities) and 'level of coordination and integration of environmental sustainability objectives with other sectors'.

While the survey found that the significance of factors related to local governance was mostly not affected by the COVID-19 pandemic, 'flexibility and ability of the local government to respond/adjust to new situations' was considered noticeably more important for supporting urban sustainability transitions than before the COVID-19 pandemic. 'Flexibility and ability of the national government to respond/adjust to new situations' was, in contrast, perceived as mainly inhibiting for cities' environmental ambitions.

Figure 3.6 Factors related to local governance that supported environmental sustainability transitions in cities

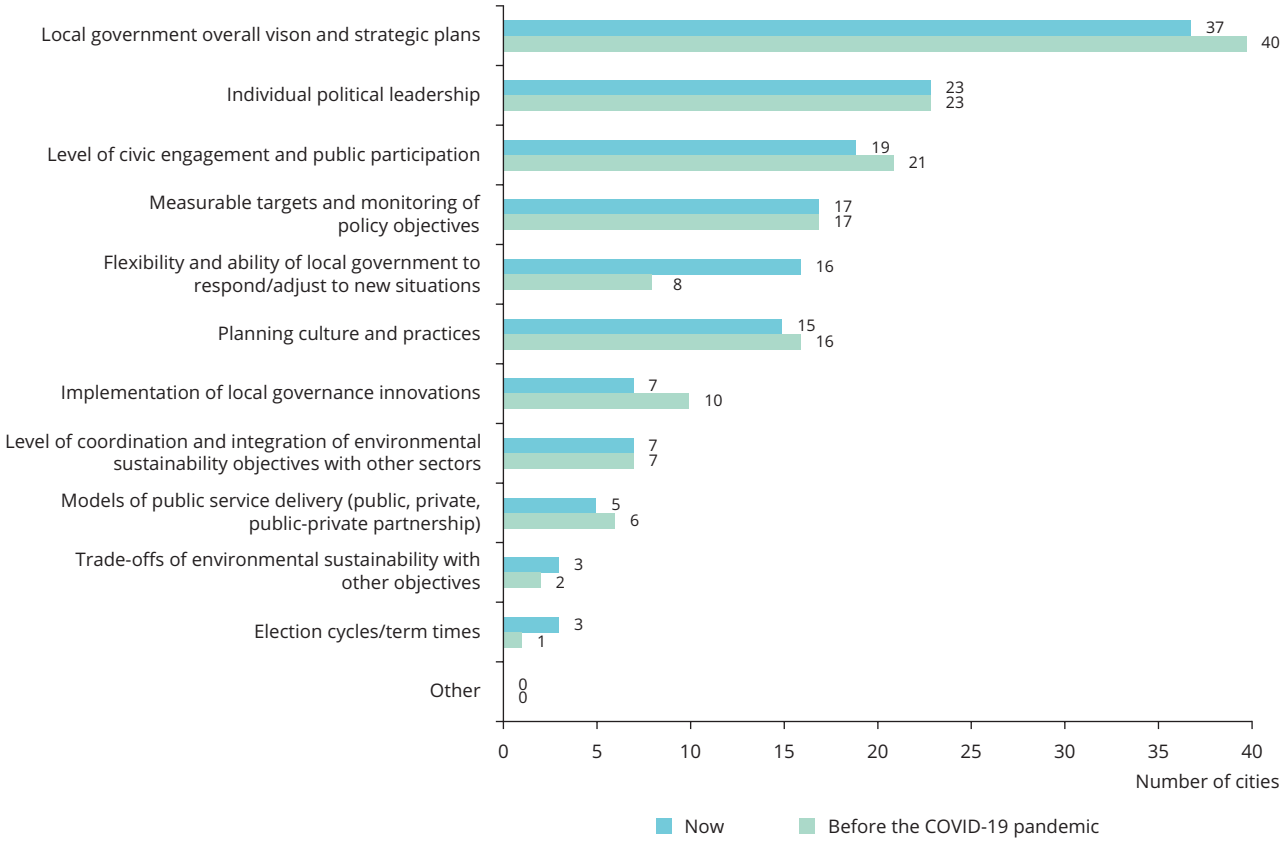
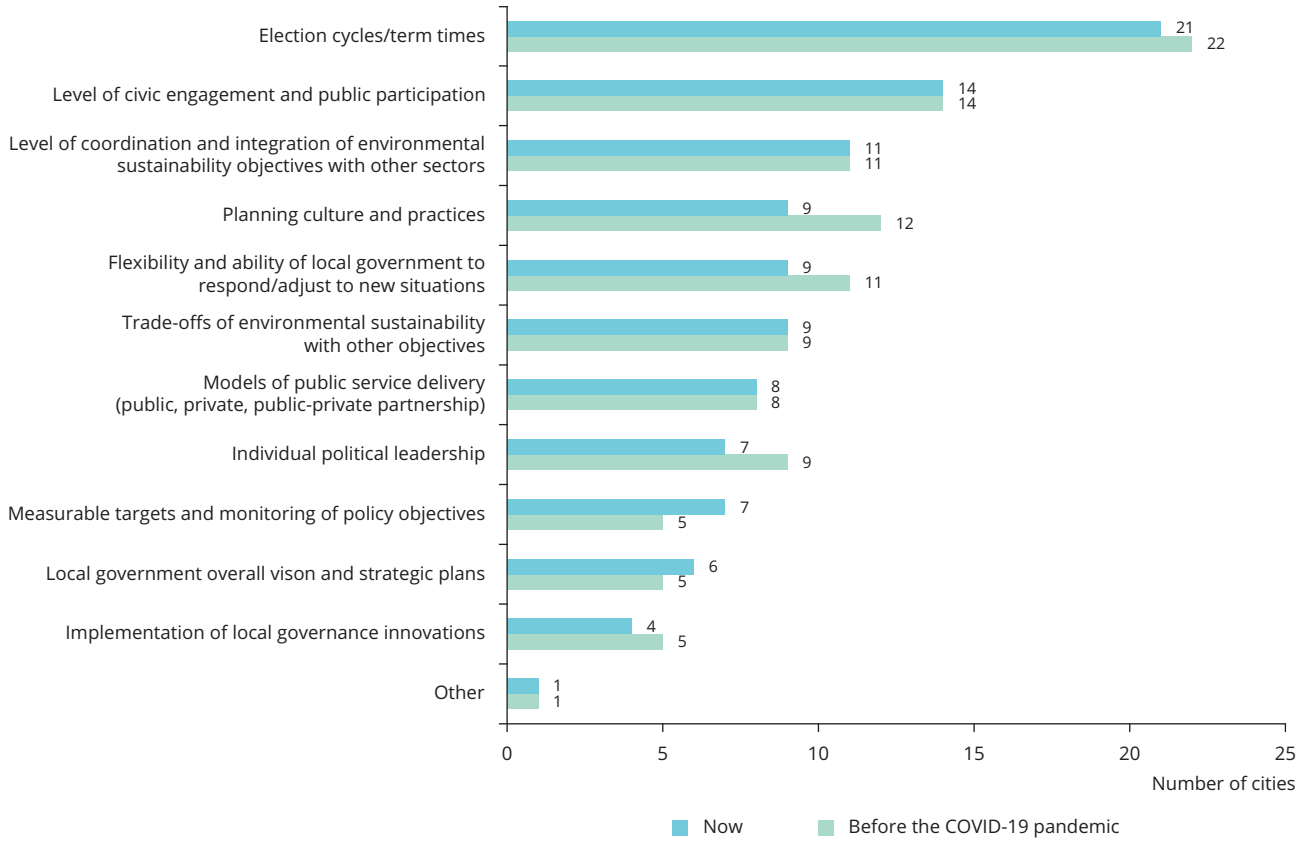


Figure 3.7 Factors related to local governance that inhibited environmental sustainability transitions in cities



Strategic thinking and planning — the start of European cities' sustainability journeys

The current research confirmed the previous research findings that 'local government overall vision and strategic plans' is one of the most important mechanisms for progressing environmental sustainability transitions in European cities. Most of the city representatives interviewed recalled taking strategic decisions that were important for them to make a shift towards a more sustainable future. Often inspired by the EU and other international initiatives, these were supported by clear visions, objectives, plans and programmes.

For example, the interviewee from Stockholm stressed the importance of integrating the Stockholm environment programme with city's other objectives in 2020. This led to the mainstreaming of environment, which is now considered in decision-making across all areas of city governance, including policy, economic growth, family and social welfare, and education.

Hosting the UN Climate Change Conference (COP26) and learning from and engaging with other cities around the world encouraged Glasgow to take immediate action and do more to transition to a green economy and green finance. The city of Glasgow appointed a new green economy team and launched its 'greenprint for investment', a GBP30 billion portfolio of investment projects designed to help deliver the city's target to become net zero by 2030 (e.g. retrofitting the existing building stock, expanding and enhancing the urban metro system, creating and supporting sustainable jobs). Following a blueprint to achieve a better and more sustainable future for all, the portfolio of projects outlined within the greenprint relate to four of the UN SDGs: SDG8, Decent work and economic growth; SDG11, Sustainable cities and communities; SDG13, Climate action; and SDG17, Partnerships for the goals (Invest Glasgow, 2021).

Political will for a shift to a more circular economy is also evident in Brussels, where the city government launched a similar initiative, BeCircular, 5 years ago.

Aiming for sustainability transitions, the city of Gdańsk is focusing on urban regeneration. The city launched its first project on urban regeneration, which was funded by the EU, in 2004. While initially trying to attract investors to 'brownfields' on the city's outskirts, in 2018 the city government introduced a major change by setting a strategic goal to direct building development into the city. Aspiring to the 'compact city' concept, the city is now planning its building developments in close proximity to public transport (i.e. transit-oriented development).

Similarly, the city of Reykjavik started to tackle urban sprawl 10 years ago by introducing a green belt and focusing on densifying the city centre to make better use of the existing infrastructure and protect nature. This, at the time bold, shift towards a 'compact city' and more strategic, environmental spatial planning was influenced (if not initiated) by the merger of the city's environmental and planning departments.

While many other city respondents interviewed echoed the role of strategic planning in fostering positive changes to support cities' sustainability transitions, some also mentioned challenges related to local government overall vision and strategic plans. These included local government objectives and plans that were 'short sighted' (i.e. lacking a positive vision or strategic planning) on the one hand and 'overplanned' (including long and resource-intensive planning processes focused on potential obstacles and leading to reluctance to take action) on the other.

Inspirational leaders are essential in driving positive change

The current research, reflecting the previous study, highlighted the importance of 'individual political leadership' in driving the changes essential to achieve sustainability transitions in European cities. The interviewees from several cities stressed that inspirational leaders can, in addition to strongly influencing political will, also create the momentum for significant changes in vision, strategic thinking and planning within and beyond city governance institutions.

The interview outcomes show that strong, committed local leaders that recognise the emergency and champion climate and environmental actions have been essential for the development and implementation of key sustainability plans and programmes in cities across Europe (e.g. Cornellà de Llobregat, Dublin, Galaţi, Istanbul, Randers, Thessaloniki).

The interviewees from Graz, Gabrovo and Zurich mentioned that leaders play an essential role in intersectoral and interinstitutional communication, which is important to break down silos and foster collaboration and policy integration. For example, based on the strong political directive of the new green vice mayor of Graz there is a much stronger collaboration between the urban and the environment departments, giving the latter a more prominent role and involvement in various areas of Graz city government.

Most of the city interviewees also highlighted the importance of leadership in fostering positive change to achieve urban sustainability transitions. The interviewee from Zurich particularly reflected on the challenges that these mostly radical changes bring to cities, as they are not always positive for everyone. In some cases, they can significantly affect industries that the cities are economically dependent on (e.g. coal, cars, energy), requiring drastic changes in or even complete abandonment of old business models. Thus trusted, inspirational leaders striving to achieve just transitions are essential to manage and look for synergies in often opposing views and beliefs.

Social inequalities and polarised views hindering public participation

The current research and in particular the survey results showed a clear divergence in views over whether the 'level of civic engagement and public participation' supports or hinders environmental sustainability transitions in European cities. It was again cited as one of the most important supporting factors; however, it was also almost as often perceived as inhibiting.

The interview findings and the results of the current and previous surveys have all identified similar reasons for why citizens' participation and engagement supports cities' environmental sustainability transitions including:

- empowering the general public;
- fostering the feeling of ownership of cities' policies (plans and projects),
- building trust (through transparent and participatory decision-making processes);
- continually improving communication between citizens and city governments (leading to better understanding of each other's views, aims and intentions).

For example, an interviewee from Braga mentioned that opening up the city's environmental themes and actions to public opinion and participation was a catalyst for a paradigm shift towards sustainability. Having a strong presence of civic organisations (non-governmental organisations, local citizens' initiatives) and public participation in Cornellà de Llobregat helps people to feel empowered, to consider themselves as part of the change towards sustainability — part of the solution. Tallinn has made significant efforts to improve stakeholder and public engagement in recent years, with thousands of residents and partners being involved (through surveys, interviews, working groups, schoolchildren' drawings and essays) in the making of the Tallinn 2035 development strategy. This has fostered a sense of ownership and improved the knowledge and understanding of the strategy in the wider community.

While it seems obvious why the 'level of civic engagement and public participation' is perceived as supporting, it is less clear why it would be inhibiting to cities' sustainability agendas. Lack of 'in-person' engagement during the COVID-19 pandemic might be the first thing that comes to mind. However, the city interviewees mainly thought that the use of digital participation tools is positive for public participation (e.g. more accessible, inclusive, and attracting more and different people/stakeholders). The current research results

imply that issues with public participation and engagement might be related to the increasing socio-economic challenges European cities are now facing. These include rising social inequalities and people's increasingly polarised (political, religious and ideological) views and their everyday struggles (e.g. worrying about the future, finance, health and well-being) taking priority over environmental concerns. Although present before, there is rising evidence that all these issues have been further aggravated by the COVID-19 pandemic (The Health Foundation, 2020; OECD, 2021; Panchal et al., 2021).

The interviewee from Dublin mentioned that it can be difficult to make participation truly 'inclusive'. It seems to be particularly hard to reach out and consider the voices of citizens from marginalised and socio-economically vulnerable groups. As explained by the interviewee, living in serious poverty means that people often do not feel that they are part of the city or that they are represented. They feel as if the actions taken and changes made are not for them and are therefore less keen to engage with the city. Linking this to social inequalities worsened by the COVID-19 crisis, issues with engaging marginalised groups were also mentioned by other city interviewees such as Cornellà de Llobregat, Glasgow, Marseille, Reykjavik, Stockholm and Thessaloniki.

Some city respondents mentioned that the increasing polarisation of citizens' political, religious and ideological views is significantly hindering public participation and engagement, particularly in relation to environmental but also other challenges city governments are dealing with. In Derry, for example, the feeling of unity needed to drive positive change towards sustainability is hampered by a long-lasting divide between the Catholic and Protestant communities. The strong political and religious split and the legacy of the Troubles in Northern Ireland, as well as deprivation and inequalities, can make people think that they have more important, existential issues to worry about than the environment and climate change.

Box 3.5 How COVID-19 has affected governance drivers and barriers

The COVID-19 pandemic highlighted the importance of city, regional and metropolitan governance in addressing complex environmental and socio-economic emergencies and challenges. Cities are often hit hardest and are at the forefront of dealing with the consequences of socio-economic and environmental crises.

This requires city governments to be flexible and have the means to respond quickly. To act they need sufficient legislative, political and financial powers. National and supranational governments also need to be flexible to support their actions. Although this was understood before, since the COVID-19 pandemic this need has become more relevant and urgent.

As shown by the current research, this is to some extent reflected in the need cities have for more powerful supra-municipal, inter-municipal or metropolitan governance levels. Early in the pandemic this need was demonstrated in a joint declaration from mayors to the European Commission demanding the active involvement of cities and direct access to funding through EU recovery programmes (Eurocities, 2020). The outcomes of the current research imply that the recovery plan for Europe, NextGenerationEU, has at least to some extent addressed these demands.

Despite the expectations that, in the light of COVID-19 pandemic, cites will shift their focus onto socio-economic struggles, the current research shows that environmental actions remain high up cities' political agendas and continue to be supported by national governments and the EU. Environmental sustainability transitions are seen as part of a successful recovery and a way towards a more resilient future.

3.3 Knowledge

Summary of findings — knowledge

- Research and innovation, networks of cities and peer-to-peer learning, the education system, and skills in local government were the factors selected most frequently by survey respondents as being important in supporting their sustainability transitions, both before the pandemic and now.
- Communication and knowledge sharing between different levels of government, level of awareness of environmental sustainability, level of awareness of shared understanding of sustainability issues in local government, and skills in government were selected most frequently in the survey as the factors that inhibit environmental sustainability transitions.
- The interviewees frequently discussed the importance of research and innovation. In this context, regional research centres that could pilot studies before their scaling up were highlighted as being important. A few respondents discussed citizen-based innovation and collaboration centres that allow for more participatory forms of governance with experimentation and innovation at their core.
- Collaboration with diverse sets of stakeholders is key for knowledge production. Collaboration with universities especially was discussed at length by several city respondents, and these relationships were valued because of their evidence-based solutions to issues, the educational opportunities they could provide outside the academic environment, and the potential for long-term partnerships.
- Inter-city networking was highlighted as especially important for knowledge exchange. This was exemplified by the number and variety of collaborative city networks that were described by respondents. Such networks provide benefits including the sharing of best practices, improved strategic metropolitan planning and the sharing of resources.
- City respondents discussed how public understanding of sustainability was steadily increasing but that more radical shifts will be needed. The increased use of public consultation procedures is also allowing improved knowledge of citizens' concerns to emerge, as well as providing an opportunity to educate citizens.
- Knowledge gaps within government remain a key challenge. These knowledge gaps, whether due to departmental silos, insufficient resources for the training and upskilling of staff, or short-term policy cycles that inhibit the development of technocratic governance, were identified as key challenges that need to be overcome for cities to effectively realise their sustainability ambitions.
- Strong leadership and having a unified strategic plan were identified as important factors in overcoming the barriers to policy integration across departments and sectors. Some cities also employed specialist facilitators to aid this integration.
- There was some, but limited, anecdotal evidence that COVID-19 may have increased our appreciation of science and data. Lessons may also have been learned from the pandemic that could be applied to the environmental crisis, which is also a collective challenge that requires a unified response.
- The pandemic engendered new opportunities for knowledge exchange, via the increased use of digital platforms that could potentially increase the frequency and diversity of citizens' participation, while also presenting challenges associated with less active engagement from municipal staff and policymakers.

For the purposes of this report, knowledge refers to the key insights, skills and expertise related to urban environmental sustainability processes, their management and options for action held by individuals and groups (EEA, 2011). Knowledge can be shared between networks of stakeholders directly involved in the creation, diffusion and use of scientific, technological and other forms of knowledge, as well as those organisations responsible for the coordination and support of these processes.

Cities in Europe will need to draw on the full range of knowledge available to them to produce impactful policies and strategies and to realise their sustainability transition goals. Knowledge can be harnessed from diverse sources, including through research and innovation, partnerships with other cities and collaborative networking. Through education, cities in Europe can improve the knowledge and skills of their employees, citizens and businesses to help support a multi-level urban transformation.

The importance of knowledge as an enabling factor was confirmed by the survey findings. Research and innovation, networks of cities and peer-to-peer learning, the education system, and skills in local government were the factors selected by most survey respondents as being important in supporting their sustainability transitions, both before the pandemic and now (see Figure 3.8).

However, in some cases knowledge was also seen as a barrier to sustainability transitions, with 'communication and knowledge sharing between different levels of government', 'level of awareness of environmental sustainability', 'level of awareness of shared understanding of sustainability issues in local government', and 'skills in government' selected most commonly by survey respondents as the factors that inhibit environmental sustainability transitions, both before the pandemic and now (see Figure 3.9). Here, issues of knowledge overlap with issues of governance. The interviews highlighted that effective collaboration between sectors and departments relies on open knowledge exchange, with knowledge therefore being a cornerstone of collaboration.

The impact of COVID-19 has created both challenges and opportunities regarding knowledge and sustainability, which are discussed at the end of this section. However, one particularly notable issue raised in the interviews was that the pandemic may have increased awareness among both citizens and municipal authorities of the kinds of crises and challenges that affect all citizens and which must be faced collectively. The pandemic has thus perhaps accelerated a drive to find novel and innovative solutions to the environmental challenges facing cities across Europe.

Figure 3.8 Factors related to knowledge that supported environmental sustainability transitions in cities

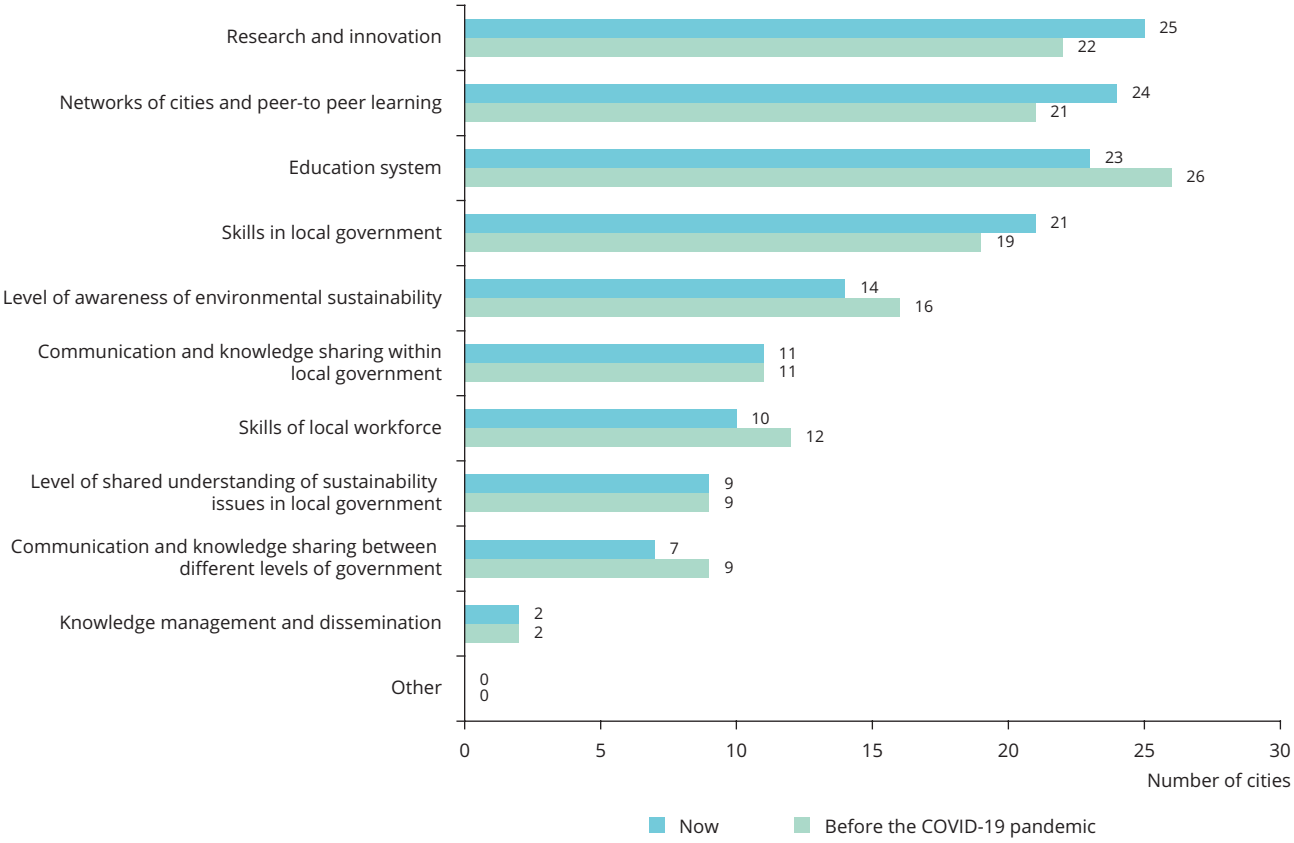
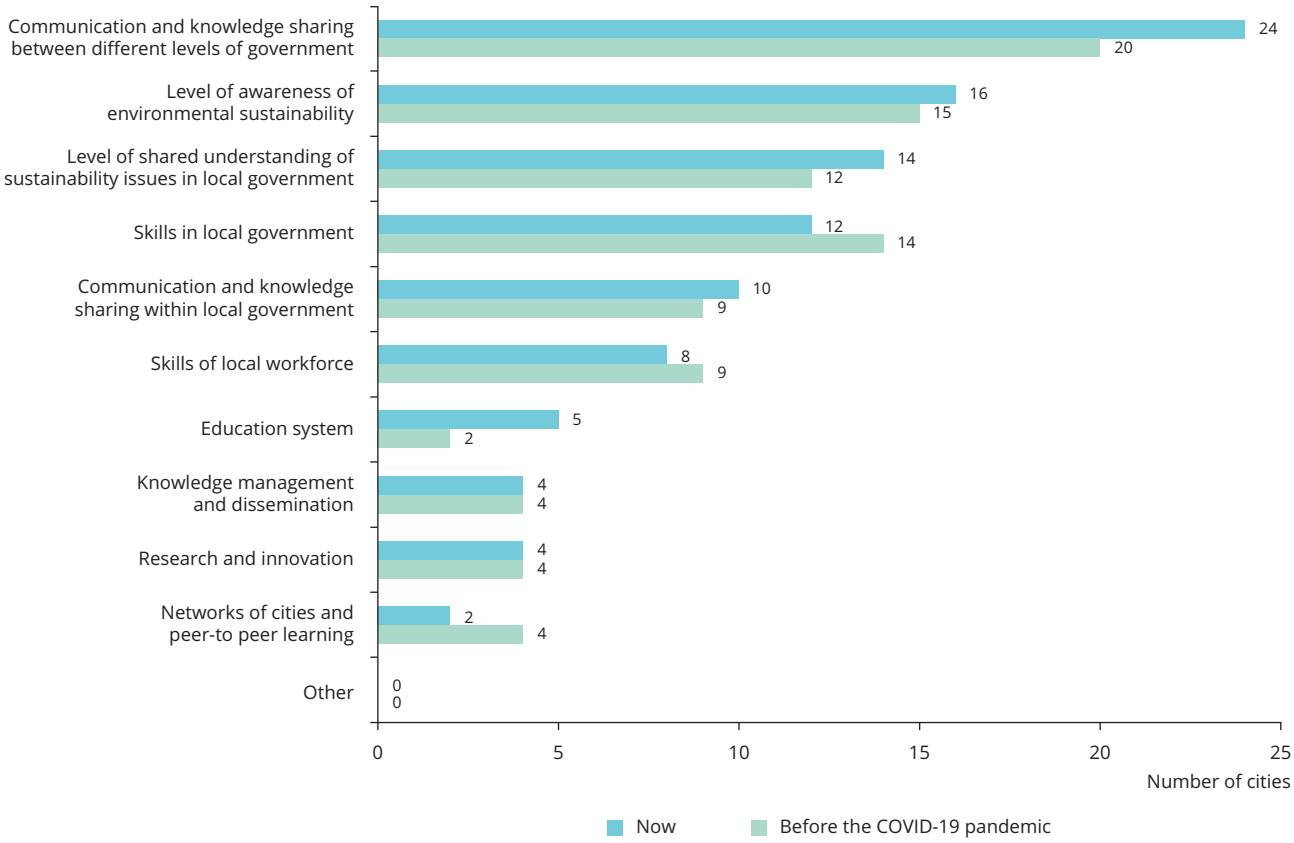


Figure 3.9 Factors related to knowledge that inhibited environmental sustainability transitions in cities



Knowledge production through research and innovation

Research and innovation was the factor most frequently selected by the current survey participants related to knowledge that supported environmental sustainability transitions.

The interviews also highlighted the importance of research and innovation, with repeated references to the importance of regional research centres and examples of implementing innovations within cities, such as smart buildings and e-charging stations. However, the importance of conducting pilot research studies before scaling up was also highlighted to ensure that innovation was not being implemented for its own sake, but rather was supported by data and evidence. The Stockholm respondent, for example, emphasised that innovation needs to be implemented effectively, and its results monitored, to ensure that it is having the intended effects.

Innovation can take many forms. An interesting perspective from Reykjavik was that attention is now shifting away from technological innovation to innovation in finance, as the former is now well established. This city respondent cited the lessons learned from Denmark on bond issuing and stated that technological innovation alone is insufficient, and it must be supported by appropriate forms of governance.

The value of working with the private sector on research and innovation was also highlighted; for example, Cornellà de Llobregat's Citilab, a digital laboratory located in a former textile factory that blends citizen-inspired innovation with research, entrepreneurship and training, was discussed as an example of this kind of collaboration. Unlike a conventional research facility, such a laboratory aims to create and validate technologies, products, services and business models for everyday contexts (Citilab, 2022).

The Dublin respondent made an interesting point that attitudes to science and data had generally become more positive as a consequence of the pandemic. While this will clearly be beneficial to cities' sustainability ambitions, it is important to remember that scientific evidence takes time to accumulate, and it may be that in the face of increasing uncertainty about the socio-economic challenges aggravated by COVID-19, as well as that generated by a worsening climate crisis, forms of participatory and reflexive governance may become ever more important to allow appropriate action. Adopting an 'agile' approach to governance, with experimentation, policy innovation and cross-sectoral innovation at its heart, has been proposed as a response to the uncertainty-laden challenges that lie ahead (Callanen and Dusek, 2021).

Knowledge production through collaboration with diverse sets of stakeholders

Collaboration with stakeholders, including academic institutions, other municipalities, non-governmental organizations (NGOs) and the private sector, is a key aspect of knowledge production for sustainability transitions. As discussed by respondents from cities including Banská Bystrica, Brussels, Glasgow, Istanbul Lausanne, Reykjavik, Tallinn and Tromsø, working with universities can be especially useful, given their production of evidence-based solutions and opportunities for long-term collaboration. For example, the Banská Bystrica respondent described the success of its 8-year partnership with the University of Oslo, and how the institution has assisted the city through teaching programmes on forest management and carbon capture. Working with the private sector was seen as especially important for the implementation of sustainability-related knowledge, in addition to knowledge production. For example, in Osijek, collaboration with the IT sector was crucial for its mobility transition plan because of the reliance on complex sets of data. The role of the private sector in funding innovation was also mentioned several times in interviews. In Tromsø, for example, it was the private sector that financed the electrification of the port. In Reykjavik, innovation competitions help bridge the link to the public sector, as does Cornellà de Llobregat's CitiLab.

City authorities that were interviewed approached collaboration with other stakeholders in a variety of ways. Some, such as Reykjavik, stated that it was important that 'clear signals' were sent by municipal authorities to other stakeholders and to the private sector, with the city driving the agenda in a rather top-down approach. Others, such as Randers, saw their role as much more of a faciliatory one, and that 'collaborating as equals' was part of a wider 'cultural shift'. Regarding the skills and technical expertise of the workforce itself, it was suggested by the Glasgow respondent that an effective means of developing these skills was to work with further education colleges, giving the example that it is not necessary to have a degree to repair or maintain an electric car.

Box 3.6 The Graz EcoProfit initiative: 30 years of partnering with the private sector

The EcoProfit concept was developed in 1991 in Graz by the Environmental Office of the City and Graz University of Technology and has since expanded to more than 19 countries. EcoProfit is a cooperative approach to reducing the cost of waste, raw materials, water and energy in private firms. Reductions in these areas not only save businesses money but also reduce environmental impacts. The model addresses the industrial sector as well as hospitals, hotels, service companies and tradespeople.

Companies that sign up receive advice from experienced environmental consultants to identify opportunities to reduce resource consumption or adopt new cleaner technologies. After the first year, the companies are audited and receive an official award from the city. In addition, companies can join the EcoProfit Club. This enables the regular exchange of experiences and offers workshops where businesses can update their knowledge of environmental law and new organisational and technical innovations that can further support their sustainability efforts.

Source: Inno4sd, 2019.

Box 3.7 Gabrovo greens its industrial sector through active collaboration and knowledge dissemination

The municipality of Gabrovo, an industrial heartland in the centre of Bulgaria developing CNC (computer numerical control) machinery, PVC (polyvinyl chloride) products and textiles, is working with industry to further its sustainability aims. When the national government introduced new legislation surrounding industrial parks, Gabrovo took the initiative and began encouraging local companies to align themselves with the ambitions of the European Green Deal. They started off by the river in the Northern Industrial Zone, where a high proportion of businesses are located, implementing a new geoengineering plan and sharing information about the potential of solar photovoltaics. From there, the city authorities encouraged companies to start collaborating on shared infrastructure investments, particularly around renewable energy generation. This city-led initiative has helped some businesses with a very high energy demand to take advantage of available roof space or free land belonging to other businesses to install solar panels, creating a new more integrated and less polluting business ecosystem.

Lessons learned from the pandemic combined with the current energy crisis increased the levels of interest among local companies, many of which had never previously engaged with each other. Since Gabrovo initiated the project there has been a noticeable increase in the sharing of ideas between companies, including on key sustainability objectives. The municipality's laying of the groundwork has made it easy for the private sector to scale up programmes and find other productive ways to work together.

Knowledge exchange via inter-city networking

The survey identified 'networks of cities' and 'peer-to-peer learning' as the second most important knowledge-related factor that supported sustainability transitions. This result was strongly supported by the interview findings. Numerous references were made to the benefits of inter-municipal collaboration, and examples of a variety of city networking organisations and partnerships were given. Among these organisations were C40 Cities, Covenant of Mayors for Climate and Energy Europe, Eurocities, European Green Capital Network, MedCities network, climate-neutral and smart cities mission 2030, Council of European Municipalities and Regions (CEMR), 100 Resilient Cities, Arctic Cities Council, Global Goals for Cities, Global Covenant of Mayors for Climate and Energy and ICLEI. The number of times such networks were mentioned, as well as their variety, is perhaps testament to the value that cities place on them for collaboration and knowledge exchange.

Several city interviewees also mentioned that inter-municipal collaboration depended greatly on the strength of personal relationships between individuals in different municipalities. The Braga respondent, for example, stated that this was especially important for work between 'technicians' in certain departments, citing the case of regional collaboration on issues of fluvial ecology, including invasive plants and river water and overall quality.

Some city interviewees mentioned the importance of twinned or sister cities for international ties, because of the strength of the long-term bonds that can develop. Inter-city collaboration was seen as important for better understanding of best practice and innovative ideas (e.g. the Zurich authorities looked at city pioneers in recycling policy to inspire them but also to discover what was and was not successful). Examples from other cities were also mentioned as being useful benchmarks when evaluating the success of sustainability interventions. Having a degree of cultural overlap appears to play a role in developing relationships with certain cities. In addition, cities with similar geographies are likely to encounter the same kinds of environmental risks. Reykjavik, for example, emphasised the special collaboration it has with the Nordic countries and its membership of the Arctic Cities Council. The respondent cited the networks the city has with Umeå, Sweden, and Stavanger, Norway, and reflected on how it tried to align its goals with the current achievements of these cities, as they have similar geographies and challenges. Inter-city networking can also foster novel opportunities for funding. The Istanbul respondent, for example, stated that projects that involved collaboration between multiple city partners offered a 'window of opportunity for funding', giving the example of European Bank for Reconstruction and Development financing (EBRD, 2013).

The word 'trust' came up several times in interviews when discussing collaboration. A major barrier to inter-municipal collaboration, although only mentioned in a few interviews, appeared to be political and cultural clashes. The Banská Bystrica respondent gave the example of a lack of cooperation with another municipality 16km away that resulted from divergent political views and lack of a shared vision. This inhibited the amount of inter-city exchange that took place and consequently the amount of regional-level EU funding that could be applied for. The Zurich respondent also mentioned that there is little interaction between the Swiss German and Swiss French counterparts because of political and cultural differences. This was also mentioned by Graz, Marseille and Thessaloniki, where differences in political priorities across municipalities and other issues, such as competition for resources from the region, can lead to a more challenging cooperation environment. At the same time, some cities, such as Braga, Cornellà de Llobregat, Gabrovo and Randers, mentioned that cooperation and knowledge sharing with surrounding municipalities and other cities within their country has been highly productive, either by enabling them to share resources and improve strategic metropolitan planning or by creating a network of like-minded city officials that speak the same language and are embedded in the same governance and cultural context. This enables the efficient sharing of best practices through formal and informal support networks.

If political alignment and shared ideals are a factor that makes collaboration between cities an easier process, issue- and challenge-based cooperation and networking (see Peinhardt and Sandler, 2015) should be encouraged among municipalities. In contexts where neighbouring municipalities have widely divergent policy priorities, it may be particularly important to find ways to compromise and find common ground to work productively together, especially given how many environmental challenges must be tackled at the functional urban area level rather than only within specific jurisdictions. Such efforts can be supported through governance and fiscal reforms that reduce competition between municipalities for scarce resources from regional or national government and are instead incentivised to pursue collaborative and integrated policy efforts.

Level of awareness of environmental sustainability issues

Respondents to the survey stated that issues to do with general levels of awareness around sustainability were among the most important knowledge-related factors that inhibited environmental sustainability transitions.

Interviewees often mentioned that awareness of sustainability issues among the general population is increasing, although they also discussed how this can be a slow process, as issues around housing, employment and education tend to be more pressing. In addition, a number of cities mentioned the issue of 'greenwashing', with citizens and stakeholders purporting to be concerned about sustainability but lacking an in-depth understanding. For Dublin, the example was given of a low awareness of what resilience is and of the

need for systems-level thinking. Many cities emphasised the commitment that has been made to raising the awareness of younger generations, through specific programmes of environmental education in schools.

A few cities also described civil society-level initiatives that involved citizens learning about sustainability through first-hand experience. In Brno, for example, local people are encouraged through community programmes to maintain public greenery, while public eco-grants are available to raise practical awareness of green energy. Two of these programmes are 'Green roofs!' and 'Catch the rain!', which, as of February 2022, had so far helped implement 176 green roofs and 89 rainwater recycling projects in the city (Duka, 2022). Overall, together with a host of other initiatives, the eco-grant programme in Brno is used by over 30,000 citizens annually (Ekodotace, 2022).

Several cities described the public consultation procedures they are running, to ensure that citizen's concerns, from diverse perspectives, are included, while also educating them about environmental issues. Open discussions with the public can play a role in wider efforts to incorporate social issues relevant to citizens in sustainability strategic plans. Developing citizens' knowledge base and their understanding of issues in turn fosters a culture of increased interest in sustainability issues and activism with the potential for generating positive feedback loops. Going beyond public consultation to making citizens partners in the co-creation of solutions to problems allows new knowledge insights as well as collective learning exchanges. For example, Portuguese municipalities' participatory budget programme is a democratic process that allows civil society to decide on public investment in various governmental areas; citizens both present investment proposals and vote on which are to be implemented (OPSI, 2017).

Knowledge gaps in government must be brokered for effective action

A lack of a shared understanding of sustainability within local government was identified from the surveys as being the third most important knowledge-related factor impeding sustainable development.

The interviews also revealed how knowledge gaps between decision-makers can be an impediment to progress. For example, in Banská Bystrica, Slovakia, the interviewee highlighted how innovative green infrastructure used in flood defences on the city's river was not always supported because of an established reliance on grey infrastructure and a lack of knowledge of the use and development of green infrastructure. The Oulu, Finland, respondent stated that trying to achieve inter-departmental coherence was difficult because of a lack of a shared understanding of which actions are complementary. Similarly, the Valmiera respondent mentioned that specialists within their own department know what actions must be taken for their specialist knowledge area, but, at the policymaking level, there is uncertainty about how best to implement sustainability policy in a holistic and integrated way. For Lausanne, projects are sometimes granted funding because the 'language of sustainability' is used correctly, but the details of the project's implementation show that it is not in fact particularly 'sustainable or climate friendly'. This shows how detailed knowledge of sustainability topics within municipal government is required to reduce the risk of 'greenwashing' and convey false information on sustainability credentials.

The survey found that the skills and expertise of those working for the municipality was an issue of moderate importance for sustainability transitions. This was supported by the interview findings, where it was repeatedly stated that most employees had a thorough understanding of terminology but a lack of the technical knowledge and expertise required for the design and implementation of sustainability projects. The Braga respondent described how, within its municipal government, it has only two architects and an engineer available to oversee sustainable construction projects in the city. Both Dublin and Oulu respondents stated that, while data may be made available to local government, such as those involved in producing a city-wide emissions inventory, staff lacked the skills to understand and apply the data. Structural constraints were also described. Short-term policy cycles, as well as individuals moving between departments too frequently, inhibit the development of technocratic governance with a high degree of specialist knowledge.

Policy integration is founded on open knowledge exchange

A lack of knowledge integration may contribute to departmental siloing and consequently inhibited policy integration (e.g. Graz, Larnaka, Tallinn, Thessaloniki, Tromsø). The Thessaloniki respondent described the obstacles to integrating 'scientific fields and knowledge', highlighting how departments desired independence from one other, and stated that strong leadership is required to overcome this (a point also underlined by Gabrovo and Graz). Some city respondents described how employing specialist organisational 'facilitators' could both reduce inter-departmental tension and also facilitate knowledge exchange to improve multilateral competencies. In Braga, for example, tourism, education and other departments were brought together by creating a specialist collaboration group around the topic of Blue Flag beaches (FEE, 2022). The setting out of a unified strategic plan and vision for the city was also identified by city respondents, most notably Tallinn, as a way of breaking down departmental silos and integrating the differing perspectives and knowledge areas of various city departments.

The interviews showed that knowledge sharing between different levels of government provided both opportunities and challenges for effective sustainability transitions. Regional collaboration, on topics such as the energy transition or water policy, can improve learning opportunities for municipalities. However, it can also make implementation a slower process.

Considering the amount of vertical integration desirable between a municipality and larger regional authorities, a trade-off for municipalities appears to exist between the opportunities for knowledge exchange and an increase in bureaucracy and the time taken to make decisions.

Box 3.8 How COVID-19 affected knowledge drivers and barriers

Last year's report (EEA, 2021a) highlighted a number of actions that existing city networks were implementing to respond to the global pandemic. For example, the C40 Global Mayors COVID-19 Recovery Task Force published an 'agenda for a green and just recovery'. However, while the current survey saw some increase in importance following the pandemic for city networks and peer-to-peer learning, with an additional 3 out of 57 responses, there was minimal discussion of this topic in the interviews. Zurich, which did discuss the topic in an interview, viewed the pandemic as limiting the learning opportunities from international city networks, in part because study tours to learn first-hand about new innovations were not possible.

It was also forecast that the pandemic's emphasis on the importance of accurate knowledge dissemination would provide opportunities for cities to foster positive behavioural change in relation to other systemic crises such as climate change. Indeed, the interviews revealed that the attitude to science and data had generally become more positive because of the pandemic. The Dublin respondent stated that people could draw on the complexities and uncertainties around COVID-19 to better understand those that exist around climate change, while the Tallinn respondent suggested that, since adaptation to climate change is largely linked to risk prevention and mitigation, lessons could be learned from the pandemic about how to better manage the environment-related threats that cities face.

Understandably, the impact of the pandemic engendered both opportunities and challenges for communication and the dissemination of knowledge. On the one hand, the impact of lockdowns and the necessity of onscreen communication may have meant that there was not the kind of engagement between policymakers necessary to make bold decisions about sustainability or to collaborate in as an effective manner. The Dublin respondent, for example, stated that it became 'harder to build trust' and 'communicate openly about something as ambitious and complex as the climate action plan'. Examples were given of less participation in meetings between local authorities and members of the public, because of unfamiliarity with digital telecommunications, making it harder to reach citizens. However, for other cities the reverse was true. The Reykjavik respondent, among others, stated that digitalisation offered the opportunity for people to participate in sustainability issues who might not otherwise have done so, including younger generations. Opportunities for educational knowledge may also have increased: the respondent for Horst aan de Maas, for example, highlighted the number of webinars that were made available for both the municipality and the local population to learn from.

3.4 Culture

Summary of findings — culture

- The two cultural factors most frequently cited as supporting environmental sustainability transitions were 'willingness by local government to adopt new behaviours and practices' and 'values and attitudes towards environmental sustainability within local government'. The most frequently cited cultural factors inhibiting environmental sustainability transitions were 'willingness by the general public to adopt new behaviours and practices' and 'level of public engagement'.
- These findings suggest that respondents think that local government is a more significant enabler of change than the public and that the most prominent barriers to positive change lie within the culture of the public administration. However, the survey findings also suggested that the public is generally more positive about environmental sustainability since the pandemic.
- Environmental attitudes within local government have seen a marked change, or 'cultural shift', in recent years and post pandemic and this was evidenced in a variety of different ways by several different cities, but it was generally an enabling factor for environmental sustainability transitions.
- Public engagement in sustainability issues is also increasing in cities across Europe, and it is notably young people who are leading the way. This was routinely discussed in the context of student-led protests, as well as the influence of Greta Thunberg and the Fridays for Future movement.
- Anecdotal evidence from a number of city interviewees supports the survey data that COVID-19 may have had a role in instigating this change. Cities diverged on whether these changes would be long term: a few respondents thought that people would soon return to their old ways, while for several others, COVID-19 represented a window of opportunity through which real change can be driven.
- Within local government, a culture of a lack of long-term responsibility was noted as key challenge for issues that require long-term planning.
- Differences in cultural values between certain demographics or localities of municipalities' populations were also highlighted as a challenge. For example, differences between metropolitan and rural citizens' attitudes were cited, as was the role of political institutional history in determining attitudes to participatory governance and also to consumerism and car use.
- While both limited and anecdotal, certain respondents also discussed the challenges associated with engaging with citizens from poorer socio-economic backgrounds, as well as how having active and engaged citizens is not necessarily conducive to achieving positive change in the realm of environmental sustainability.

For the purposes of this report, culture refers to the shared characteristics, patterns of behaviour, understanding of and attitudes to an issue (e.g. urban environmental sustainability and willingness to adopt new behaviours) of a particular group of people (in urban areas) that are learned through socialisation. A key component of culture is adherence to a set of shared social norms and practices that are either positively or negatively sanctioned (CARLA, 2022).

Culture is an essential part of urban sustainability transitions (EEA, 2019a). Every population's unique composition of its relations between actors, institutions, beliefs and norms results in differing behaviours and attitudes to environmental sustainability. Its importance is reflected in the emphasis on cultural and natural heritage for UN SDG11, Sustainable cities and communities (UN, 2015). Culture is deeply embedded within a society and layered with historical and collective memory. However, it is also continually evolving with the contributions of people with different backgrounds, lifestyles and heritages coming together and engaging with one another. Cities are cultural hotspots because of the density and diversity of their populations. They are therefore fertile grounds for developing innovative solutions to the challenging issues they face.

The current survey showed that the most important cultural factors for supporting environmental sustainability transitions were those to do with the attitudes of local government (see Figure 3.10). 'Willingness by local government to adopt new behaviours and practices' and 'values and attitudes towards environmental sustainability within local government' were the two most frequently cited. These were followed by the equivalent factors for the public. 'Willingness by the general public to adopt new behaviours and practices' and 'level of public engagement' were both the most frequently cited factors inhibiting environmental sustainability transitions (Figure 3.11).

These findings imply that the survey respondents feel that local government is a more significant enabler of change than the public and that the most prominent barriers to positive change lie within the culture of the public administration. However, it is also worth pointing out that the respondents were mostly from local government, so this may simply be a reflection of the survey sample. It may also be that the changes imposed 'from the top' are those that create the resistance itself. This is one reason why it is important to engage with citizens not simply through authorities informing citizens but also by allowing citizens to inform authorities through participatory forms of government (McGlade, 2008).

Nonetheless, 'values and attitudes towards environmental sustainability by the general public' was an inhibiting factor that was cited much less frequently now than before the pandemic (from 18 to 12).

Figure 3.10 Factors related to culture that supported environmental sustainability transitions in cities

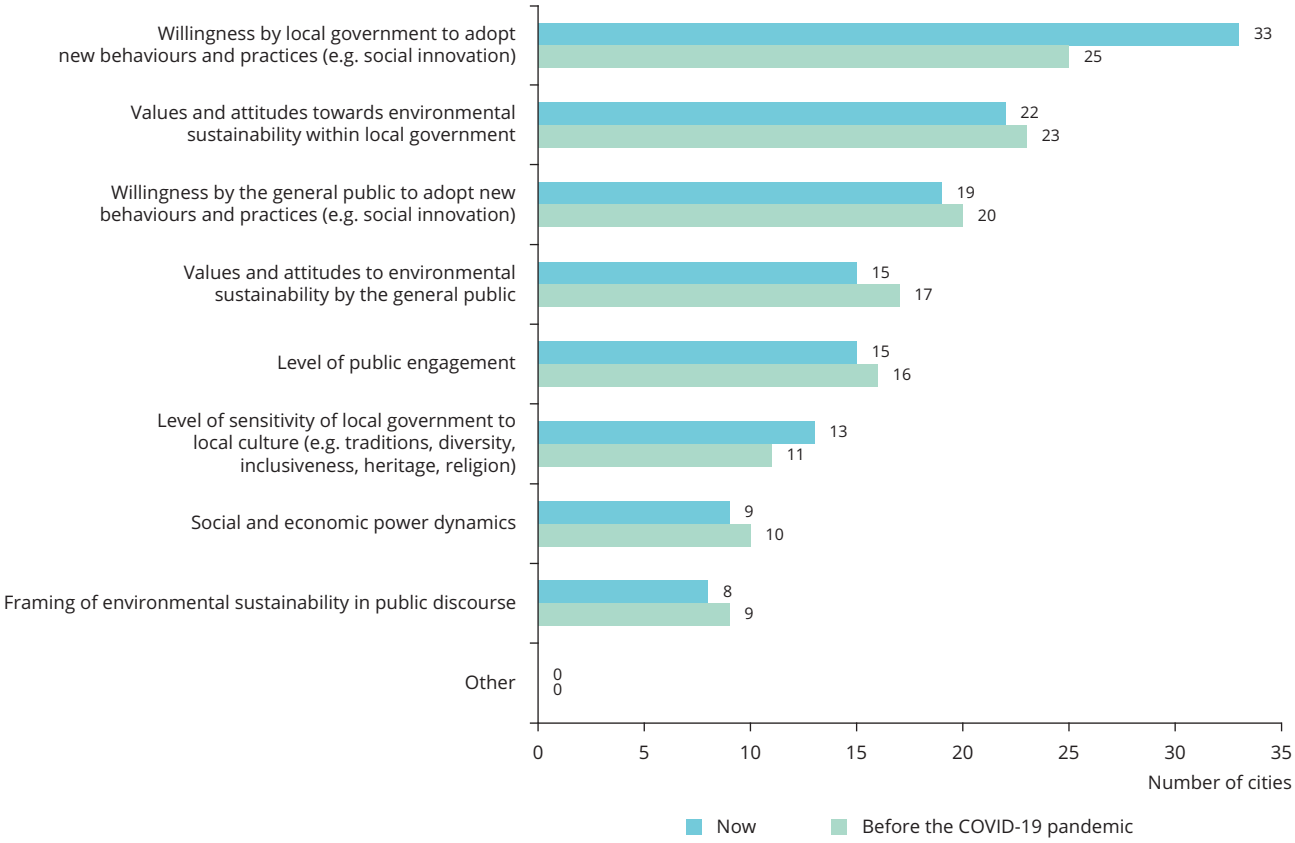
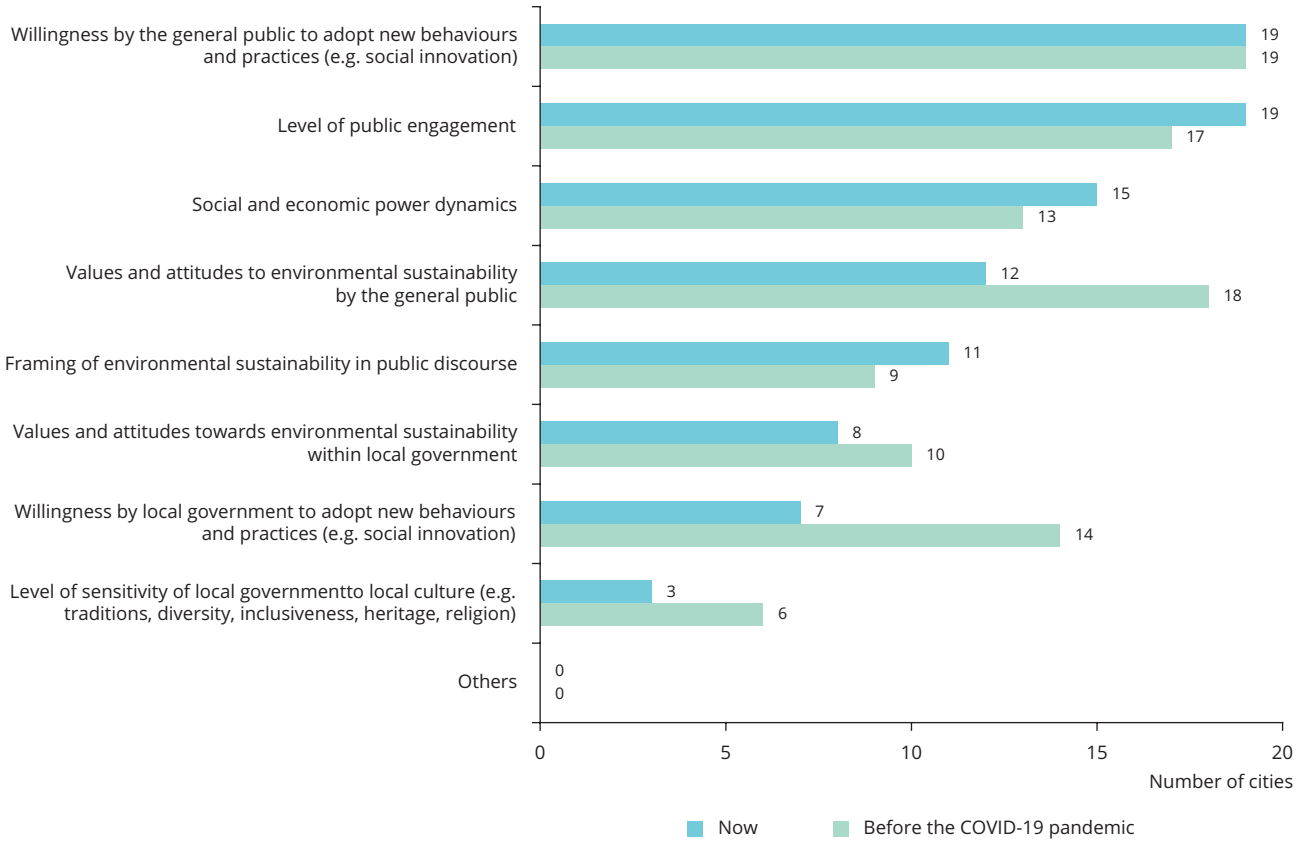


Figure 3.11 Factors related to culture that inhibited environmental sustainability transitions in cities



Local governments are seeing more support for environmental sustainability across departments, but a culture of long-term responsibility is required

The interview results imply that 'willingness by local government to adopt new behaviours and practices' and 'values and attitudes towards environmental sustainability within local government' are demonstrated by a culture in European city authorities that enables environmental sustainability transitions. This may be partly demonstrated by the level of inter-departmental integration to support sustainability policies. As suggested by cities including Gabrovo, Graz and Istanbul, a strong figurehead sets the right tone for a positive cultural attitude to sustainability within a municipal department (see also Section 3.3).

Respondents from the cities of Braga, Glasgow, Lausanne and Reykjavik all specifically referenced a 'cultural shift' or a 'building up' in terms of changes of attitudes within municipal departments. The Glasgow respondent mentioned how inter-departmental collaboration on sustainability was smoother than it has ever been without the need to 'evangelise' to colleagues, while the Reykjavik respondent stated that there were now notions of tying environmental policy to political nationhood, mentioning how there was a desire to 'reclaim nature and country' with undertones of an idyllic pre-industrial past. For Braga, this cultural shift was mainly seen in the desire to involve citizens in participatory governance and to educate them on environmental sustainability issues (see also the impact of digitalisation on e-governance and education in Section 3.5).

However, challenges involving the culture of local government was also a topic of discussion. Respondents from Banská Bystrica and Valmiera highlighted the following as major issues: a culture of being interested in environmental sustainability only as far as policies related to the next election cycle, and a lack of a sense of responsibility for solving long-term issues that require long-term planning. The interviewee from Thessaloniki also stated that public consultation can sometimes be seen as a burden, especially if local political representatives are too distant from citizens. While the points raised in the interviews may be subjective, they reflect on how any country's, or indeed city's, culture might influence a myriad of issues related to environmental sustainability.

European cities are seeing positive shifts in levels of public engagement, with young people leading the fight

While the efforts of municipal authorities to engage with the public on sustainability matters are clearly of great importance, these are only effective if there is a mutual response from citizens themselves. Indeed, 'willingness by the general public to adopt new behaviours and practices',

and 'level of public engagement' were the factors most frequently cited as thought to inhibit environmental sustainability transitions. But the survey also showed that 'level of public engagement' was a factor that increased significantly after the pandemic, and the interviews revealed a picture of very active citizens, in cities across Europe, pressing for further action on environmental sustainability matters. For example, in Lanarka, citizens are 'ready more than ever to welcome new schemes, become more energy efficient', while respondents from Brussels, Gabrovo, Glasgow, Graz, Lausanne, Reykjavik, Tromsø and Zurich all drew attention to the culture of activism and not just interest in, but demand for, change. Pressure on authorities is being applied from a variety of organisations, including small and medium-sized enterprises (SMEs), NGOs and local conservation and neighbourhood groups. However, the key emerging trend from the interviews was demographic in nature, with the young people in European cities leading the charge in environmental activism.

Box 3.9 Young people are the environmental activists of today and the guardians of tomorrow

No demographic was mentioned more than young people in the interviews conducted for this study, with many city respondents mentioning the role that youth movements have played in driving more radical action around the climate especially. The influence of Greta Thunberg was mentioned in four separate interviews (Gabrovo, Reykjavik, Stockholm, Zurich), and activism by young people generally discussed in an additional four (Brussels, Lausanne, Istanbul and Tromsø).

In Lausanne, public demonstrations by students were a 'key turning point' in causing policymakers to become drivers of positive change; in Gabrovo, the youth climate movement was seen as being what shifted decarbonisation from ambition to action; while in Brussels the movement among young people was likened to 'a contagion'. Repeatedly, younger generations were cited as essential to mainstreaming environmental behaviours and accelerating ambitious policymaking. Such attitudes are manifest in movements such as the Fridays for Future climate strikes that have galvanised young people across Europe and the globe into action. The reifying force of young people is seen not only in their catalytic activism but also in their offer of new perspectives. In Tromsø, for example, a new generation of international students of aquaculture have been particularly important in bringing change to the historic Norwegian fishing port and city.

Old habits die hard: urban sustainability transitions are slowed by cultural attitudes resistant to change

While a growing number of urban citizens are concerned about the state of the environment, firmly entrenched cultural values and habits can often lead to contradictions between these new-found aspirations and lived realities. Thus, transitions to sustainability require cultural shifts in behaviour. This requirement can generate anxieties and suspicion within local communities, for example when new living and transport arrangements change how people experience urban life.

Indeed, municipalities witness disparities between certain demographics or localities of their populations. For example, respondents from both Reykjavik and Zurich discussed the differences between urban metropolitan and rural citizens; concern about nature conservation is more prevalent in the highlands of Iceland; and in Zurich, the urban population is seen as more 'progressive and ambitious' in its environmental sustainability attitudes.

History is clearly important when discussing cultural attitudes. This appeared to be particularly important for some of the city respondents in eastern European countries. In Galaţi, the people spent a long time under autocratic rule and are therefore unused to being consulted on matters, with the prevailing mindset being that decisions are to be made only by political leaders. For several cities (Banská Bystrica, Braga, Brussels, Gdańsk, Osijek and Reykjavik), a strong reliance on the use of cars was said to be very difficult to shake. In Gdańsk, this was attributed to the fact that car ownership in the Soviet era was seen as something quite significant. Similarly, the Banská Bystrica respondent related how they were 'a bit behind' when it came to being at all receptive to notions of a post-consumerist attitude. The transition from communism to capitalism brought with it new freedoms as well as the trappings of wealth, as quality of life quickly became correlated with material consumption. While this is of course true for all of Europe, this interviewee appeared to suggest that such a statement may hold especially true in eastern Europe, because of its history. For such a region there is a sense of it being 'too soon' for movements that promote not flying on holiday, and not eating meat or buying a car, to begin to take hold. Somewhat relatedly, the interviewee for Glasgow related how it is important to engage people from poorer socio-economic backgrounds with environmental issues in the right way, as such demographic cohorts will understandably have more immediate matters to attend to. It is true that the prevalent well-being and sustainability discourse is one that is largely emerging in affluent sections of society, and such discourses will not hold true for all. Similar themes of exporting an affluent Western-centric ideology on nature and sustainability to the developing world have been widely discussed (Geisinger, 1999; Fairhead et al., 2012).

Public engagement is a key mechanism for bridging the gap between the community and sustainability issues. In countries where public participation is well established, this does not mean that the participation is necessarily conducive to positive change in the realm of environmental sustainability. The Zurich respondent described how bureaucracy and 'nimbyism' ([12]) gave recourse for a lot of the population to block changes they do not want, while Dublin struggled with the fact that the same people tend to attend public hearings, meaning that diverse voices are not heard. The issue of a more active citizenship blocking changes compounds the need for a centralised and shared vision to be adopted from the outset of a municipality's sustainability transition plans.

Box 3.10 How COVID-19 has affected cultural drivers and barriers

During the pandemic, many people reported an increase in awareness of the connection between human activities and their impacts on the natural world (Rousseau and Deshacht, 2020). In last year's report (EEA, 2021a), we predicted that this would instigate a shift in cultural attitudes to environmental sustainability among the citizens of Europe, and the results of this study appear to bear that out to an extent.

'Values and attitudes towards environmental sustainability by the general public' was judged to be less of a barrier now than pre-pandemic (falling from 18 to 12 responses), while 'willingness by local government to adopt new behaviours and practices' was seen to be a more important driving factor now (rising from 25 to 33 responses). These results suggest that both the public and local government are generally more positive in their attitudes to environmental sustainability since COVID-19. This may be due in part to a greater recognition that we are able to change the way we do things at all levels of society and that these changes can be implemented much faster than perhaps previously assumed, a point made by the Cornellà de LLobregat respondent in particular.

Public engagement is key in bridging the gap between policy supporting behavioural change and environmental outcomes, and several city respondents mentioned how there was some benefit to new forms of virtual engagement when it came to connecting with citizens. However, the interviews also showed that fostering an open culture of exchange was more difficult in some cities where in-person interactions remained restricted. However, cultural attitudes were the area where the most interesting changes were seen. In Istanbul, the pandemic led to a more forward-thinking shift in perception and concern with the future, while, in Braga, citizens realised the importance of collaboration and paused to think about the importance of community and shared responsibility.

The key question that remains is to what extent these reported shifts in cultural attitudes that were instigated by the pandemic will remain. In some cities, such as Galaţi, it was felt likely that people would soon 'return to their old habits'. Despite this, many other cities recognised the window of opportunity for promoting an accelerated transition to more sustainable behaviours in cities. Research shows that major disruptive events are often the most fruitful time to adopt more sustainable habits (Schäfer et al., 2012) and open up space to reflect on what we want our cities and societies to look like in the future. It is therefore important that cities do not lose momentum and continue to support their residents in transitioning to a new and more sustainable 'normal'.

([12]) https://dictionary.cambridge.org/dictionary/english/nimbyism

3.5 Technology

Summary of findings — technology

- **The survey identified that the most important technology-related factors that supported urban environmental sustainability transitions were (in declining order) remote (tele-) working, low-carbon technologies, technologies for environmental monitoring, and information and communications technology. Unsurprisingly, remote (tele-) working was considered much more important now than pre-pandemic (previously cited only six times, compared with 37 times now).**
- **Energy decentralisation will be key in adapting to an unstable future in which the energy supply cannot be as guaranteed. The interviews confirmed that there was increasing recognition that local energy production for specific homes, buildings and businesses is key to urban environmental transitions. Several city respondents mentioned two technologies: photovoltaic solar cells and hydrogen fuel cells.**
- **Technology is revolutionising public infrastructure — smart city solutions include the electrification of public transport systems, goals for emission-free inner-city traffic, increased investment in e-charging stations and intelligent solutions for public lighting — but to be effective such solutions must be supported by appropriate financial and governance systems.**
- **COVID-19 accelerated the digital transformation via remote working, and this might have resulted in some environmental benefits due to, for example, the short-term reduction in public transport and personal car use. It has also created challenges, with some cities stating that participation and engagement in public consultations and meetings declined.**
- **The pandemic has accelerated the shift to digitalisation. Pre-pandemic, digitalisation was being built into the resilience plans of European cities to adapt to future environmental risks. The pandemic accelerated this shift and accelerated wider technological solutions, and arguably the pandemic has therefore made European cities more resilient in the face of the environmental crises to come.**

In this report, technology refers to the various types of products and processes used to facilitate or support changes in practices, processes and behaviours in different forms and areas of technological development, including education, construction, transport, energy, and information and communications.

Digitalisation is at the forefront of technological innovation, transforming the ways that we work, produce and consume goods and services, and socialise. Digital technologies have the potential to support inclusive and sustainable growth by spurring innovation, generating efficiencies and improving services. Because of their generally high population densities, these effects are most pronounced in cities (WEF, 2020b). Technological solutions can help European cities as they seek to transition to cleaner and renewable forms of energy, reduce their carbon footprints and minimise negative impacts on the wider environment. The EU recognises the importance of technological development for environmental sustainability. The European Green Deal states that the 'Commission will support work to unlock the full benefits of the digital transformation to support the ecological transition' (European Commission, 2019).

However, technology can also exacerbate inequalities, both because of its skills-bias nature, which can limit who benefits from the employment created, and because innovators can generate high revenues that are not always passed on to wider society (Newton, 2014). A further concern is that differences in access to certain technologies and the growing digital divide risk excluding vulnerable segments of the population from important aspects of urban life — an issue of particular concern for older generations (Kunonga et al., 2021). At the same time, there are also important environmental implications that need to be weighed up carefully to ensure that new technologies are truly driving transformative change away from a reliance on the excessive resource consumption that will be needed to confront the climate and ecological emergency. Smart, digitally enabled cities have tremendous potential to improve people's quality of life while optimising energy use and reducing emissions. However, the infrastructure and technology that enables them often relies on high material inputs, can itself consume a lot of energy and generates hard-to-recycle waste (Hossain et al., 2015). The COVID-19 pandemic in many ways accelerated the digital transition, creating both challenges and opportunities for European cities, but ultimately demonstrating that technology,

and digital technology in particular, has a key role to play in enhancing resilience, provided it is deployed in a way that considers the implications for both equity and sustainability.

The survey found that the most important factors related to technology that supported urban environmental sustainability transitions were (in declining order) remote (tele-) working, low-carbon technologies, technologies for environmental monitoring, and information and communications technology (see Figure 3.12). Remote (tele-) working, was cited as being important six times pre-pandemic and 37 times when the current survey was run. The survey also found that the most important technology-related factors that inhibited urban environmental sustainability transitions included online retail and e-commerce, e-governance and big data analytics (see Figure 3.13). However, these factors were not cited as being as important as the supporting factors were, being cited as important 'now' just 11, 10 and 10 times, respectively.

Figure 3.12 Factors related to technology that supported environmental sustainability transitions in cities

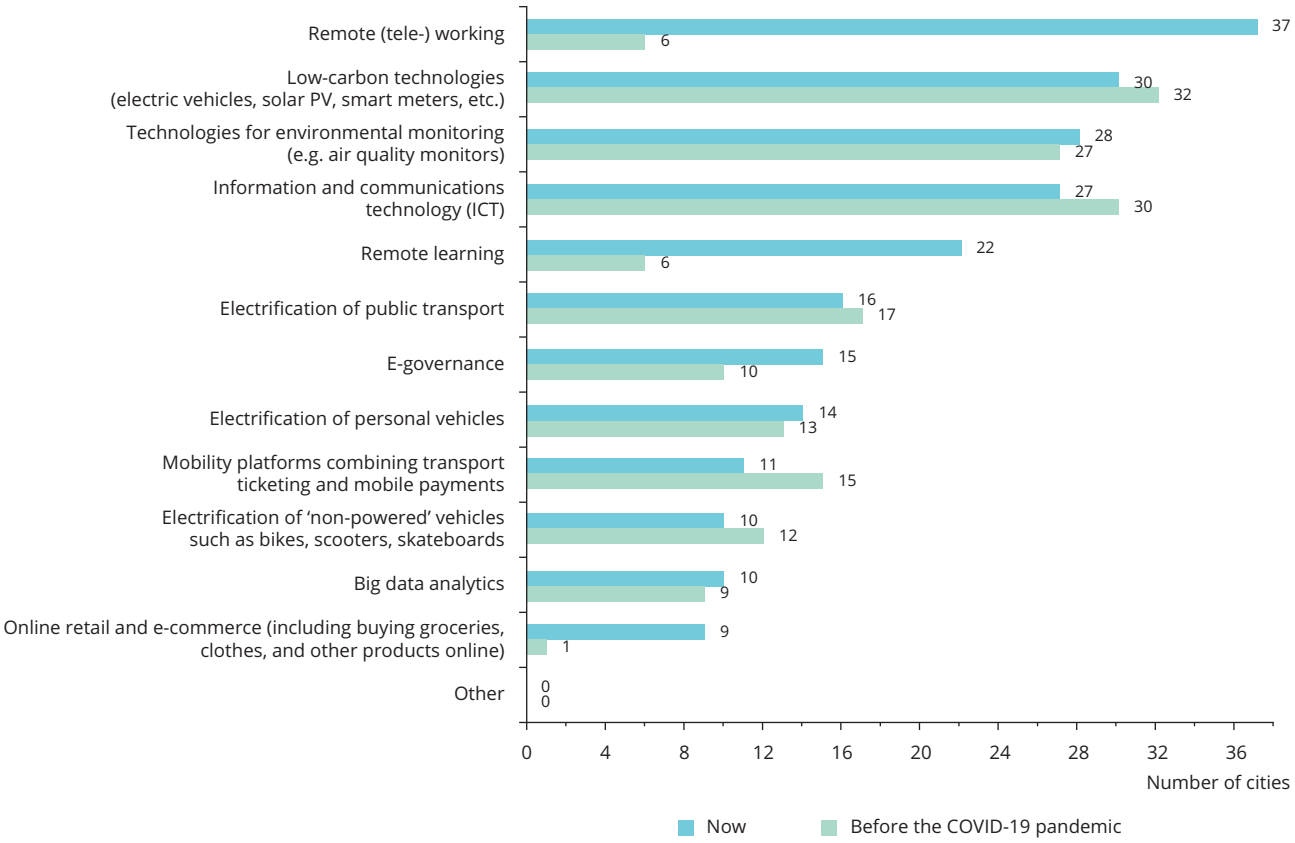
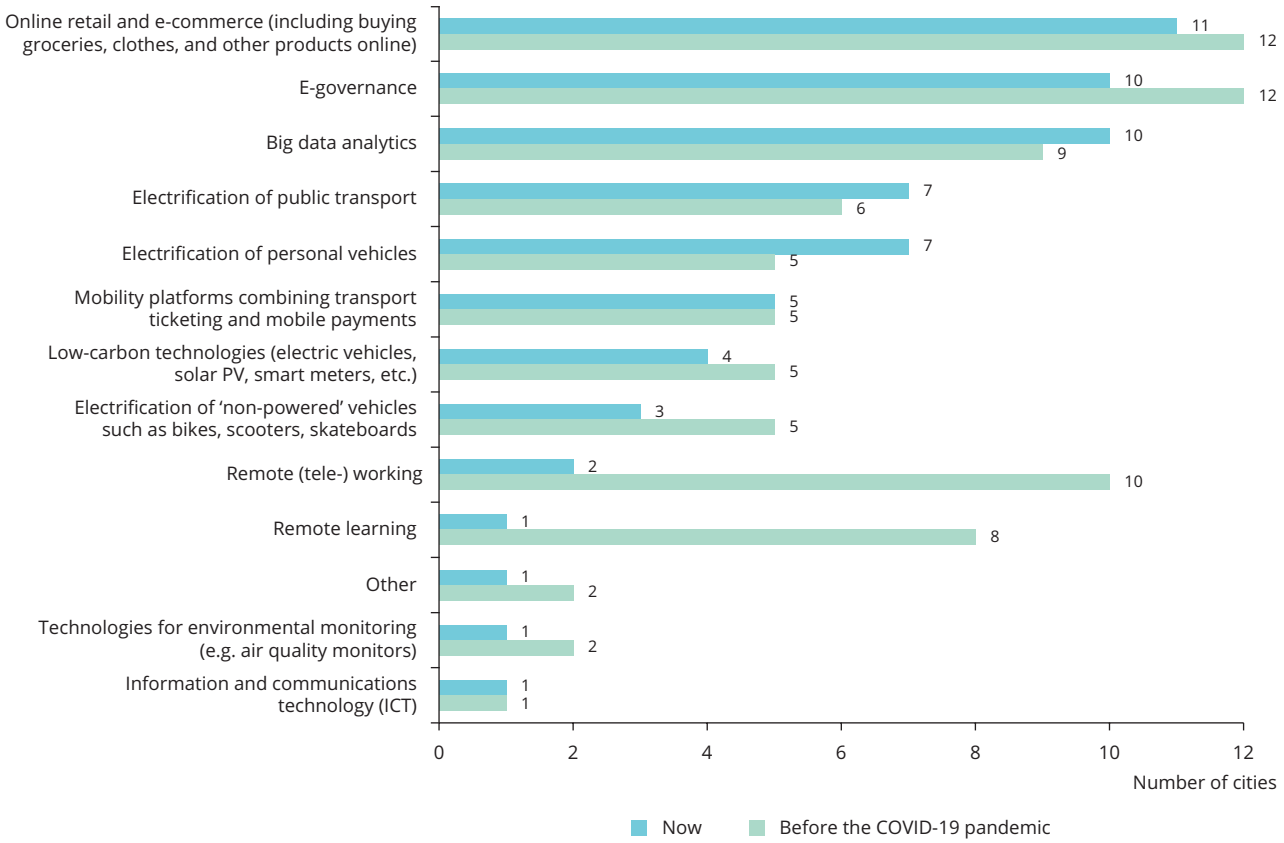


Figure 3.13 Factors related to technology that inhibited environmental sustainability transitions in cities



Energy independence and post-industrial digitalisation are key trends for European cities

Low-carbon technologies were the second most frequently cited technology-related factor for supporting environmental sustainability transitions in the survey. The interviews confirmed that there was increasing recognition that local energy production for specific homes, buildings and businesses is key to urban environmental transitions. Two technologies that were discussed several times were photovoltaic solar cells and hydrogen fuel cells. As well as municipalities making wholescale energy efficiency transformations to public buildings, respondent also said that decentralisation will be key in adapting to an unstable future in which energy supplies may be more unpredictable. Municipalities are key enablers of this democratisation of green technology; eco-grants are increasingly being made available to fund citizens and businesses to install green photovoltaic roofs and other technologies allowing energy independence. As well as supplying funding, some cities, such as Graz, have initiated low-carbon standards for new building stock, although challenges remain in making changes to the existing building stock, especially if privately owned. This was an issue highlighted for the city of Gdańsk, in which 40% of buildings were built before 1970.

Former industrial heartlands are also being converted into 'green hubs'. Gabrovo's regional innovation centre, 'Ambitious Gabrovo', for example, helps SMEs initiate smart manufacturing through mechatronics and digital technologies. The post-industrialisation phenomenon is exemplified by the city of Glasgow, host of the 2021 global COP26 summit. The interviewee explained that, along with other European cities such as Dortmund and Essen in Germany, Glasgow has undergone profound industrial losses: a century ago it produced one quarter of the world's locomotives, but is now transforming itself from being an iron- and coal-fuelled powerhouse to a centre of low-carbon clean technology and industry. As ever, geographical context is important: the Reykjavik respondent explained that its major carbon transition happened over 50 years ago, as its geothermal bedrock allows both the heating of homes and cleaner energy production.

Box 3.11 Mapping the most efficient solar panel and bio-roof locations in Braga, Portugal

The municipality of Braga recently initiated a new programme funded through the Horizon 2020 European City Facility (EUCF). The aim of the EUCF is to unlock the potential of local authorities to drive the energy transition by providing them with tailor-made, fast and simplified financial support to help them build a case for large sustainable energy investment projects. Better data collection and analysis plays a central role in supporting these efforts across Europe. In the case of Braga, the EUCF funding will support a feasibility study for the installation of photovoltaic panels associated with green rooftops in various economic and special-use zones in Braga.

To advance this integrated solution the municipality is using remote sensing technology to collect and process aerial image data that will be combined with investment simulations to identify the areas with the greatest potential for photovoltaic energy generation and calculate the return on investment and the potential to integrate photovoltaic panels with a 'bio-roof'. After creating a solar map that will identify the most suitable buildings (considering factors such as roof inclination, orientation and shading by other buildings) Braga will make this information available on an intuitive and easy-to-access platform, allowing building owners to make more informed decisions about potential investments. The municipality expects that this project will increase Braga's solar generation capacity by 160GWh/year and reduce CO_2 emissions by approximately 35,524 tonnes of CO_2 equivalent every year.

Source: European City Facility, 2022.

Technology is revolutionising public infrastructure but must be supported financially and with sound governance structures

In the realm of public infrastructure, smart city solutions include the electrification of public transport systems, goals for emission-free inner-city traffic by 2030, increased investment in e-charging stations and intelligent solutions for public lighting. Mobility transitions are relying increasingly on informative real-time data, exemplified by systems such as MaaS (mobility as a service), and municipal collaboration with the digital sectors is therefore crucial. The phenomenon of e-scooters, which at point of use are emission free, is one that has swept across Europe, although, perhaps unsurprisingly, they were also mentioned as a social issue because of people using them on roads and pavements. Waste management is an area in which technological innovations, including data analytics and waste-processing technologies, are allowing increased recycling performance. Horst aan de Maas, in the Netherlands, now has 75% less unrecyclable waste per capita compared with the rest of the Netherlands, thanks to a concerted effort by the municipality to tackle this persistent issue.

To be effective however, technology relies on the wider governance and financial systems that can implement and support it, a theme echoed by respondents from Glasgow, Reykjavik and Zurich. As recognised in Glasgow, technological solutions to the crises we face abound; the issue is finding the resources to implement them. In addition, technologies can fail, and they require frequent monitoring and upgrades and support from a skilled workforce (see also Section 3.3, Knowledge). The city of Braga gave the example of air quality monitors during the pandemic: following increased scrutiny of their readings, many were found to be faulty, resulting in the realisation that data sets sent to the EU for years may have been inaccurate.

COVID-19 has accelerated the digital transition, presenting both challenges and opportunities for sustainability

The interviews confirmed the key finding from the survey — that COVID-19 has accelerated the digital transformation via remote and more flexible working and that this had led to environmental benefits. These were discussed, in particular, by respondents from Thessaloniki, Tallinn and Horst aan de Maas. The clearest reason for this is the short-term reduction in public transport and personal car use, although it is worth noting that data suggest that car use has mostly returned to pre-pandemic levels in European cities (TomTom, 2022). Another benefit cited was that it has resulted in cost savings, which has made finance available to fund other sustainability projects. However, while this was the most frequently cited technology-related factor, it is pertinent to remember that cities could choose from multiple options and that this does not make it 'the most powerful' driver. Indeed, the Graz respondent made the point that, in the wider context, remote working will make a small contribution to reducing transport emissions, and there will also be rebound effects, as people return to offices or take other car-based leisure trips. In addition, online literacy is not evenly distributed across generations, and this could lead to a generational divide in capacities and access to new digital opportunities.

While 'online retail and e-commerce' was the most frequently cited technology-related factor hindering urban sustainability transitions, because of the increased transport emissions associated with it, this was an issue discussed just once in the interviews. City respondents mostly felt that this was an area that was largely beyond their immediate control, given that urban freight and logistics tend to be dominated by the private sector. They also acknowledged the importance and

difficulty of tackling unsustainable consumption patterns (Braga, Stockholm) that may be further exacerbated through the proliferation of online retail.

Several city respondents also stated that the pandemic had accelerated wider technological solutions: new systems and applications were developed to deal with the changes that the crisis brought on (Lanarka), while technical solutions may already have been available, but it was only the crisis that enforced their use (Reykjavik).

Often within the same context, cities also frequently mentioned the impact of the pandemic on the digitalisation of public services, and e-governance more generally, was frequently mentioned (cited as the second most important factor potentially inhibiting sustainability transitions). Digitalisation has meant that more people are able to participate online in discussions, increasing engagement from wider sections of society. However, participation may also be negatively affected. On the other hand, the Gabrovo respondent mentioned that the city's development plan had drawn on input from focus groups, but moving these online because of the pandemic had meant that interactivity was reduced. This meant that the municipality was forced to take the lead on decisions once more. Likewise, Horst aan de Maas and Valmiera were forced to terminate some of their programmes involving citizens because of participation issues.

Box 3.12 How COVID-19 has affected technological drivers and barriers

Technology, in particular information and communications technology (ICT), has played an important role in alleviating the unprecedented social and economic implications of COVID-19, by enabling online education, working from home and home deliveries. Tele-working meant that transport emissions were reduced, and that trend has continued to some extent post pandemic, although it remains to be seen for how long. ICT can enable greater participation in discussions around urban sustainability issues from wider sections of society but may also reduce the quality of engagement, as well as alienating certain demographics with poor computer literacy or limited access to high-speed internet connections. Digitalisation must therefore be integrated in a way that does not undermine wider sustainability objectives, ensuring that social inclusion does not suffer as a result.

Technological development is generally seen as an important driver of sustainability transitions, and important EU policy frameworks such as the European Green Deal are rightly placing significant emphasis on the digital agenda. Technology is proving crucial in the realms of low-carbon construction, industry and energy production, as well as supporting improvements in mobility and transport infrastructure. Nonetheless, the pandemic's major impact on technological development has been an increased reliance on the digitalisation of services. Interview responses revealed that some cities saw COVID-19 as 'a crisis in miniature' of the pressing environmental crises they face. Pre-pandemic, digitalisation was being built into the resilience plans of European cities to adapt to future environmental risks. The pandemic accelerated this shift and, arguably, the pandemic has therefore made European cities more resilient in the face of the environmental crises to come.

3.6 Data and information

Summary of findings — data and information

- **Cities are transitioning to data- and evidence-based policymaking and decision-making practices; therefore, good (i.e. accessible, robust, reliable, relevant, comparable, compatible, at the right scale) data and information is becoming increasingly important for urban sustainability transitions. To support their environmental agendas, cities across Europe are cooperating with universities and agencies to develop and manage data platforms that can be used in evidence-based policymaking and planning, and for knowledge sharing and cooperation among stakeholders.**
- **Particularly since (and in response to) the COVID-19 pandemic, many cities reported that their data and information systems have been enhanced. However, cities still struggle with using (e.g. acquiring, organising, storing, managing) large volumes of data and information in a way that would help them to better plan and monitor the outcomes of their environmental and sustainability efforts. They have to deal with challenges such as lack of appropriate technologies and skills, as well as insufficient (financial and human) resources to support the running of data platforms.**
- **To encourage positive behavioural change in the context of urban sustainability transitions, it is essential for citizens to understand why more radical action to transform urban life is urgently needed. With people being exposed to a flood of very complex epidemiological data, including statistical models and probabilities, the COVID-19 pandemic has created a window of opportunity for cities to improve their public communication practices when addressing other systemic challenges, including climate and environmental issues.**

Data and information can provide city planners with the insights they need to effectively plan future development. They enable the identification of environmental and socio-economic risks, and help cities to assess both the impact of past interventions and the benefits and drawbacks of future actions. The United Nations has identified data as an opportunity for agile, efficient and evidence-based decision-making (UN, 2022). Nevertheless, there is significant need for investment in 'data infrastructure' before its full potential benefits can be realised and applied in the context of urban sustainability (Kharrazi et al., 2016). Cities also need to develop the capacity to effectively collect and interpret data to maximise the benefits and mitigate any risks. The survey explored the existing opportunities and barriers related to the use of data and information for urban sustainability and its future implications.

For the purpose of this report, data refers to raw, unorganised facts in various forms (e.g. big data, open data) on relevant issues, whereas information is processed, organised and/or structured data made useful for developing knowledge on a subject, issue, event or process relevant to achieving sustainability transitions (GCU et al., 2022).

Good data and information is gaining importance

The current survey results demonstrated that several factors related to data and information were relevant in supporting cities in their environmental sustainability transition both before and after the COVID-19 pandemic (see Figure 3.14). 'Data and information sharing practices', 'data and information collection practices' and 'the accessibility of data and information' were the factors most frequently selected as supporting. However, as implied by the results of the current survey, these factors now seem to be more important than they were before the COVID-19 pandemic. In the interviews several city respondents stressed the importance of data in understanding the complex challenges they are facing. This is essential to help them create better policies and track progress against their goals. It also enables cities to communicate in new, more data-driven ways, with residents. The respondent from Dublin, for example, mentioned that the public is more engaged with science and generally more data literate following the COVID-19 pandemic.

Figure 3.14 Factors related to data and information that supported environmental sustainability transitions in cities

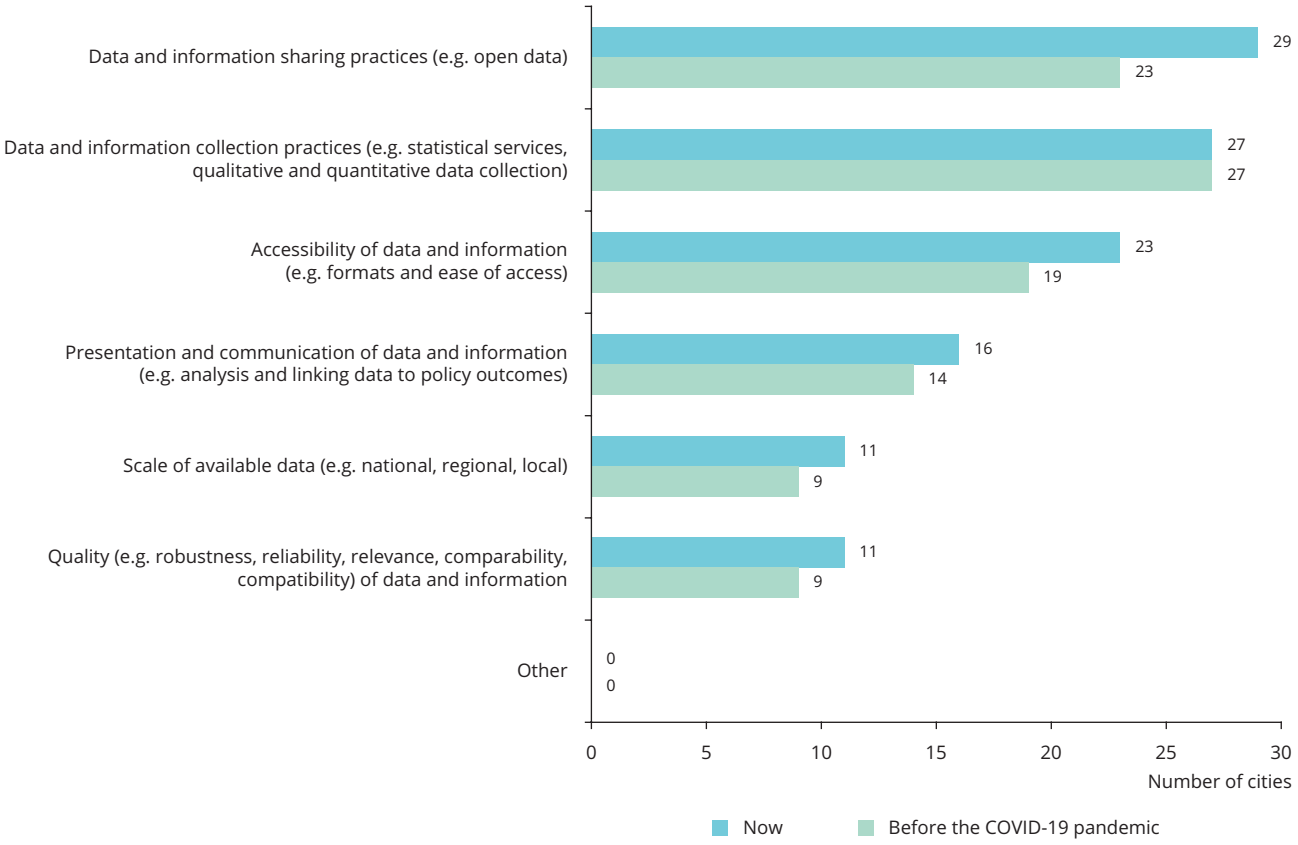
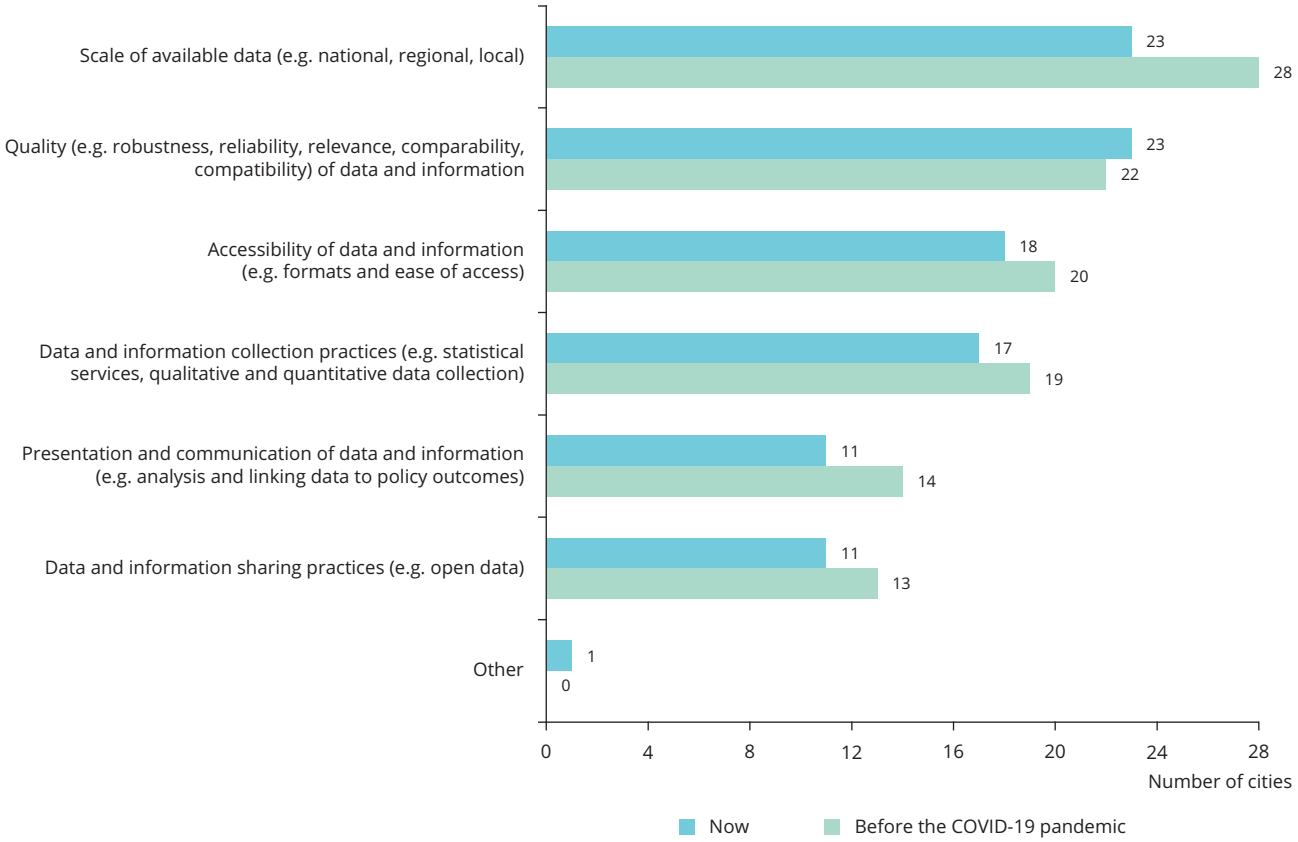


Figure 3.15 Factors related to data and information that inhibited environmental sustainability transitions in cities



Cities are transitioning to data- and evidence-based policymaking and decision-making practices

The interviews revealed that data analytics is gaining importance in cities' policymaking and decision-making practices, and it seems that the amount of data collected on a local level (e.g. air and water quality, traffic monitoring, energy efficiency evaluation) is increasing. Glasgow, for example, is working alongside academic institutions (University of Glasgow) to understand how the data held and generated by cities can be used in the most efficient way to support evidence-based policymaking. Similarly, Lausanne is cooperating with universities to create databases to support its sustainability transitions. Istanbul and Randers use data- and information-sharing spaces to develop their sustainability plans and actions.

Box 3.13 Randers' climate action plan receives a boost by joining the Danish information-sharing platform initiative DK2020

In May 2021, Randers City Council's climate plan was approved, and the city (along with many other municipalities in Denmark) joined the DK2020 initiative, aiming to accelerate climate change adaptation and mitigation efforts (C40 Cities, 2021). DK2020 acts as a platform for sharing information and best practices between cities. Using a standardised method and a set of indicators developed by C40 Cities to support municipalities to meet the commitments of the Paris Agreement, the platform supports the development and implementation of cities' own tailored climate action plans (KL, 2022). By signing up, cities commit to reducing their emissions by 70% by 2030 and becoming climate neutral by 2050. Randers' climate action plan incorporates 40 separate initiatives, many of which are inspired and supported by networking and information exchange through DK2020. These include the restoration of 3,000ha of forest by 2030, the expansion of the electric charging infrastructure and the full transition to renewable energy.

The Danish Union for Municipalities is also working on a unified data programme to support all cities with their climate strategies. According to the interviewee from Randers, networking through the DK2020 initiative enables municipal staff to reach out to and engage with colleagues in another municipality through a shared Microsoft Teams forum. Peer-to-peer learning, which is a key aim of DK2020, also reflects the decentralised nature of the Danish governance systems more generally. The national government and the EU set certain regulatory frameworks (e.g. national laws and directives), but the way these are implemented is decided by the municipalities.

Box 3.14 The Istanbul Planning Agency: towards a 'fair, green, creative and happy' Istanbul through scientific coordination

The case of Istanbul demonstrates the key role of publicly available data and information to allow effective collaboration and multilateral participation (see also Section 3.3, Knowledge). The Istanbul Planning Agency (IPA), established in early 2020, produces accurate and up-to-date data and information on Istanbul that can be used to develop social policy models to improve the lives of its citizens. The models are linked to the city's sustainability and climate agendas. The Agency supports information and knowledge sharing between diverse sets of stakeholders. Going beyond mere data collection, it also provides a space to encourage more participatory planning and design of the city, all with the aim of realising Istanbul's ambitious Vision 2050 — to make the city 'fairer, greener, more creative and happy'.

The IPA has been described as a 'collective mind' for the city. Key stakeholders including non-governmental organisations, academia, the private sector, international organisations and planning agencies are encouraged to collaborate and take action based on the outcomes of the IPA's research and analysis. The IPA's research results have highlighted important socio-ecological challenges that need addressing. For example, in 2020, the IPA reported that 70% of Istanbul's population lived in earthquake-vulnerable zones. The report also concluded that 25% of the city's agricultural land has been lost in the past 25 years, while almost 100km^2 of forest has been lost to large infrastructure projects. It further revealed that 40% of Istanbul's 690km coastline remains inaccessible to the public.

The IPA also opened a special socio-political office to observe and advise on the socio-economic effects of the COVID-19 pandemic. In this capacity, the office successfully mapped the vulnerability of households that asked for social support during COVID-19.

Sources: IPA, 2021; Vision 2050, 2022.

Data and information systems are improving

Among the current survey respondents, scale of available data (e.g. national, regional, local) and the quality (e.g. robustness, reliability, relevance, comparability, compatibility) of data and information were identified as the most significant barriers to sustainability transitions. Cities reported that these barriers were generally greater before the COVID-19 pandemic, which indicates that the pandemic may have contributed to better data and information systems. Especially in the case of scale of available data (e.g. national, regional, local) the situation seems to be improving (see Figure 3.15).

While it seems to be improving, data quality remains a challenge for cities when they try to identify their most acute sustainability challenges and monitor their progress towards sustainability targets. The interviewees from Derry and Dublin stated that poor data quality is making the development of climate action plans and monitoring progress against their objectives quite difficult. For example, data gaps and challenges related to calculating consumption-based emissions (e.g. methods used, data availability, comparability) create difficulties in terms of developing actions to address these in climate action plans, and in monitoring the cities' progress against these actions. Furthermore, even when data might be available, assessing cities' environmental performance is hindered by lack of appropriately skilled staff and budget constraints.

Cities also have technological challenges related to data storage and organisation. For example, an interviewee from Lausanne mentioned that they do not have a professional database to store the data they receive. This lack of data centralisation is hindering data availability for decision-making and knowledge sharing purposes. The Braga respondent also emphasised challenges such as the city's limited capacity to deal with large data volumes and new data collection methods. These challenges were exemplified in the city's malfunctioning air quality monitors, resulting in it unintentionally reporting false data to the EU.

Box 3.15 How COVID-19 has affected data and information drivers and barriers

To encourage positive behavioural change in the context of urban sustainability transitions, it is essential for citizens to understand why more radical action to transform urban life is urgently needed.

The COVID-19 pandemic has highlighted the importance of clearly presenting and communicating data and information to the public. It has created a window of opportunity for cities to improve their public communication practices when addressing other systemic challenges, including climate and environmental issues.

People have been exposed to a flood of very complex epidemiological data, including statistical models and probabilities. This may have led to an overall 'upskilling' of the general public's ability to understand and interpret complex information.

More accessible, available and regularly updated digital data and information and greater interest in what influences the health and well-being of city dwellers (e.g. lifestyle choices, habits, socio-economic conditions, education) may inform the timely assessment of how different policy interventions affect urban sustainability transitions.

3.7 Finance

Summary of findings — finance

- The survey revealed variability in whether particular finance factors are considered a driver or a barrier to sustainability transitions, and it also highlighted that some of these views changed between the pre-pandemic period and now.
- Access to multilateral funding through the EU continues to be fundamental but does require very specific capacities. Many of the substantial investments required to develop more sustainable infrastructure exceed what cities can finance through their own budgets and will therefore rely on support from national and supranational governments as well as public-private partnerships.
- Recovery tools such as NextGenerationEU are clearly important, but access to these funds is at times complicated by excessive bureaucracy and a lack of agency in sub-national governments to determine spending priorities.
- Despite this, 'level of multilateral EU funding' was selected the most frequently as an important supporting factor in the survey and was also judged to be slightly more important now than pre-pandemic (32 versus 29 responses). The other most frequently cited supporting factors were 'level of funding for infrastructure projects', 'level of national/state government public funding for environmental sustainability' and 'level of own source revenue (e.g. local taxes, fees, charges)'.
- Overall, 'level of fiscal decentralisation' was cited as the most important inhibiting factor in the survey and this theme also emerged repeatedly in the interviews where city respondents emphasised that insufficient fiscal autonomy can be a barrier. 'Level of funding for infrastructure projects' and 'level of own source revenue' were cited frequently as both supporting and inhibiting factors.
- The interviews highlighted that wealth matters to an extent but that it can also be a double-edged sword, given that Europe as a whole has not managed to decouple gross domestic product from resource consumption and carbon emissions and that wealthier economies (and wealthier individuals) continue to have an outsized environmental footprint.
- Partnerships with the private sector can help cities to scale up innovative solutions but need to be carefully planned and managed to ensure that cities remain the problem owners and that such investments are aligned with the wider sustainability vision of the city.
- Cities are rethinking how they allocate budgets to remove perverse financial incentives and support the transition. Significant finance continues to support 'business-as-usual' urban infrastructure projects rather than supporting the green transition, although this is slowly starting to change.
- On the whole, COVID-19 has had a significant impact on local government finances, although it appears that this has not had a large negative effect on the budget cities have available for environmental sustainability initiatives. Some city respondents suggested that environment and climate budgets and related investments had actually increased.

The EEA's state of the environment report *The European environment — state and outlook 2020* (SOER 2020) emphasises the key role that finance has to play in either enabling or hindering sustainability transitions (EEA, 2019a), and funding and budgetary allocations remain one of the most significant ways for governments to transform cities. However, the COVID-19 pandemic has imposed a considerable strain on local government finances. A simultaneous rise in expenditure on public health, social services, social benefits and support for businesses, workers and citizens was accompanied by decreased revenue from reduced economic activity, as well as tax relief and deferment. This phenomenon has been referred to as the 'scissor effect' and, while most cities across Europe have had to grapple with it to some extent, the impact has been unevenly distributed depending on local funding structures and the severity of the crisis in different parts of the continent (CoR, 2021).

For the purposes of this report, finance refers to the provision and management of public or government money and the process of acquiring funds through traditional (e.g. taxes, public-private partnerships) and innovative (e.g. micro-contributions or crowdfunding, land value capture) financial mechanisms to support green investments and the transition to urban environmental sustainability. Note that financing typically refers to how the upfront costs of building infrastructure, etc., are met, while funding refers to how it is paid for over its life cycle (Institute for Governance, 2018).

The survey revealed some clear differences in the factors related to finance that either support or inhibit the sustainability transition in cities. It also showed that the importance of some factors has changed quite a bit between the pre-pandemic period and now. There were also several factors with highly divided responses (considered supporting by some and inhibiting my others), highlighting the diversity of models of finance and funding structures that exist across Europe. 'Level of funding for infrastructure projects' and 'level of own source revenue' were selected frequently as both supporting and inhibiting factors (Figures 3.16 and 3.17), with the former highlighting a divide when it comes to whether cities feel that infrastructure is receiving sufficient investment and the latter hinting at divergent levels of fiscal decentralisation across European cities.

Perhaps unsurprisingly, 'level of multilateral EU funding' was selected as the most important supporting factor and was also judged to be more important now than pre-pandemic (32 versus 29 responses). The importance of EU recovery funding will be discussed in more detail below, given that it was also an important theme emerging from the interviews. The other factors selected most frequently in terms of being supportive included 'level of funding for infrastructure projects (both private and public sources)', 'level of national/state government public funding for environmental sustainability', and 'level of own source revenue (e.g. local taxes, fees, charges)'. All these factors were also assessed as strongly supporting the sustainability transition in the previous survey. One area where respondents felt that there had been a shift since the pandemic was around the 'level of public investment in research and development' (8 versus 12 responses). This corresponds with the interview results in which several respondents highlighted the importance of the public sector embracing new ways of problem solving and innovation.

The financial factors considered a barrier (most inhibiting) by the highest number of cities in the survey included 'level of fiscal decentralisation', 'level of own source revenues', and 'level of funding for public service operations and maintenance'**.** The 'level of private sector funding for environmental sustainability' was considered less inhibiting now than before the pandemic (16 versus 12 responses), suggesting that there may have been a shift in investment priorities since COVID-19, although the changing legislative and political context in response to the climate emergency and incentives from the EU as part of the European Green Deal may also be behind this change.

Figure 3.16 Factors related to finance that supported environmental sustainability transitions in cities

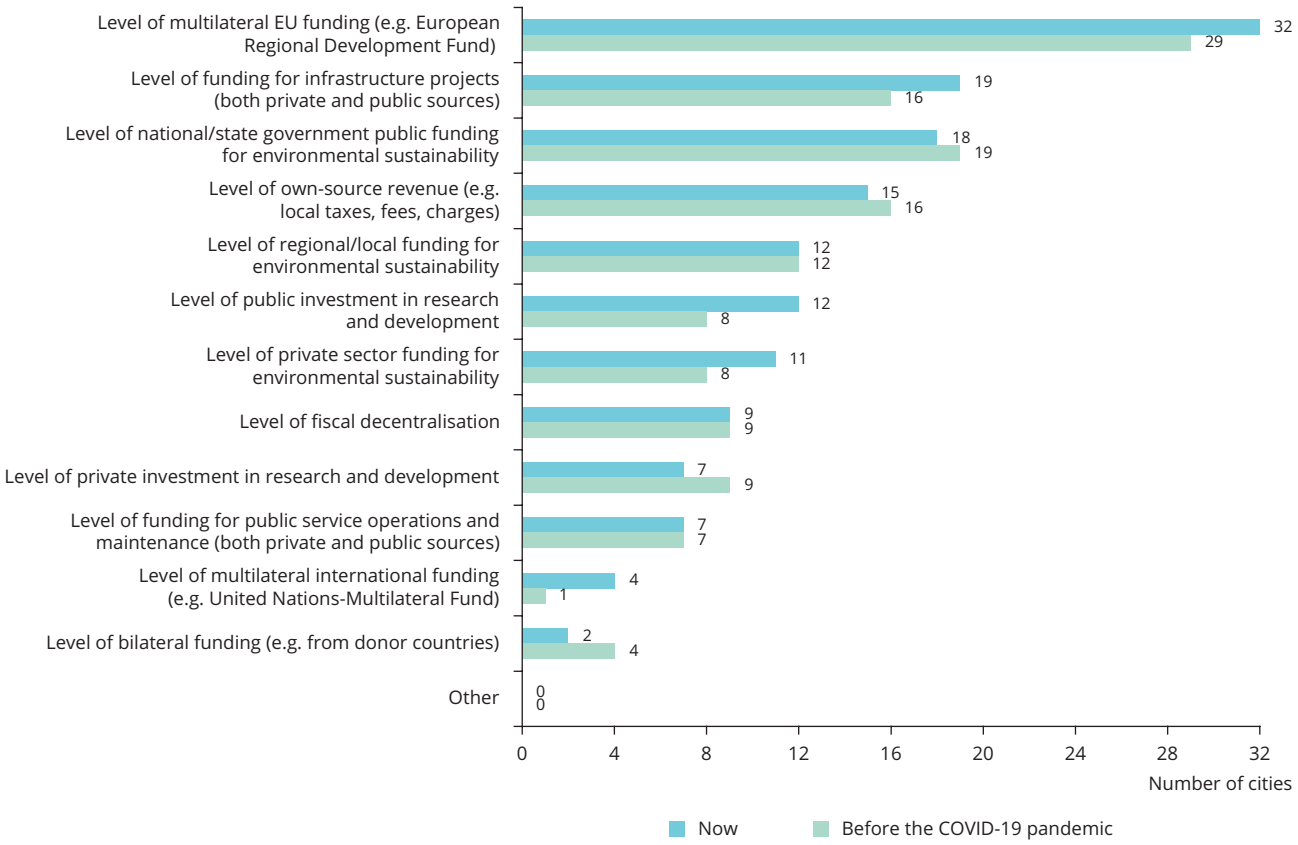
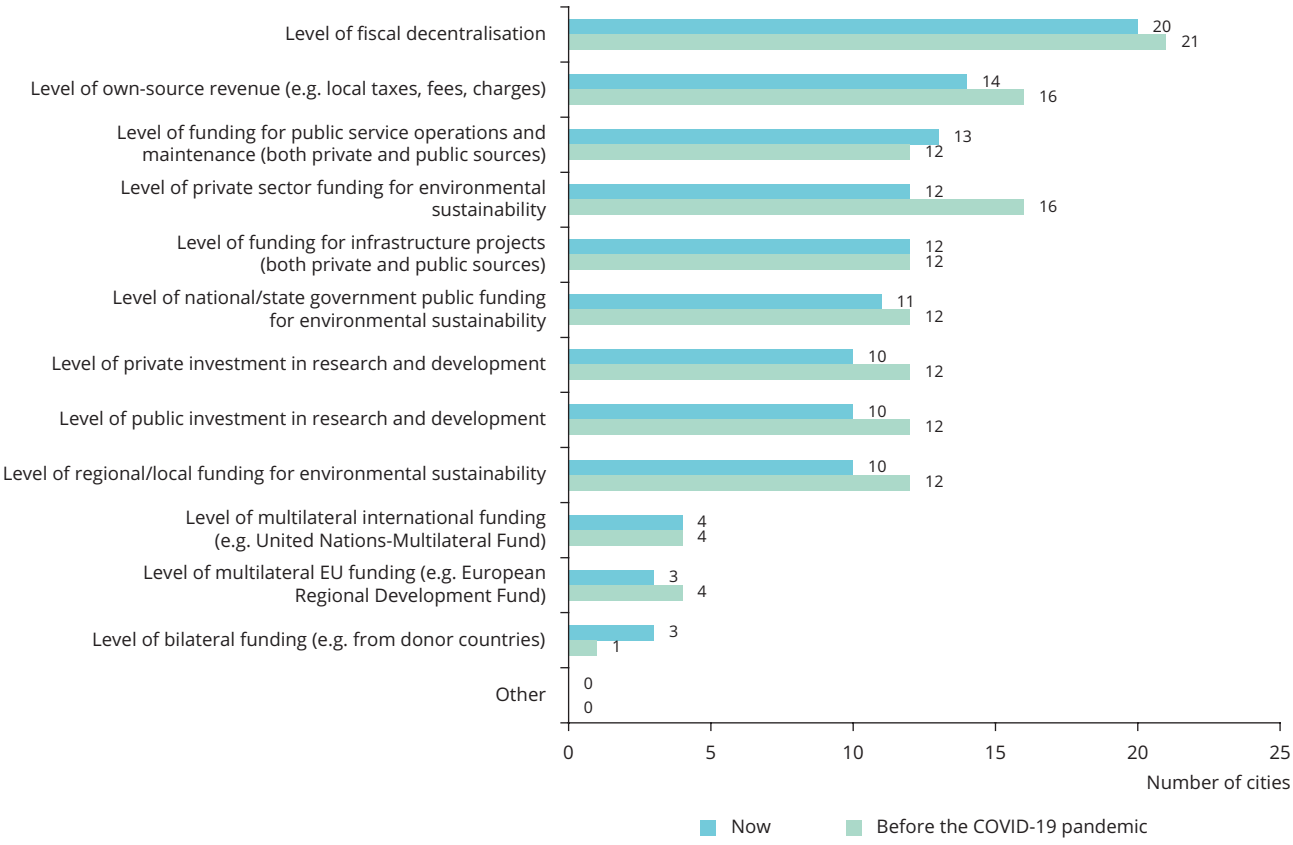


Figure 3.17 Factors related to finance that inhibited environmental sustainability transitions in cities



Wealth matters — but it is not the only thing driving sustainability

Urban sustainability transitions will require significant capital investments across multiple sectors (e.g. transport systems, housing retrofits and electricity systems), many of which have to be supported by new business and financing models. Investments in low-carbon and green and blue infrastructure will need to be complemented by increased spending on research and development and financial support for new processes and policies that can change behaviour. When looking at international sustainability indices, many seem to suggest a correlation between GDP per capita and urban sustainability (Akande et al., 2019). For example, the Siemens Green City Index points out that the best-ranked cities in its European index have one thing in common — they are all wealthy — with Copenhagen, Stockholm, Amsterdam, Vienna and Oslo topping the list (Siemens, 2009).

On the other hand, cities such as Gabrovo, Istanbul and Tromsø explicitly emphasised what they were able to do with limited funding, demonstrating that political will and vision is at least as important as a big budget. High-impact initiatives and changes do not always have to be expensive, and relatively low-cost interventions, such as public awareness campaigns or increasing community engagement, can still make a major difference.

A certain level of wealth nevertheless tends to create positive feedback loops, enabling city governments to reinvest high tax revenues in sustainability initiatives and giving them leverage to set and implement ambitious policy goals, which in turn maximise both environmental and socio-economic returns. The interviews confirmed this, with some of the wealthier cities such as Lausanne, Stockholm and Zurich indicating that strong economic growth and sufficient government resources had enabled a lot of the more expensive investments these cities have undertaken in recent years and provided the momentum for them to push their green agendas further.

It also tends to be the case that individuals who are sufficiently well off to comfortably meet all their basic needs will find it easier to invest time and money in greener lifestyle choices. Several city respondents mentioned that financial hardships (often exacerbated since the pandemic) made it difficult for some segments of the population to prioritise sustainable choices (e.g. Braga, Derry, Glasgow, Istanbul). Despite this dynamic, the overall environmental footprint of wealthier Europeans continues to outweigh any willingness they may show to embrace more sustainable lifestyles. Analysis by Oxfam and the Stockholm Environment Institute has shown that the richest 10% of EU citizens account for over one quarter (27%) of CO_2 emissions, the same amount as the poorest half of the EU population combined. While low- and middle-income EU citizens have reduced their emissions by

24% and 13%, respectively (compared with 1990 levels), the emissions of the richest 10% actually increased by 3% (Gore and Alestig, 2020).

Tackling resource consumption: Europe's wealth remains a double-edged sword

When it comes to true sustainability transitions, one of the most intractable challenges is that Europe has not yet decoupled GDP from resource consumption and carbon emissions. While cities such as Stockholm and Zurich may be seen as sustainability leaders, much of this reputation tends to neglect any rigorous reckoning with a city's consumption footprint. All European cities must confront the reality that a lot of the continent's wealth is fuelled by resource extraction (and the associated pollution and environmental degradation) that has often been outsourced to other countries, or to the city's rural hinterland, and that this pattern is fuelled by continued unsustainable consumption levels. Such impacts can be difficult to quantify and even more difficult for city governments to control, but without this more holistic view sustainability transitions will remain incomplete. A growing number of cities have recognised that the phase of recovery from the pandemic may be a real opportunity to reassess their economic development plans and put forward ambitious new strategies that aim to tackle these pressing issues holistically (e.g. Brussels, Randers, Reykjavik, Stockholm. Tromsø, Zurich).

Increasingly, attention is also turning to the role of individuals in changing their spending and lifestyles to be more compatible with a circular economy model that radically reduces resource consumption. Despite this, city respondents emphasised the challenges of influencing individual decisions and the tension that people felt between the role of individual behavioural change and systemic change (e.g. Banská Bystrica, Lausanne). The Braga respondent noted that there is still no true paradigm shift towards a less materialistic society: while young people may no longer be purchasing cars that were considered status symbols in the past, they are now buying trainers and other fast fashion items that come with their own environmental challenges.

Insufficient levels of fiscal autonomy continue to be a barrier for certain cities

Just as in the previous report, many cities highlighted that constrained municipal budgets and a lack of independent revenue sources (or access to other sources of funding) can be a challenge when it comes to implementing more ambitious sustainability projects (e.g. Brussels, Gabrovo, Gdańsk, Istanbul, Larnaka, Lausanne, Osijek). Across Europe, there has been a push towards greater fiscal decentralisation, increasing the ability of local governments to collect their own revenues, while also giving them greater autonomy in spending the funds they receive from national government. This issue has been in the spotlight because of the sudden and significant COVID-related increase in expenditure, coupled with constrained revenues (due to reduced business rates, transport fares, tourist taxes, etc.), leading to a 'scissor effect' in local government budgets (CoR, 2021).

Box 3.16 Brussels launches new 'Shifting Economy' initiative to align with its social and environmental vision

The Brussels Capital Region recently launched an integrated economic strategy up to 2030 that aims to respond to the needs of Brussels citizens in terms of resources and services while also transitioning towards a carbon-free, regenerative, circular, social, democratic and digital economy.

It is based on recognising that the world is facing a time of crisis that requires a rethink of the models of production and consumption to guarantee the sustainable functioning of the city region into the future. It also focuses on the importance of local companies rethinking their economic models to adapt to this new reality. It is based on the UN Sustainable Development Goals and the longer term goal of achieving carbon neutrality by 2050.

Source: Brussels Capital Region, 2022.

The picture is very mixed across Europe though, and disparities remain when it comes to the powers that cities in different countries (and even within individual countries) have over their spending. While in some countries local governments receive a high share of tax revenue and have relatively high autonomy over how to spend it (e.g. Belgium, Finland, Germany, Spain, Sweden), in others local tax revenue is a lot lower and cities have more limited decision-making powers when it comes to spending (e.g. Bulgaria, Estonia, Greece, Ireland, Slovenia) (Alexandru et al., 2011).

The Lausanne respondent mentioned the difficulty in requesting funding from national government for strategic projects but also highlighted that the climate crisis moving up the political agenda has facilitated some of these conversations and made it easier to acquire financing for low-carbon infrastructure investments and other climate-related projects. This was echoed by other city respondents, who also felt that the urgency with which the EU and national governments are now focusing on climate issues had made it easier to access funding (e.g. Cornellà de Llobregat, Graz, Larnaka).

Access to multilateral funding through the EU continues to be fundamental but does require very specific capacities

Many of the substantial investments required to develop more sustainable infrastructure exceed what cities can finance through their own budgets and will therefore rely on support

from national and supranational governments as well as public-private partnerships. Even for cities that have relatively high own-source revenues and therefore more financial flexibility, the vitally important role of multilateral funding, in particular diverse sources of EU funding, was repeatedly highlighted in this context. The European Commission was seen as essential in facilitating access to investments that support more sustainable infrastructure and operations, with all cities highlighting how important this had been to their progress. In the context of the COVID-19 pandemic, the NextGenerationEU recovery budget was mentioned as a particularly valuable source of funding, with eastern and southern European cities such as Cornellà de Llobregat, Gabrovo, Larnaka, Osijek, Tallinn, Thessaloniki and Valmiera identifying it as a real opportunity to accelerate more ambitious climate-related and environmental transitions in their contexts.

Some cities can build on a long legacy of successfully applying for EU funding, which can be an important investment source for cities with low own-source revenues and other funding constraints. As the previous report highlighted, Gabrovo is one of the cities that has built up considerable know-how when it comes to accessing EU funds to support sustainability initiatives and urban infrastructure projects, and EU funding makes up nearly 85% of the city's operating budget (EEA, 2021a). This is now paying dividends and Gabrovo also advises other Bulgarian cities on how they can access EU funds.

However, navigating the complex and often bureaucratic system of EU funding applications is not something all cities are able to do or even interested in. Stockholm, for example, tries to avoid dependence on EU funds except for very select research projects, citing the cumbersome application process and lack of in-house expertise as a major barrier. The fact that the city has a strong local tax base, as well as access to a significant pot of national government finance, has shaped its relative independence from EU funding sources ([13]). Overall, it seems that cities that have found other simpler forms of financing their policy priorities tend to find EU funding less important (e.g. Graz, Stockholm), while such sources remain important for smaller cities with more limited financial means. Coordinating efforts and knowledge sharing with other municipalities may be one fruitful way to effectively access EU funding, as the example of Cornellà de Llobregat demonstrates.

Box 3.17 Cornellà de Llobregat, Spain, benefits from metropolitan coordination to maximise EU funding for sustainable mobility

Cornellà de Llobregat is one of 36 municipalities that make up the Barcelona Metropolitan Area (AMB). Unlike some other European metropolitan regions, Barcelona has a well-established metropolitan governance system, with the AMB responsible for managing territorial and urban planning, mobility, housing, the environment, economic development and social cohesion (AMB, 2020). As the previous report already highlighted, Cornellà has benefited in many ways from this integrated multi-level governance system, which has driven major environmental improvements in recent years (EEA, 2021a).

To maximise the funding that Barcelona and its neighbouring municipalities would be able to access from the NextGenerationEU mobility fund, the AMB coordinated closely with the city governments to support the development of their proposals and suggest strategically valuable investments they might want to consider. Cornellà was eligible for up to EUR4 million and decided to request EUR2.5 million to support local active mobility initiatives and public realm improvements. It then used the remaining EUR1.5 million of its allocation to support the renovation of the metropolitan bus fleet. Other cities followed this approach, using the support of the AMB government to guide their applications so that they maximised the overall impact for the wider metropolitan area.

([13]) There were also cities that participated in the research that do not have access to these funds, as they are not part of the EU (i.e. Lausanne, Istanbul, Tromsø, Zurich).

Box 3.18 The NextGenerationEU recovery budget — a missed opportunity to involve cities' voices?

NextGenerationEU is a temporary EU recovery instrument, with more than EUR800 billion available to help address the immediate economic and social damage brought about by the COVID-19 pandemic. The centrepiece of this budget is the Recovery and Resilience Facility, which is allocating funding between 2021 and 2026 to recovery initiatives in EU countries that can demonstrate that they are making their economies and societies more sustainable and resilient and better prepared for the challenges and opportunities of the green and digital transitions. In theory, a lot of the projects eligible for funding are likely to be in cities, and several interviewees mentioned the transformative role that this funding could play in rapidly scaling up much needed financing for urban sustainability initiatives.

Sub-national stakeholders were not consulted in the planning of this once-in-a-generation new financial instrument and have only limited say over if or how the money is allocated to specific urban projects. The degree to which they can effectively shape how the money is spent therefore varies from country to county and depends a lot on how well aligned a city's vision and plans are with those of the national government. City networks, such as Eurocities and the Council of European Municipalities and Regions, have repeatedly stressed that this side-lining of local governments risks undermining the transparency and democratic legitimacy of this process and may lead to missed opportunities to support the highest impact projects that will deliver on the wider objectives of the European Green Deal. It remains to be seen if there will be opportunities for cities to play a more active role in deciding on projects that will receive funding, as well as in monitoring the effectiveness of these initiatives in driving truly transformative change.

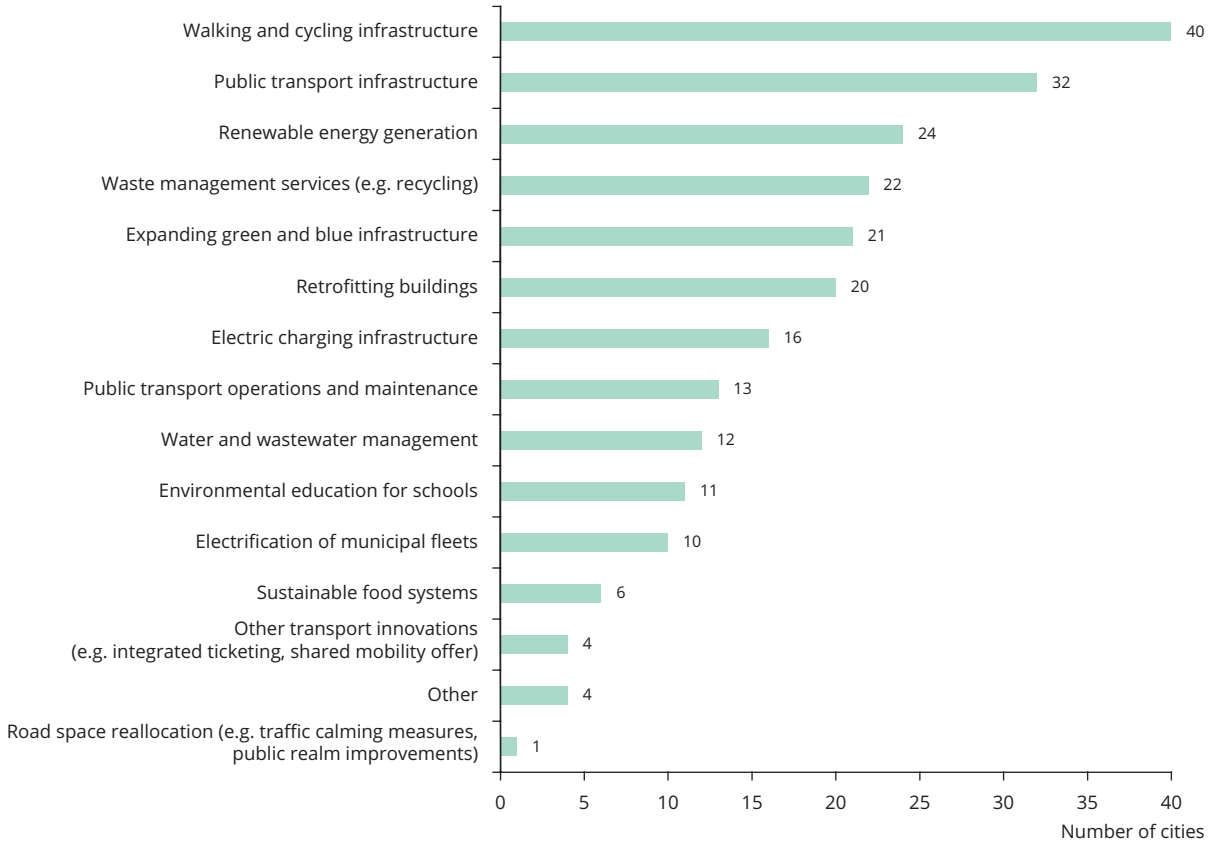
Sources: Boni and Zevi, 2021; Tosics, 2021; European Commission, 2022d.

Partnerships with the private sector can help cities scale innovative solutions but need to be carefully planned and managed

Despite the importance of EU funding, highlighted by many city respondents, and the push towards strengthening cities' ability to grow their own revenue base and find innovative new funding models, much of the spending that will drive decarbonisation over the coming years will have to come from the private sector. Working closely with the private sector to increase investment in sustainable infrastructure was mentioned by most of the city respondents as an important driver, but the survey also showed that a lack of private sector investment is still an important inhibiting factor, although things seem to have improved compared with before the pandemic (see Figure 3.17).

The survey asked respondents to indicate the current five top spending priorities in their city (see Figure 3.18), and investments in sustainable mobility dominate, with walking and cycling and public transport infrastructure seen as a clear priority across Europe. While investments in walking and cycling are less capital intensive and funding sources such as the Recovery and Resilience Facility will be able to support these efforts, public transport infrastructure projects tend to require long-term funding that is often beyond the means of individual cities. Respondents from Istanbul and Thessaloniki both mentioned the complexity of devising innovative new funding structures to finance metro expansion projects and the important role of the private sector in supporting such efforts. This suggests that private sector partnerships will remain important in most cities when it comes to financing urban sustainability transitions. The same applies to some of the other highly ranked spending priorities (e.g. renewable energy generation, waste management services, retrofitting buildings and electric charging infrastructure). Collaboration with the private sector in these key areas can accelerate progress towards a city's existing policy objectives while, at the same time, providing significant benefits for local businesses. Respondents from Gabrovo, Graz, Stockholm, Tallinn and Tromsø all highlighted the co-benefits of involving the private sector and partnering with like-minded and innovative local businesses, which can take advantage of the new green economy that is emerging in their cities. The Zurich respondent highlighted the massive return on investment of public funding schemes for start-ups working on climate issues, as well as the way in which such private sector involvement can accelerate change.

Figure 3.18 The current most important spending priorities to achieve cities' environmental sustainability objectives



Box 3.19 Stockholm, Sweden: how to ensure that technology is working for the city rather than the city working for the technology

Stockholm has a reputation for innovation capacity and its willingness to embrace new technologies to further its sustainability transition. Collaboration with the private sector has a key role to play in funding and scaling up innovations, but the city is keen to remain the 'problem owner, especially when it comes to big transition questions that often require a wider perspective beyond just the 'tech fix'. This approach ensures that investments in new technologies work for the city rather than the city working for the technology.

This focus on a problem-led rather than a solutions-led approach to working with the private sector means that the city now carefully considers what it needs, or what challenge it is trying to solve before considering something like a public-private partnership and works to ensure that the private sector is brought in at the right stage of the project cycle. It also uses innovation funding from the Swedish national government to pilot new ideas and experiment with different options before going to the private sector with a clear business case and letting the sector scale it.

Cities are rethinking how they allocate budgets to remove perverse financial incentives and support the transition

Although ensuring that both public and private investments support sustainability objectives in cities is essential, this is still not happening in a consistent way. As the United Nations Environment Programme notes, 'clearly, some capital is flowing to the new economy that we need. But far more is continuing to support the old economy' (UNEP, 2018). Despite the timely ambition at the EU level to better align recovery spending with the green and just transition and prevent a return to the 'old normal', city representatives still emphasised that there was a certain level of inertia when it comes to redirecting capital flows in a way that reduces or eliminates negative environmental and social externalities. Existing policies that channel money into unsustainable urban outcomes can often be difficult to reverse. The Graz respondent highlighted that there are still fiscal incentives and direct and indirect subsidies in Austria that encourage the construction of detached single-family housing and promote car dependence. The flip side of this is a persistent underinvestment in environmental public goods, with the Osijek respondent, for example, highlighting the lack of subsidies for public transport fares, and respondents from Derry, Gdańsk and Horst aan de Maas highlighting the lack of funding for energy efficiency retrofits in buildings. Although many cities cited efforts to provide eco-grants (e.g. Brno) or other subsidi, this was often seen as being insufficient to tackle the scale of the funding challenge.

But there is an encouraging trend for cities to align their spending more purposefully with key environmental objectives and to reform budgetary allocations so that the work of all departments supports a common agenda. Reykjavik already has a system in which the budget of all departments is aligned with the city vision. Tallinn will be prioritising investments linked to environmental sustainability so that the city budget is aligned with its Tallinn 2035 agenda from next year. In Dublin, all government departments now need to justify how their spending supports the city's climate ambitions, and Brussels is rethinking budgetary allocations from the ground up through its new Shifting Economy Strategy.

Box 3.20 Graz uses targeted subsidies to incentivise behavioural change

Graz has long used targeted subsidies to try to accelerate the transition to more sustainable lifestyles and behaviours. It has explicit subsidy programmes to support everything from district heating, solar photovoltaic installations, building insulation, electric vehicle fleets and urban greening to repair of electronic items and even promoting reusable nappies.

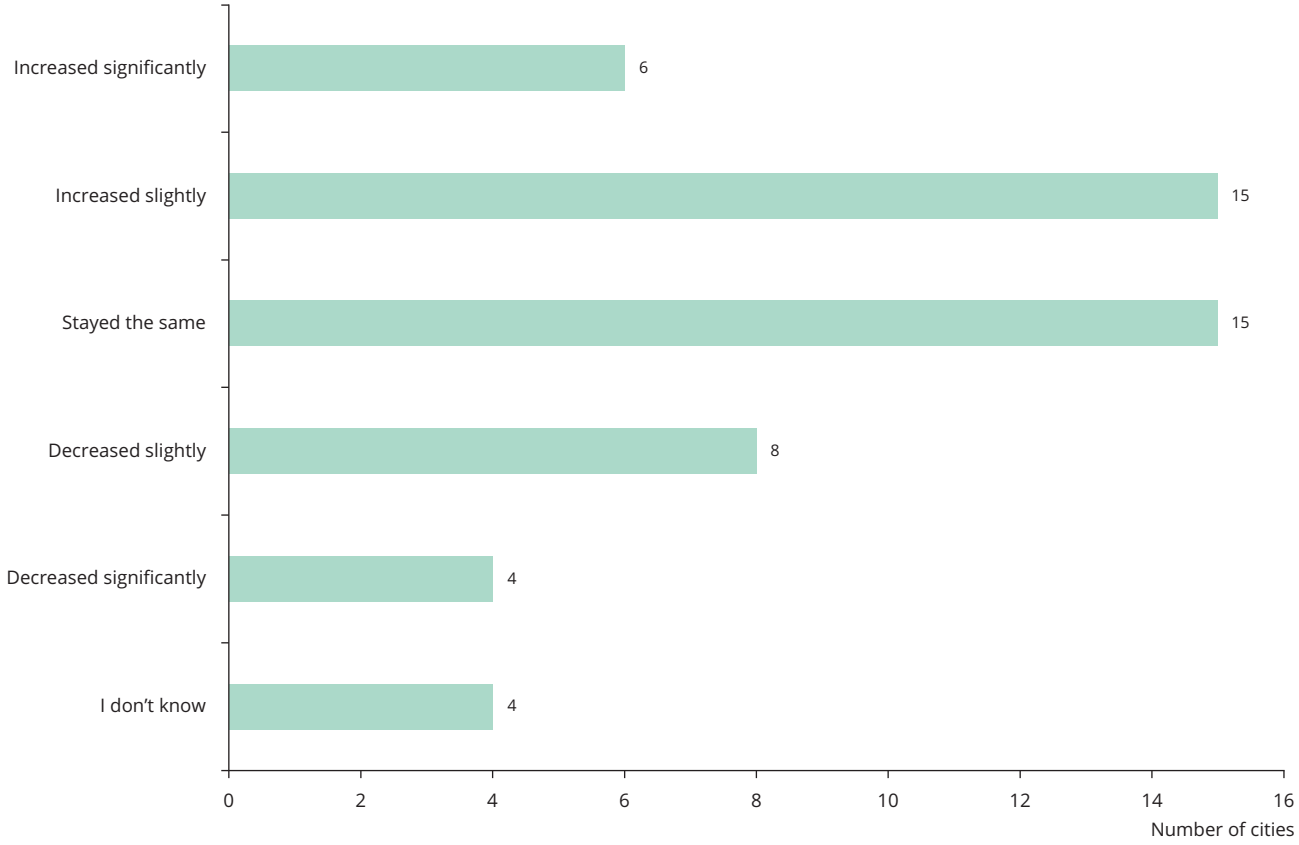
It was also one of the first cities in the world to set up a subsidy scheme for cargo bikes. The programme was established by the city in 2011 to enable small businesses and groups of households to adopt more sustainable mobility behaviours and accelerate a shift away from cars. The model has since been copied across Europe with cities including Barcelona, Bologna, Munich, Oslo, Paris and Utrecht all providing subsidies to reduce the initial capital costs preventing the more rapid uptake of cargo bikes. In Graz, the city covers up to 50% of the value of a cargo bike up to a maximum of EUR1,000. Recognising that safe storage is also a potential barrier, the city also subsidises the installation of cargo bike hangars, with a further financial incentive for applicants who can prove that they have removed a car parking spot to make way for cycle storage.

Source: Municipality of Graz, 2022.

The COVID-19 pandemic appears to have been an important catalyst for accelerated spending on environmental sustainability

One of the key questions that motivated this current expanded report was whether the COVID-19 pandemic had hindered environmental sustainability efforts in cities, either by diverting resources elsewhere or by creating new and more urgent priorities. Based on the results of both the survey and the interviews, this does not really appear to be the case, with nearly two thirds of survey respondents indicating that the pandemic either did not affect the proportion of the city's budget spent on environmental sustainability measures, or coincided with an increase in such spending (see Figure 3.19). Eight respondents suggested that there had been a slight decrease, and for four cities there was even a considerable decrease.

Figure 3.19 How the proportion of cities' budget/expenditure on environmental sustainability measures has changed as a result of the COVID-19 pandemic



This was also reflected in the interviews in which most city respondents did not report a major budgetary impact from COVID-19, at least on the environmental budget of the city. In the interviews, the cities that struggled most with budget reductions as a result of the pandemic were those that are either highly dependent on national government transfers or where environmental spending was not explicitly ringfenced and therefore had to be reallocated to deal with other COVID-19-related expenditures (e.g. Banská Bystrica, Istanbul). The Istanbul respondent highlighted that the additional spending on social welfare over the past 2 years had had a major and lasting impact on overall city budgets, reducing the city's ability to invest in new environmental sustainability initiatives.

Box 3.21 How COVID-19 has affected finance drivers and barriers

The financial repercussions of the COVID-19 crisis are being felt across all sectors of society in Europe and across all levels of government. However, the results of this study suggest that the impact on urban environment and climate agendas appears less negative than assumed at the outset of this research. Although there is no doubt that cities will continue to face significant expenses related to the recovery from COVID-19, environment and climate budgets seem to have been relatively unaffected thus far, enabling cities to continue advancing their sustainability efforts. One of the reasons for this appears to be that some of the key spending priorities and policies that helped to tackle the spread of COVID-19 are also aligned with existing sustainability strategies (e.g. investments in walking and cycling and green and blue infrastructure).

Cities will require commitments by EU and national governments to maintain or increase funding to address local shortfalls and enable them to continue to deliver vital public services, while at the same time making progress towards their environmental targets. At the same time, investment by the private sector will continue to play a role, but cities will need to manage it carefully to ensure that new forms of financing truly support existing sustainability visions and plans.

Without this support, there is a real risk that cities will not be able to advance important green initiatives, which could have catastrophic consequences for Europe's wider sustainability transitions. Fortunately, there is clear evidence that just and green economic recovery measures (e.g. investing in energy-efficiency retrofits) can help municipal governments to maximise short-term benefits for employment, while catalysing wider transformations and securing the longer term socio-economic rewards associated with ambitious climate action (C40 Cities, 2021).

The European Green Deal provides an important framework to guide how recovery funds should be spent, although it will still be up to individual cities to identify opportunities that move them away from 'business-as-usual' spending decisions. The limited involvement of cities in deciding how the NextGenerationEU funds will be spent may also represent a challenge, although there is no doubt that this multilateral funding is already accelerating positive changes in many cities and is likely to remain extremely important as a financial driver of urban sustainability.

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4
Lessons learned and opportunities for future research

This concluding chapter provides an overview of some of the most interesting and relevant lessons arising from the research in both this and the previous study. These lessons may help policymakers at all levels identify levers of change that can help to accelerate urban environmental sustainability transitions in European cities. They also provide insights that may be relevant to other urban stakeholders, including local citizens, non-governmental organisations and the research community. The final part of this chapter briefly discusses opportunities to both deepen and broaden this research in the future.

4.1 Lessons emerging from this research

In the context of environmental sustainability efforts, the COVID-19 pandemic has mostly had a positive impact on cities

In most cases, the pandemic has not created major new barriers to cities' environmental sustainability efforts. In fact, most city respondents indicated that COVID-19 has actually had a positive influence by accelerating much-needed changes and enabling transferable lessons to be learned both within city governments and across society. This includes a broader recognition that change can happen quickly and that local governments can play a role in confronting urgent societal and environmental crises. It also led to an acceleration of sustainability initiatives, particularly around low-carbon mobility, more equitable access to green and public spaces, and rethinking how we live, work and travel.

But these benefits could easily be eroded if the recovery from the pandemic is not inclusive

Compared with the findings of the previous study, cities showed a heightened awareness of the role of tackling social and economic inequalities to effectively advance sustainability transitions and the importance of a just transition. COVID-19 highlighted the fundamental inequities in urban society and at times exacerbated polarisation around issues, from vaccines to climate change. Cities will therefore need to ensure that new green policies do not further alienate some segments of the population. A focus on inclusivity and justice, on clearly communicating the science, and on new ways of engaging disaffected residents will be crucial in this context. This challenge will be heightened in many cities that are now receiving a renewed influx of refugees because of the war in Ukraine, which may put further pressure on public services.

Cities need to work in their existing context but also to accept that they are evolving systems

Understanding the complex relationships between the existing urban context and sustainability efforts can help cities prioritise those environmental policies that are the most appropriate for their individual circumstances. What emerges clearly from the research is that a good understanding of a city's context, and its constantly evolving nature, are prerequisites to successful sustainability planning. Fixed contextual factors form part of a city's distinctiveness and, wherever possible, they should be embraced, as they can enable unique ways of addressing sustainability transitions. At the same time, many aspects of a city's context are changeable (either by targeted policy intervention or through more large-scale external forces). COVID-19 acted as an important reminder that cities are living and constantly evolving systems, and urban policymaking must remain agile to respond to emerging challenges and new realities.

Transition pathways need to be tailored to individual cities and their unique qualities

There are significant variations between European cities when it comes to the most important drivers and barriers shaping their sustainability transitions, and solutions will always have to be tailored to respond to these unique conditions. This is also relevant when it comes to EU legislation and policy frameworks that must leave enough flexibility to enable cities to implement initiatives in ways that are most relevant and effective for them, respecting the unique local drivers and barriers they face on their sustainability journey. It also suggests that cities will have very different policy priorities and divergent abilities to influence specific sectors that are relevant to their sustainability transitions.

Despite this, there are recurrent themes and challenges that are common to all cities

Rethinking existing urban infrastructure (both grey and blue and green) appears to be a unifying theme across European cities, regardless of their size, their wealth or their location. In this context, tackling issues of urban sprawl and breaking with decades of car-centric urban planning emerged as one of the most frequently cited barriers to environmental sustainability transitions. While this was already an important theme in the previous study, the pandemic appears to have created a sense of urgency around this topic, with city respondents citing the need to increase liveability and access to green space while at the same time transitioning to zero-carbon mobility and limiting sprawl into the rural hinterland. Cities also face difficult and often competing priorities, including how best to build new and affordable housing, without further compromising natural areas, and to deal with deeply entrenched cultural preferences for single-family detached housing, which can create obstacles for effective urban densification.

Strategic planning and a clear vision are important, but once established the focus needs to shift to implementation

Having an overall sustainability vision and associated strategic plan at the city level is a precondition for advancing towards ambitious environmental goals. All city respondents highlighted the importance of having well-thought-out plans that provide a clear trajectory and can act as a baseline for their sustainability transitions, as well as committed leadership to drive progress towards that vision. A plan on its own is just a piece of paper, however, which is why there needs to be greater emphasis on measurable targets, clear accountability mechanisms, dedicated funding and support to move from planning to actual implementation. Another potential issue relates to the priorities that may be included in a city's strategic plan, which are often conditioned by the issues and sectors that a city can meaningfully influence, as well as political preferences and ideologies. This highlights why urban sustainability plans should be aligned with and respond to wider programmes and plans set at the national and EU levels.

Mainstreaming climate and sustainability considerations across all government departments is becoming more recognised as a priority

While the effective horizontal integration of policy priorities across departments continues to be a challenge most cities have not fully overcome, a growing number seem to be making significant progress when it comes to ensuring that climate and sustainability objectives are effectively mainstreamed across most of their policies and decision-making processes. This also means reforming governance structures such as by ensuring that the mayor's office has direct involvement in implementing climate strategies — thereby making it a political priority at the top and ensuring that relevant reforms are implemented to encourage a change in mindset across the entire administration. This can include different approaches, such as putting in place requirements for departments to demonstrate how their proposed actions have an impact on climate goals or are aligned with a city's overall sustainability strategy when applying for funding.

Cities need to be empowered, both politically and financially, for real change to take place

Although higher levels of government (EU, national, regional) clearly have an essential role to play in supporting urban sustainability transitions, it tends to be beneficial for cities to have a greater degree of decision-making power and fiscal autonomy. The importance of both fiscal and political decentralisation emerged repeatedly throughout this research, with city respondents stating that it was essential for them to have a substantial level of independence when it comes to policy sectors that most acutely influence local sustainability outcomes. Many felt that they had demonstrated through the pandemic that they could be trusted with this responsibility, and that their proximity to the concerns of local residents actually made them well placed to tackle complex emergencies and challenges. A lack of fiscal autonomy was repeatedly highlighted as a barrier that constrains cities from accelerating their sustainability transitions, particularly when it comes to big investments, such as new transport infrastructure, which they can rarely finance independently. COVID-19 has already had a significant impact on local government budgets, so finding innovative ways to access local sources of revenue will have to be complemented by financial support from other tiers of government and the private sector.

EU laws and policy frameworks matter — as does creating a shared identity

EU laws, standards and regulations play a major role in shaping local sustainability ambitions and actions, and this role seems to have grown in importance in recent years. Cities are strongly incentivised, supported and even inspired by EU legislation and strategies, such as the European Green Deal, the EU urban agenda and various EU directives. This is in part because EU regulations are legally binding and are linked very clearly to other EU incentive mechanisms (e.g. funds, networks, awards). But the EU also plays a clear role in shaping a new narrative about the role of cities in the green and just recovery from the pandemic and in the wider future of Europe, which goes far beyond the tangible financial support or regulatory frameworks and has more to do with creating a shared European identity and ensuring that cities feel part of a collective effort to bring about lasting change.

National and supranational governments can facilitate, and inhibit, systemic change

National and supranational governments can accelerate systemic change by facilitating knowledge exchange and supporting strong networks that enable peer-to-peer learning. Initiatives

such as the EU's 100 climate-neutral and smart cities and many other EU initiatives are crucial for sharing knowledge and best practice. This is also true for collaborative European research initiatives that provide the framework for cities to learn from each other and find innovative solutions to shared challenges. At the same time, some city respondents highlighted that a lack of alignment between local, national and supranational priorities and objectives can undermine progress, underscoring why it is so essential that urban leaders are consulted in wider decision-making processes related to the sustainability transition. An example is the NextGenerationEU recovery instrument, which had no mechanism for cities to be consulted, creating some tension around cities' desire to be seen as legitimate policy stakeholders alongside national governments.

Knowledge sharing between cities and with other stakeholders is critical to learning

All cities identified the importance of sharing knowledge and experiences with others, often facilitated through regional or thematic networks that enable them to co-create solutions to shared sustainability challenges. City networks work best when they encourage collaboration rather than competition and when the value added for individual member cities is very clear. Having a safe space to share successes and failures was highlighted as an important aspect of such networks. Cities must take care not to overcommit to too many initiatives and rather to focus on the networks and partnerships that provide them with concrete inputs and support to help them to advance towards specific goals. COVID-19 has also shown how city networks can be essential not just for information sharing but also by enabling cities to speak with a unified voice, raising their collective profile in important policy conversations. Recent examples of this include the C40 Global Mayors COVID-19 Recovery Task Force and explicit calls by the Global Covenant of Mayors for Climate and Energy and Eurocities for a green recovery and cross-border solidarity.

Local research and experimentation can accelerate innovation

Urban sustainability transitions are inherently complex and often must respond to 'wicked problems' that can be difficult to solve or have unintended consequences. Research and experimentation can help to identify locally appropriate solutions. Using the city as a test bed can accelerate innovation because it ensures that new approaches and technologies are appropriate for the local context. It also allows city authorities to think about the different sustainability nexuses that they want to address and to find solutions that can lead to co-benefits across different policy sectors. At the same time, a supportive research agenda at the EU and national levels is also needed to support and reinforce efforts by individual cities, while also providing important insights into issues that are shared by a wide range of cities. Increasingly, cities also seem to be embracing the value of citizen-based innovation and learning and are committed to new forms of public participation and knowledge generation.

Involving various stakeholders and supporting effective public engagement in decision-making processes leads to better outcomes

Including a broad range of stakeholders in decision-making — from various sectors and across all levels of government and society — tends to lead to better outcomes in terms of urban environmental sustainability transitions. The sense of ownership and shared responsibility for dealing with environmental challenges can help to create a common understanding of sustainability issues across various sectors of society and government. Achieving sustainability transitions also requires public engagement in defining a city's visions and pathways — without this buy-in and participation it can be difficult to achieve positive change. Educating civil society through informative campaigns on sustainable policies and plans equips citizens to place demands on municipalities to act, while also empowering individuals to take meaningful action within their own communities. Having an engaged and empowered population that is open to new innovative technologies and willing to change behaviours and habits, and to embrace more sustainable lifestyles, can facilitate the implementation of more transformational changes.

Young people are increasingly important agents of change across European cities

While there appears to be an overall shift in public attitudes towards environmental sustainability and greater public engagement with key issues, including climate change, the role of young people and youth movements such as Fridays for Future cannot be understated. In cities across Europe, young people are becoming increasingly sophisticated political stakeholders and are not only holding their governments accountable but also driving a real sense of urgency that has mainstreamed climate and environmental considerations in the span of just a few years. Cities can build on this momentum by investing in educational initiatives and creating concrete opportunities for young people to continue to be involved in decision-making processes (e.g. by encouraging them to become involved in politics in their city, creating youth councils and supporting outreach initiatives).

New technologies can play an important role but need to be inclusive and fit for purpose

Innovation cannot be embraced for its own sake but rather must respond to genuine needs — first and foremost the need for more liveable and sustainable cities. Similarly, new technologies are not a panacea for all environmental challenges, and care must be taken to ensure that technologies do not have unintended consequences or side effects (e.g. social exclusion and inequality in access to goods and services). While there is clearly massive potential for greater digitalisation to increase inclusivity and tackle various environmental externalities, such efforts need to be rolled out carefully and incrementally to ensure that they have the

intended effects. The COVID-19 pandemic accelerated the adoption of new technologies, with remote working being by far the most significant. Although remote working has the potential to reduce unnecessary motor vehicle trips and many cities experienced a temporary drop in transport emissions as a result, some of these environmental benefits may be offset in the long run by higher energy use and people moving to larger homes in more remote locations beyond the city centre. The percentage of 'remotable' jobs in Europe is also unevenly distributed, and many jobs will continue to rely on face-to-face interactions. Digitalisation therefore remains only one part of a much larger and more complex puzzle.

Updated and accessible data and information are needed to monitor progress

Better data and information generally lead to better environmental management, making it easier to demonstrate progress towards specific goals. National legislation and EU directives, and membership of other EU networks, can help cities to identify areas where they may be lagging behind and incentivises them to improve their data and information collection processes. Again, new technologies can play an important role in both data collection and analysis, and the importance of this seems to have increased during the pandemic, but a proliferation of data is only useful if a city has the capacity to analyse it and integrate it into its decision-making processes. Therefore, it is essential for cities to acquire the skills to work with large data sets that can help them to identify patterns and track the impact of specific policy interventions. This is also an important reminder that the provision of timely, relevant and accessible European-level data and information on environmental issues is essential for cities and should remain a priority for agencies such as the EEA.

Communicating information effectively and innovatively is an important part of engaging the public

Thinking in innovative ways about how data and information can be presented to highlight challenges or new initiatives can ensure that the public is clear about what the city is aiming to achieve and how they can be part of the sustainability transition. COVID-19 was a great test case for this, and innovative communication includes more qualitative storytelling, and accessible and attractive ways of data visualisation and presentation, as well as better availability of relevant open data (e.g. appropriate scale, thematic). All this can improve the accessibility and understanding of relevant information for the public and various other stakeholders and can support urban environmental sustainability transitions. City respondents also mentioned other ideas, such as having high-profile 'champions' to promote more sustainable behaviours, involving the public and private sectors through competitions, and holding events where the public can try out new technologies, regular town hall meetings and other ways of engaging with citizens that enable dialogue and the development of shared sustainability objectives.

Accessing EU, national and private funding plays a key role

Non-urban governments can drive change by reorienting financial flows towards sustainable investments and developing relevant knowledge systems and skills to support these. Wealthier cities may find it easier to independently invest in important sustainability initiatives and upgrade urban infrastructure. However, particularly for cities with lower own-source revenues, knowing how to access other sources of funding at EU and national levels can play a key role in overcoming this barrier. It is clear that the issue of funding has become even more important in the context of COVID-19 and the accelerating climate crisis. Although EU funding may be available, applying for such funds can be time consuming and require a particular skillset that not all local authorities necessarily possess. This means that access to EU funds is not equally distributed across Europe and may not always reach the cities that need it most. Public-private partnerships are another way that cities can increase investment in sustainable infrastructure. Successful collaboration with the private sector can accelerate progress towards core policy objectives while, at the same time, providing significant benefits for local businesses, but they need to be carefully managed to ensure that cities remain firmly in the driving seat of such partnerships and remain the main 'problem owner'.

Cities need more support to decouple growth from resource consumption

Although cities are often at the forefront of innovative approaches that embrace circular economy thinking, inclusive growth and a move towards decarbonisation of the economy, most cities have not managed to successfully decouple economic growth from resource consumption, and wealthier cities also continue to contribute the most to overall carbon emissions across Europe. While some cities may feel that the consumption behaviour of individual residents is outside their control or requires stronger regulatory intervention at the national and supranational levels, there are many policy levers available to cities that can drive more sustainable outcomes across all levels of society and the economy. Cities should not underestimate their own role in driving behavioural change and fostering a shared sense that radical transformation is both achievable and inevitable. This will of course require cities to continue to advocate greater political and fiscal autonomy, but it also means that they need to remove perverse financial and policy incentives that continue to lead to unsustainable outcomes (e.g. subsidies that indirectly promote urban sprawl and car ownership).

4.2 Future research opportunities

This second and expanded piece of work built on the prototype developed in the previous study and further refined the approach of using literature reviews, surveys and interviews with city authorities to identify potential drivers of and barriers to urban environmental sustainability transitions. This work demonstrated the value of scaling up the analysis to a larger sample of cities to both confirm and expand on some of the initial findings and lessons from the previous study. It also added important additional diversity in terms of both geography and size and managed to include the experiences of cities far beyond the 'usual suspects' known to be at the forefront of sustainability efforts in Europe. This mostly served to enrich the picture of urban Europe as an extremely heterogenous space with many unique pathways towards greater sustainability but also made it more challenging to identify 'universal' barriers and drivers.

Therefore, the findings and emerging lessons should be seen as an entry point into a wider conversation about the drivers of urban sustainability transitions. Looking ahead, a number of themes emerge from this analysis that would provide fruitful avenues for further enquiry.

Expanding the sample size to include more cities and enable more comparative analysis

- While the survey and interview sample size where expanded compared to the initial study, they remain relatively small, and it would certainly be interesting to be able to draw on a larger dataset to be able to create a more sophisticated assessment of different city typologies. A larger sample size could begin to highlight any particular patterns in how the drivers and barriers manifest across different types of cities, thereby enabling more nuanced recommendations and a more comparative approach. This would also allow cities to be clustered by themes to start to discern whether there are very clear differences.

- To date, the research has been based on personal perceptions of city officials, and future research might consider how these subjective insights could be complemented by more quantitative analysis of the drivers and barriers that individual cities experience. While the sample was enlarged, it also remains too small to meaningfully disaggregate findings by city typology or draw conclusions about the interdependencies and causal feedback loops between different drivers and barriers that emerged.

Tracking the impact of recent EU policy changes and the pandemic on urban environmental sustainability

- Given the proliferation of major new EU policy initiatives, including the European Green Deal, the New European Bauhaus, the revised Leipzig Charter, the new EU adaptation mission and climate-neutral and smart cities mission, and the NextGenerationEU recovery instrument and associated national recovery and resilience plans, it may be useful to track to what extent these various EU initiatives are shaping urban environmental sustainability outcomes. How are the barriers and drivers identified by cities in this study reflected in the priorities set out by these key EU policies? This report can be used as a baseline to identify important gaps where the efforts of cities to transition might be better supported through existing EU initiatives and legislation.

- Cities, countries and the EU are still figuring out how best to recover from the human and economic toll of the pandemic, while ensuring that the inevitable economic challenges do not undermine urgent agendas related to climate change and ecological restoration. Research into the types of recovery packages that will allow us to 'build back better', while also accelerating progress towards environmental sustainability in Europe's cities, will be important, and this report could provide an entry point into these discussions.

- Unpacking opportunities for cities to become much more recognised as essential stakeholders in these important EU-level conversations will be another important priority. European cities are key actors in the transition to a climate-neutral society, and the success of the European Green Deal and the NextGenerationEU recovery instrument depend in large part on finding new and more effective ways of involving city leaders, authorities and citizens in decision-making processes that can ensure a fair and inclusive transition for all.

Exploring wider themes and subject areas that may be driving the sustainability transition

Some rich themes emerged from this research but could not be explored in sufficient depth to determine to what extent they are supporting or inhibiting specific environmental sustainability efforts in cities. It would therefore be very valuable to explore some of the enabling factors individually. These include:

- The importance of rethinking urban infrastructure financing to support the transition in cities. As this work has shown, many of the major investments required to transition quickly to net zero far exceed the financial capacity of individual cities and require bold new partnerships and new valuation approaches, as well as reform of infrastructure finance and major capacity building around innovative funding mechanisms to support cities in their efforts to find new ways of delivering transformational change.

- Another theme worth further enquiry relates to the importance of effective urban and territorial planning, especially how differences in planning and urban

development contexts among different cities may shape their sustainability transitions. In the light of recent updates to the EU territorial agenda and the revised Leipzig Charter, integrated urban development may be an important aspect to explore in follow-up research, ensuring that these important conversations and emerging policy priorities are more adequately reflected in this analysis and that the link between urban planning and environmental sustainability is explored in more depth. In this context, a better understanding of the role of metropolitan governance systems might be particularly illuminating, as this work repeatedly highlighted that a lack of effective coordination beyond administrative boundaries can be a serious barrier to sustainability transitions.

- Another important theme that emerged in the interviews with cities but could not be explored in depth was governance for transformation, including discussions of how cities are creating a climate for innovation in the municipality, where new approaches can be tested without the fear of failure and where failure is seen as a means of learning and growth. Understanding to what extent having such openness to experimentation embedded in local government culture can accelerate progress towards greater environmental sustainability may be a relevant focus for future research. Related to this, work to better understand the difference between more top-down leadership on sustainability versus more bottom-up drivers emerging from civil society and the public might also be of value.

- While this work was focused on understanding the drivers of environmental sustainability transitions, it is also important to understand what the social and economic drivers of sustainability in cities might be. Linking this work to the rich body of research now emerging around social innovation for sustainability transitions will be particularly valuable, especially in the context of the just transition movement and findings from this work that demonstrated the importance of changing deeply embedded cultural norms and practices so that lasting change can take place.

- Similarly, understanding interlinkages between different drivers and barriers could be explored further. Many of the enabling factors explored as discrete categories in this work are actually deeply intertwined. Therefore, it may be useful to take a more integrated approach as a starting point for future primary research with specific cities. This would most likely require deep dives into individual case studies that could provide transferable lessons for other urban contexts. For example, a more in-depth exploration of cities that are at the forefront of tackling the interplay between technology, digitalisation and data in driving decarbonisation might yield interesting insights about an emerging area of urban policymaking that an increasing number of cities will have to confront in the years ahead.

- Finally, it would be valuable to explore the role of lock-ins and path dependencies in greater detail. This would help to understand how cities might be supported to move from incremental improvements and linear progress to more transformative action and accelerated change. The COVID-19 crisis has clearly added to the urgency of this type of research, given that cities are currently facing unprecedented pressures to respond to deeply interlinked health, social, economic and environmental challenges that risk hampering their efforts to effectively drive forward the sustainability transition across Europe.

Abbreviations

EEA	European Environment Agency
EU	European Union
GDP	Gross domestic product
ICLEI	Local Governments for Sustainability
NGO	Non-governmental organisation
SMEs	Small and medium-sized enterprises
SOER	State of the environment report — *The European environment — state and outlook*

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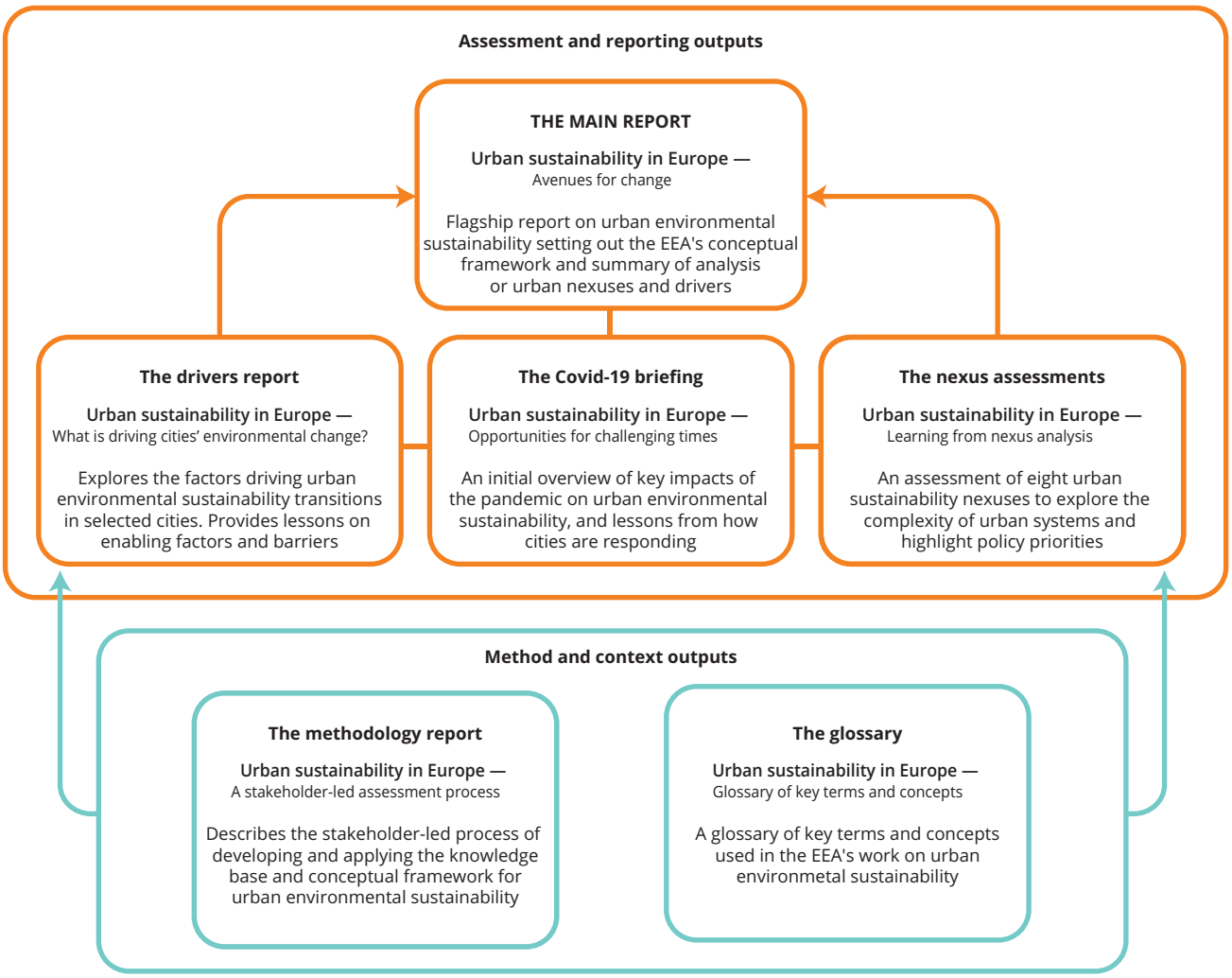
Annex 1
Overview of previous EEA outputs related to urban sustainability in Europe



Annex 2
Overview of cities that took part in the current research

Table A.2.1 presents all the cities that took part in the current research in either the survey or the interviews or both. Some of these also took part in the previous research (i.e. survey or interviews or both). The table shows which parts of each piece of research the cities participated in.

Table A.2.1 Overview of cities that took part in the current research

Country	City	City size ([a])	Region	Current research		Previous research	
				Survey	Interviews	Survey	Interviews
Austria	Graz	294,630	Western Europe	✓	✓		
	Klagenfurt am Wörthersee	94,796	Western Europe	✓			
Belgium	Brussels	2,065,284	Western Europe		✓		
	Leuven	92,704	Western Europe	✓		✓	✓
	Liège	197,013	Western Europe	✓			
	Gabrovo	58,950	Western Europe	✓	✓	✓	✓
	Haskovo	75,641	Eastern Europe	✓			
Croatia	Osijek	107,784	Eastern Europe	✓	✓		
	Zagreb	792,875	Eastern Europe	✓			
	Slavonski Brod	59,141	Eastern Europe	✓			
Cyprus	Larnaka	51,468	Southern Europe	✓			
	Nicosia	55,014	Southern Europe	✓			
Czechia	Brno	379,526	Eastern Europe		✓		
	Liberec	104,261	Eastern Europe	✓			
Denmark	Odense	200,703	Northern Europe	✓			
	Randers	62,623	Northern Europe	✓	✓		
Estonia	Tallinn	437,619	Northern Europe	✓	✓	✓	✓
Finland	Oulu	209,648	Northern Europe	✓	✓		
	Mikkeli	52,121	Northern Europe	✓		✓	✓
	Rovaniemi	64,194	Northern Europe	✓			
France	Marseille	861,635	Western Europe		✓		
Germany	Münster	291,754	Western Europe	✓			
Greece	Agia Varvara Attikis	26,550	Southern Europe	✓			
	Athens	664,046	Southern Europe	✓			
	Thessaloniki	325,182	Southern Europe	✓	✓		

Country	City	City size ([a])	Region	Current research		Previous research	
				Survey	Interviews	Survey	Interviews
Iceland	Reykjavik	131,136	Northern Europe	✓	✓		
Ireland	Dublin	525,383	Northern Europe	✓	✓		
Italy	Padua	214,000	Southern Europe	✓			
Kosovo	Prsitina	205,133	Eastern Europe	✓			
Latvia	Valmiera	23,125	Northern Europe		✓		
Netherlands	Horst aan de Maas	42,291	Western Europe	✓	✓	✓	
Norway	Tromsø	76,974	Northern Europe	✓	✓		
Poland	Gdańsk	582,205	Eastern Europe		✓		
	Łódź	672,185	Eastern Europe	✓			
	Rzeszów	196,638	Eastern Europe	✓			
Portugal	Lisbon	544,851	Southern Europe	✓		✓	✓
	Setúbal	118,696	Southern Europe	✓			
	Torres Vedras	83,075	Southern Europe	✓		✓	
	Braga	193,333	Southern Europe	✓	✓		
Romania	Bucharest	1,883,425	Eastern Europe	✓	✓		
	Galaţi	304,639	Eastern Europe	✓	✓		
	Iaşi	349,992	Eastern Europe	✓			
	Oradea	204,625	Eastern Europe	✓			
Serbia	Novi Sad	262,856	Eastern Europe	✓			
	Niš	260,237	Eastern Europe	✓			
	Subotica	97,910	Eastern Europe	✓			
Slovakia	Banská Bystrica	78,758	Eastern Europe		✓		
	Prešov	87,886	Eastern Europe	✓			
Spain	Cornellà de Llobregat	89,936	Southern Europe	✓	✓	✓	
	Logroño	152,485	Southern Europe	✓			
	Murcia	441,354	Southern Europe	✓			
	Vincios	82,802	Northern Europe	✓			
Sweden	Jönköping	93,797	Northern Europe	✓			
	Stockholm	978,770	Northern Europe	✓	✓	✓	✓
	Växjö	66,275	Northern Europe	✓			
Switzerland	St Gallen	507,697	Western Europe	✓			
	Lausanne	137,810	Western Europe		✓		
	Zurich	402,762	Western Europe		✓		
Türkiye	Bursa-Osmangazi	3,056,120	Southern Europe	✓			
	Istanbul	15,462,452	Southern Europe	✓	✓		
	Izmir	4,367,251	Southern Europe	✓			
United Kingdom	Derry	83,625	Western Europe	✓	✓		
	Dundee	141,870	Western Europe	✓			
	Glasgow	598,830	Western Europe	✓	✓	✓	

Note: ([a]) The population figures presented are from various sources and not all from the same year (e.g. UNdata, Eurostat, municipal census data). They are shown to give a rough impression of cities' current sizes and do not necessarily reflect the exact number of inhabitants.

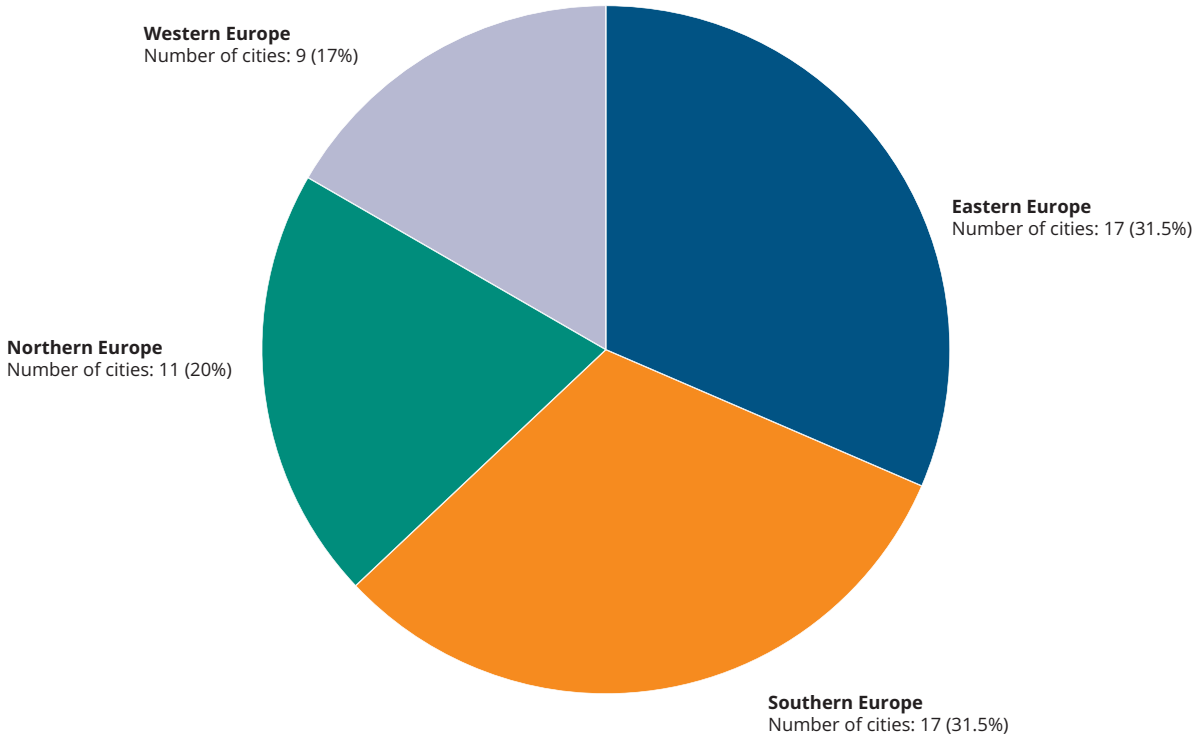
A2.1 Characteristics of participating cities

Geographical breakdown of survey respondents

In total, 56 cities responded to the current survey, and Figure A.2.1 shows their geographical distribution. Eastern and southern European cities had the highest proportion of respondents (both 31.5%). There was a slightly higher proportion of respondents from northern European cities (20%) than from western European cities (17%).

This is in contrast to the response rate in the previous survey, where eastern European cities represented just 8% and southern European cities 19%. This was partly driven by the fact that the previous sample was biased towards western and northern European cities, which have traditionally dominated the European Green Capital and Green Leaf Awards.
This second round of the survey therefore successfully accomplished the objective of building a more balanced view of the drivers of and barriers to environmental sustainability transitions in different European regions.

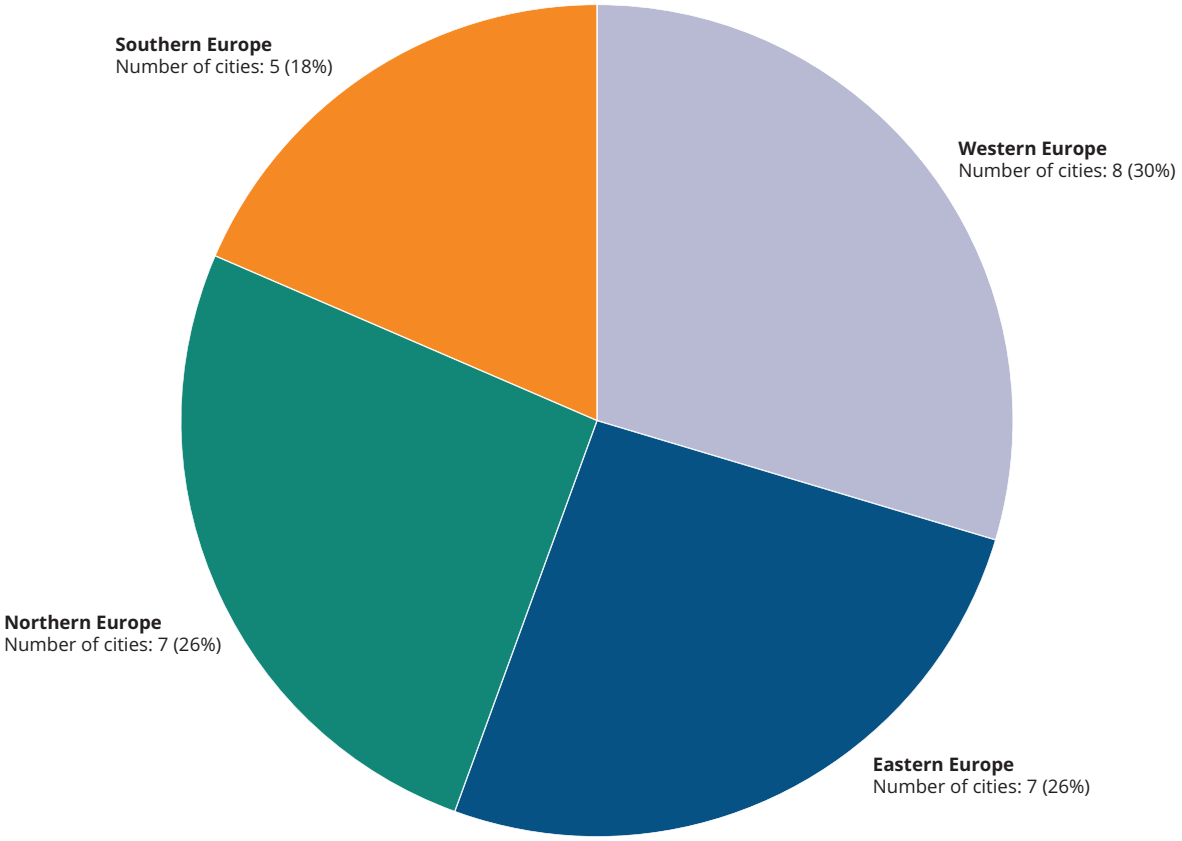
Figure A.2.1 Geographical distribution of survey respondents



Geographical breakdown of interview respondents

In total, 27 city representatives were interviewed, and Figure A.2.2 shows the cities' geographical distribution. In contrast to the survey, western European cities were most frequently represented in the interviews (30%), followed by both eastern European cities (26%) and northern European cities (26%). Southern European cities were the least well represented (18%). While every effort was made to keep the interview sample as balanced as possible, some city officials, particularly in southern European cities, were reluctant to agree to an interview, because of language barriers, a lack of resources allowing them to dedicate time to the process, or administrative hurdles making it challenging for them to get sign-off to speak on behalf of the city as part of this project.

Figure A.2.2 Geographical distribution of interview respondents



Survey participation by city size

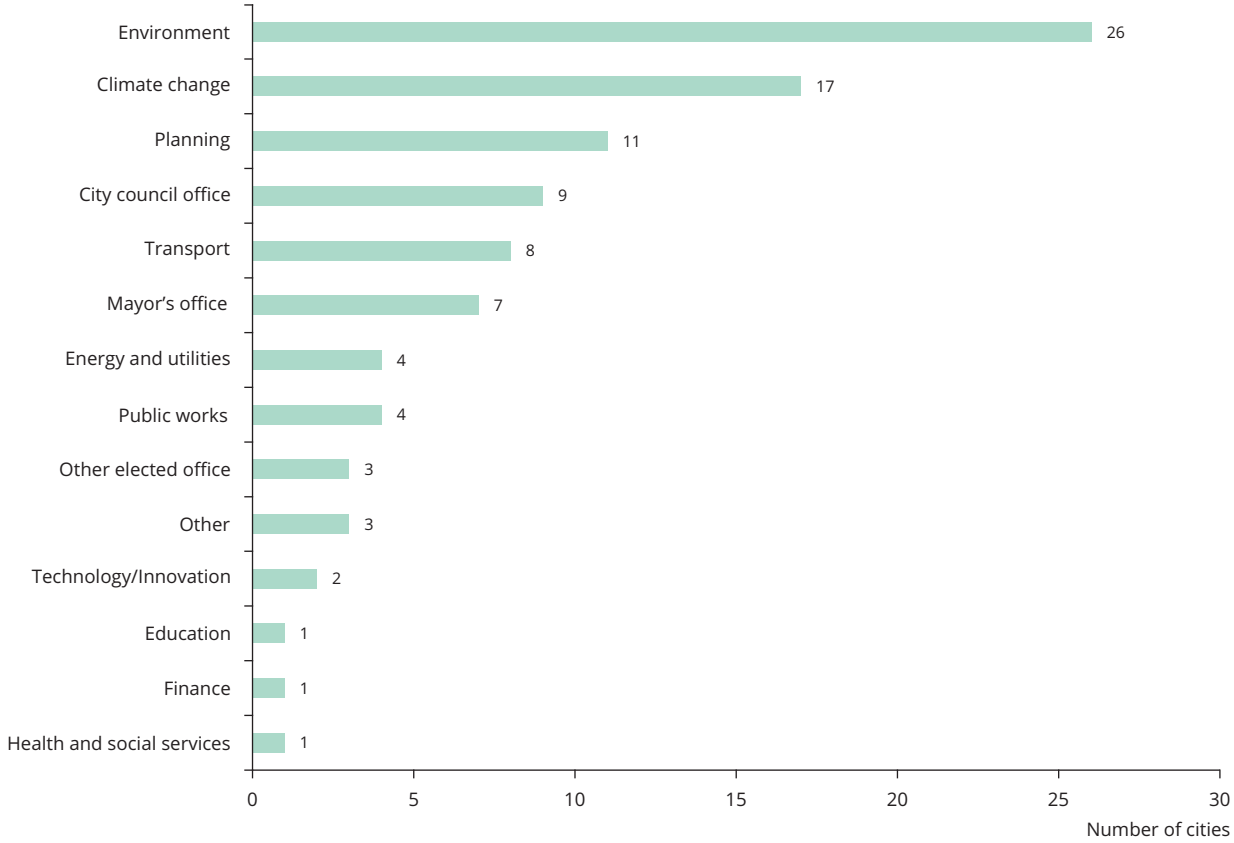
Of the 56 cities that were represented in the survey, 36% were classed as large cities, and 64% were classed as smaller cities. A large city was classed as any urban area with a population of more than 250,000. The largest urban area represented in the survey was Istanbul (Türkiye) with a population of 15,462,452 inhabitants ([14]). The smallest was Agia Varvara (Greece), with a population of 26,550 inhabitants.

A2.2 Survey respondents

Figure A.2.3 presents the specific government department to which the survey respondents were affiliated. Most of the city representatives who responded to the survey worked in their city's environment departments (26 of the cities, or 46%). A significant number also worked in their city's climate change department (17 of the cities, or 30%). The other most common departments or sectors selected were planning, city council office, transport and mayor's office, which accounted for 20%, 16%, 14% and 12.5% of respondents, respectively. When selecting contacts from a city's municipal departmental website, the approach taken was to email those who would be best placed to answer questions about sustainability, reflected in the fact that environment and climate change departments were the most commonly selected departments.

When searching for email contacts, it was often difficult to identify the most relevant city department for sustainability transitions. Because of this, the city council office and mayor's office were the third and fifth most selected departments, respectively. Information for these departments was generally easier to find than information on specific sectoral departments. This was particularly the case for western European cities, and this may be part of the reason for this region's relatively low participation in the survey compared with other regions (see Figure A.2.1). In addition, several respondents selected more than one department. Ninety-seven departments were selected, despite there being only 56 responses to the survey. This could be because respondents consulted colleagues from other departments, or because their roles or departments are integrated across various thematic areas. The latter reason may be especially true for smaller cities.

Figure A.2.3 Department or sector of the city administration where survey respondents work



([14]) The population figures presented are from various sources and not all from the same year (e.g. UNdata, Eurostat, municipal census data). They are shown to give a rough impression of cities' current sizes and do not necessarily reflect the exact number of inhabitants.

Annex 3 Urban environmental sustainability transitions survey

A3.1 Selection of cities and survey dissemination

Initially 400 cities across Europe from all EEA member countries and cooperating countries were selected as potential candidates for the current survey. Because of their inclusion in the previous research, cities from the United Kingdom were also included. Seeking balanced geographical and regional representation across Europe, cities included in the current survey had to satisfy one or more of the following criteria: having participated in the previous research (to enable comparison); having recently won or been a finalist in the European Green Capital Award (EGCA) or European Green Leaf Award (EGLA); having a population of between 50,000 and 250,000 (small and medium-sized cities); having a population above 250,000 (large cities); belonging to different European regions (i.e. northern, western, eastern and southern Europe); belonging to different regions within individual countries; and differing in population size within a country.

The decision to include the United Kingdom was based on the results of previous research showing that EU policies and initiatives are an important driver of urban environmental sustainability. With the United Kingdom having been an EU Member State for a long time, it is likely that (at least) some of its cities have been significantly influenced by the EU interventions, legislation and programmes (e.g. Horizon 2020, European Green Capital Award, European city networks). To avoid missing out on the opportunity to capture views, experiences and potentially lessons on urban sustainability transitions from the United Kingdom's cities, these were also included in the initial sample.

The survey questionnaire was published on EUSurvey. As noted above, 400 relevant city, council or mayoral officials' contacts were identified, largely through cities' public websites but also using project team's contacts to reach out to them directly. This was different from the approach taken in the previous project in which the identification of potential participants (encompassing city officials of 42 EGCA and EGLA winners and finalists) was supported by the European Commission's Directorate-General for Environment and the EEA.

Initially, the current survey was mainly disseminated through personalised emails using the EUSurvey tool. However, in the later stages the survey link was publicly advertised through social media and city networks. Potential survey respondents were also contacted by phone to encourage responses. Follow-up emails, phone calls and reminders on social media were used to boost the survey response rates.

A3.2 Survey questionnaire

About the survey

Thank you for completing this survey. It is part of a European Environment Agency (EEA) project to better understand what enables or hinders environmental sustainability transitions in European cities and how these factors may have changed due to the Covid-19 pandemic.

This survey follows a pilot survey with a smaller sample of cities in 2019 and is part of the EEA's ongoing work on urban sustainability. The results of this survey will directly inform this work, including the next European state of and outlook on the environment report (SOER) in 2025.

Responses across a wide range of different cities are critical to the success of this survey, and your participation is greatly appreciated. By participating, you can directly support the EEA's assessments and consequently inform EU and wider policy debate and formulation.

We also hope that taking part in this survey will give you a chance to reflect on your city's sustainability journey and trigger new ideas on and insights into urban policymaking.

Responding to this survey

While the survey is in English, replies to open-ended questions may be submitted in any European language. As a guide, the survey should take about 20-30 minutes to complete. When responding to the questions you might wish to consult colleagues, which may increase the amount of time it takes to complete the survey.

Please do not share this survey, as we are seeking only one response per city. However, you are of course welcome to consult with colleagues to help you complete the survey.

You can save your session at any time and return to the survey at a later stage. If you do so, **please remember to keep the link to your saved answers, as this is the only way to access them**. Once you have submitted all your answers, you will be able to download a copy of the completed questionnaire.

The survey is being conducted by Eunomia Research & Consulting Monoprosopi IKE (Eunomia), in partnership with Collingwood Environmental Planning (CEP), LSE Cities at the London School of Economics, and Milieu, on behalf of the EEA. In addition to the results from this questionnaire, there will be optional follow-up interviews with a selection of cities that have responded to the survey.

Publication of contributions

This survey uses the European Commission's platform EUSurvey. EUSurvey conforms to the policy on the protection of personal data by the EU community institutions.

Please note that responses received will be used to form the basis of a report that will be published online. Only the name of cities responding to the survey will be mentioned in this report, and all personal data will be kept confidential. Your answers will therefore be anonymous. For further information please read the specific privacy statement also referred to at the bottom of this web page.

In case of any problems or queries about this survey, please contact Špela Kolarič at CEP, s.kolaric@cep.co.uk, and Tugce Tugran at Milieu, tugce.tugran@milieu.be.

If you have questions about the wider EEA project, please contact Ivone Pereira Martins, IvonePereira.Martins@eea.europa.eu.

About you and your city

Please provide your name and email address, so we can contact you in case we have any questions about your responses. We may also reach out to invite you to participate in a follow-up interview or focus group, which would of course be entirely optional. All contact information will be kept confidential.

Name:

Email address:

Phone number (optional):

Do you consent to be contacted by the European Environment Agency (EEA) in relation to other projects or events related to urban sustainability?

☐ Yes ☐ No

1. In what country is your city?

2. What city do you represent?

3. Which of the following best describes the department/sector in which you work? If you (and your colleagues) work in more than one department or your department covers more than one area, please choose all that apply.

☐ Mayor's Office

☐ City Council Office

☐ Other elected office

☐ Education

☐ Environment

☐ Climate change

☐ Health and social services

☐ Public works

☐ Planning

☐ Technology/innovation

☐ Transport

☐ Finance

☐ Energy and utilities

☐ Public and international relations

☐ Culture

☐ Other

If other, please specify (*Word limit 10 words)*

Introduction

Understanding your city's environmental sustainability story.

4. What were the most important environmental challenges for your city and its region before the Covid-19 pandemic, and what are they now. ***Please select up to five (5) challenges from each column.***

	Before the Covid-19 pandemic	**Now**
Heat waves	☐	☐
Sea level rise	☐	☐
Severe storms and flooding	☐	☐
Water shortages/droughts	☐	☐
Forest fires	☐	☐
Air pollution	☐	☐
Water pollution	☐	☐
Ground contamination	☐	☐
Noise pollution	☐	☐
Light pollution	☐	☐
Energy shortages/scarcity	☐	☐
Drinking water shortages/scarcity	☐	☐
Timber, mineral and other natural resource shortages	☐	☐
Land/soil erosion	☐	☐
Food shortages/scarcity	☐	☐
Solid waste processing	☐	☐
Solid waste disposal	☐	☐
Sewage treatment and disposal	☐	☐
Stormwater management	☐	☐
Decline of native species/natural habitats	☐	☐
Lack/loss of green space	☐	☐
Lack/loss of ecologically productive land	☐	☐
Traffic congestion	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

5. What were the most important socio-economic challenges for your city and its region before the Covid-19 pandemic, and what are they now. ***Please select up to five (5) challenges from each column.***

	Before the Covid-19 pandemic	**Now**
Urban sprawl	☐	☐
Overcrowding	☐	☐
Inadequate or absent infrastructure	☐	☐
Community severance (a physical and psychological barrier created by e.g. roads or rail infrastructure)	☐	☐
Road congestion	☐	☐
Social exclusion	☐	☐
Unemployment rates	☐	☐
Lack of affordable housing	☐	☐
Insufficient public services	☐	☐
The Covid-19 pandemic or other communicable diseases	☐	☐
Non-communicable diseases (e.g. heart disease, cancer, asthma, diabetes)	☐	☐
Mental health	☐	☐
Demographic change	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

6. How significant are the following triggers in making environmental sustainability objectives an important part of your city's political agenda?

	Very significant	Somewhat significant	Not significant	I don't know
A specific environmental crisis	☐	☐	☐	☐
The Covid-19 pandemic	☐	☐	☐	☐
Another (non-environmental) crisis	☐	☐	☐	☐
A change in local political leadership	☐	☐	☐	☐
Pressure from national government, including national strategies and regulations	☐	☐	☐	☐
Pressure from the EU government, including EU strategies and regulations	☐	☐	☐	☐
Pressure from supranational organisations such as United Nations	☐	☐	☐	☐
EU funding mechanisms and programmes (e.g. EU-supported research and development activities such as H2020, FP7, Interreg, etc.)	☐	☐	☐	☐
Pressure from stakeholders	☐	☐	☐	☐
Public opinion/awareness	☐	☐	☐	☐
Other	☐	☐	☐	☐

If other, please specify (*Word limit 20 words)*

Understanding the drivers of urban environmental sustainability

The following sections will ask you more detailed questions about specific factors and how their importance to your city's sustainability transition may have shifted since the onset of the Covid-19 pandemic. These factors are grouped based on key enabling factors of the urban sustainability framework of the EEA. You can find more information about this framework here.

Context

Context is understood as the range of current and historical physical (e.g. geographical, environmental), cultural and institutional characteristics which create and shape the setting in which a specific city exists, develops and functions. These characteristics influence the ability of a city to transition to environmental sustainability.

7.A What were the most important contextual factors that supported or inhibited the environmental sustainability transitions in your city before the Covid-19 pandemic? Please select up to five (5) from each column.

	Supporting factor	**Inhibiting factor**
City size	☐	☐
Existing urban form (e.g. level of compactness)	☐	☐
Existing infrastructure (e.g. public transport network)	☐	☐
GDP per capita	☐	☐
Structure of the economy	☐	☐
Demographics	☐	☐
Level of gentrification	☐	☐
Geographic location (e.g. coastal, mountainous)	☐	☐
Climatic conditions	☐	☐
Natural assets	☐	☐
Air/water/soil quality	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

7.B What are currently the most important contextual factors that support or inhibit the environmental sustainability transitions in your city? ***Please select up to five (5) from each column.***

	Supporting factor	**Inhibiting factor**
City size	☐	☐
Existing urban form (e.g. level of compactness)	☐	☐
Existing infrastructure (e.g. public transport network)	☐	☐
GDP per capita	☐	☐
Structure of the economy	☐	☐
Demographics	☐	☐
Level of gentrification	☐	☐
Geographic location (e.g. coastal, mountainous)	☐	☐
Climatic conditions	☐	☐
Natural assets	☐	☐
Air/water/soil quality	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

Governance

Governance is understood as the structures and processes as well as the norms, values and rules through which affairs are conducted by political, business or community leaders exercising their power of authority.

8.A What were the most important factors related to national governance that supported or inhibited the environmental sustainability transitions in your city before the Covid-19 pandemic? ***Please select up to three (3) from each column.***

	Supporting factor	**Inhibiting factor**
Distribution of powers among levels of government: the extent of political decentralisation	☐	☐
International treaties	☐	☐
EU laws, standards and regulations	☐	☐
National laws, standards and regulations	☐	☐
Sub-national laws, standards and regulations	☐	☐
National taxes, subsidies or other economic instruments	☐	☐
Sub-national taxes, subsidies or other economic instruments	☐	☐
Flexibility and ability of the national/state government to respond/adjust to new situations	☐	☐
Actions and policy objectives of the national/state government	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

8.B What are currently the most important factors related to national governance that support or inhibit the environmental sustainability transitions in your city? ***Please select up to three (3) from each column in the table below.***

	Supporting factor	**Inhibiting factor**
Distribution of powers among levels of government: the extent of political decentralisation	☐	☐
International treaties	☐	☐
EU laws, standards and regulations	☐	☐
National laws, standards and regulations	☐	☐
Sub-national laws, standards and regulations	☐	☐
National taxes, subsidies or other economic instruments	☐	☐
Sub-national taxes, subsidies or other economic instruments	☐	☐
Flexibility and ability of the national/state government to respond/adjust to new situations	☐	☐
Actions and policy objectives of the national/state government	☐	☐
Other	☐	☐

If other, please specify (Word limit 20 words)

9. Have the following international and EU policy initiatives supported or inhibited the environmental sustainability transition in your city?

	Strongly supported	Slightly supported	Neither supported nor inhibited	Slightly inhibited	Strongly inhibited	I don't know
European Green Deal	☐	☐	☐	☐	☐	☐
Urban Agenda	☐	☐	☐	☐	☐	☐
New Leipzig Charter	☐	☐	☐	☐	☐	☐
Climate-Neutral and Smart Cities mission of the Horizon Europe programme	☐	☐	☐	☐	☐	☐
Other missions under Horizon Europe programme	☐	☐	☐	☐	☐	☐
Other EU-supported research and development activities	☐	☐	☐	☐	☐	☐
NextGenerationEU — the EU recovery plan from the Covid-19 pandemic	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐

If other, please specify (Word limit 20 words)

10.A What were the most important factors related to local governance that supported or inhibited the environmental sustainability transitions in your city before the Covid-19 pandemic? ***Please select up to three (3) from each column.***

	Supporting factor	**Inhibiting factor**
Local government overall vison and strategic plans	☐	☐
Individual political leadership	☐	☐
Election cycles/term times	☐	☐
Flexibility and ability of local government to respond/adjust to new situations	☐	☐
Level of civic engagement and public participation	☐	☐
Implementation of local governance innovations	☐	☐
Measurable targets and monitoring of policy objectives	☐	☐
Level of coordination and integration of environmental sustainability objectives with other sectors	☐	☐
Trade-offs of environmental sustainability with other objectives	☐	☐
Planning culture and practices	☐	☐
Models of public service delivery (public, private, public-private partnership)	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

10.B What are currently the most important factors related to local governance that support or inhibit the environmental sustainability transitions in your city? ***Please select up to three (3) from each column.***

	Supporting factor	**Inhibiting factor**
Local government overall vison and strategic plans	☐	☐
Individual political leadership	☐	☐
Election cycles/term times	☐	☐
Flexibility and ability of local government to respond/adjust to new situations	☐	☐
Level of civic engagement and public participation	☐	☐
Implementation of local governance innovations	☐	☐
Measurable targets and monitoring of policy objectives	☐	☐
Level of coordination and integration of environmental sustainability objectives with other sectors	☐	☐
Trade-offs of environmental sustainability with other objectives	☐	☐
Planning culture and practices	☐	☐
Models of public service delivery (public, private, public-private partnership)	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

Knowledge

Knowledge is understood as key insights, skills and expertise related to urban environmental sustainability processes, their management and options for action held by individuals within a group or among groups ([15]).

11.A What were the most important factors related to knowledge that supported or inhibited the environmental sustainability transitions in your city before the Covid-19 pandemic? ***Please select up to three (3) from each column.***

	Supporting factor	**Inhibiting factor**
Education system	☐	☐
Research and innovation	☐	☐
Skills in local government	☐	☐
Skills of local workforce	☐	☐
Communication and knowledge sharing between different levels of government	☐	☐
Communication and knowledge sharing within local government	☐	☐
Level of awareness of environmental sustainability	☐	☐
Level of shared understanding of sustainability issues in local government	☐	☐
Knowledge management and dissemination	☐	☐
Networks of cities and peer-to peer learning	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

([15]) This definition draws on the EEA MDIAK (monitoring-data-indicator-assess-knowledge) framework.

11.B What are currently the most important factors related to knowledge that support or inhibit the environmental sustainability transitions in your city? ***Please select up to three (3) from each column.***

	Supporting factor	**Inhibiting factor**
Education system	☐	☐
Research and innovation	☐	☐
Skills in local government	☐	☐
Skills of local workforce	☐	☐
Communication and knowledge sharing between different levels of government	☐	☐
Communication and knowledge sharing within local government	☐	☐
Level of awareness of environmental sustainability	☐	☐
Level of shared understanding of sustainability issues in local government	☐	☐
Knowledge management and dissemination	☐	☐
Networks of cities and peer-to peer learning	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

Culture

Culture is understood as shared characteristics (e.g. language, religion, cuisine, etc.), patterns of behaviour (e.g. social habits, etc.) and understanding/attitude towards an issue (e.g. urban environmental sustainability and willingness to adopt new behaviour) of a particular group of people (in urban areas) that are learned by socialisation ([16]).

12.A What were the most important factors related to culture that supported or inhibited the environmental sustainability transitions in your city before the Covid-19 pandemic? ***Please select up to three (3) from each column.***

	Supporting factor	**Inhibiting factor**
Willingness by local government to adopt new behaviours and practices (e.g. social innovation)	☐	☐
Willingness by the general public to adopt new behaviours and practices (e.g. social innovation)	☐	☐
Values and attitudes towards environmental sustainability within local government	☐	☐
Values and attitudes to environmental sustainability by the general public	☐	☐
Framing of environmental sustainability in public discourse	☐	☐
Level of sensitivity of local government to local culture (e.g. traditions, diversity, inclusiveness, heritage, religion)	☐	☐
Level of public engagement	☐	☐
Social and economic power dynamics	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

([16]) This definition draws on the Center for Advanced Research on Language Acquisition. Available at: http://carla.umn.edu/culture/definitions.html

12.B What are currently the most important factors related to culture that supported or inhibited the environmental sustainability transitions in your city? ***Please select up to three (3) from each column.***

	Supporting factor	**Inhibiting factor**
Willingness by local government to adopt new behaviours and practices (e.g. social innovation)	☐	☐
Willingness by the general public to adopt new behaviours and practices (e.g. social innovation)	☐	☐
Values and attitudes towards environmental sustainability within local government	☐	☐
Values and attitudes to environmental sustainability by the general public	☐	☐
Framing of environmental sustainability in public discourse	☐	☐
Level of sensitivity of local government to local culture (e.g. traditions, diversity, inclusiveness, heritage, religion)	☐	☐
Level of public engagement	☐	☐
Social and economic power dynamics	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

Technology

Technology is understood as different types of products and processes used to facilitate or support changes in practices, processes and behaviours in different forms and areas of technological development, including education, construction, transportation, energy, information and communication among others.

13.A What were the most important factors related to technology that supported or inhibited the environmental sustainability transitions in your city before the Covid-19 pandemic? ***Please select up to five (5) from each column.***

	Supporting factor	**Inhibiting factor**
Information telecommunication technology (ICT)	☐	☐
Big data analytics	☐	☐
Low carbon technologies (electric vehicles, solar PV, smart meters, etc.)	☐	☐
Technologies for environmental monitoring (e.g. air quality monitors)	☐	☐
E-governance	☐	☐
Mobility platforms combining transport ticketing and mobile payments	☐	☐
Electrification of public transport	☐	☐
Electrification of personal vehicles	☐	☐
Electrification of 'non-powered' such as bikes, scooters, skateboards	☐	☐
Online retail and e-commerce (including buying groceries, clothes and other products online)	☐	☐
Remote working	☐	☐
Remote learning	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

13.B What are currently the most important factors related to technology that support or inhibit the environmental sustainability transitions in your city? ***Please select up to five (5) from each column.***

	Supporting factor	**Inhibiting factor**
Information telecommunication technology (ICT)	☐	☐
Big data analytics	☐	☐
Low carbon technologies (electric vehicles, solar PV, smart meters, etc.)	☐	☐
Technologies for environmental monitoring (e.g. air quality monitors)	☐	☐
E-governance	☐	☐
Mobility platforms combining transport ticketing and mobile payments	☐	☐
Electrification of public transport	☐	☐
Electrification of personal vehicles	☐	☐
Electrification of 'non-powered' such as bikes, scooters, skateboards	☐	☐
Online retail and e-commerce (including buying groceries, clothes and other products online)	☐	☐
Remote working	☐	☐
Remote learning	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

14. Please select up to five (5) sectors in which the environmental sustainability transition will be most influenced by technological development.

Government and administration	☐
Transport	☐
Energy generation, distribution and storage	☐
Land management and planning	☐
New building construction to improve sustainability and energy efficiency	☐
Retrofitting existing buildings to improve sustainability and energy efficiency	☐
Water management	☐
Waste management	☐
Environment and nature protection and conservation	☐
Agriculture	☐
Forestry	☐
Health	☐
Education	☐
Other	☐

If other, please specify (*Word limit 20 words)*

Data and information

Data is understood as raw, unorganised facts in various forms (e.g. big data, open data, etc.) on relevant issues, whereas information is processed, organised and/or structured data so as to make it useful to form knowledge on a subject, issue, event or process relevant to achieve (urban environmental) sustainability transitions.

15.A What were the most important factors related to data and information that supported or inhibited the environmental sustainability transitions in your city before the Covid-19 pandemic? ***Please select up to three (3) from each column.***

	Supporting factor	**Inhibiting factor**
Data and information collection practices (e.g. statistical services, qualitative and quantitative data collection)	☐	☐
Data and information sharing practices (e.g. open data)	☐	☐
Accessibility of data and information (e.g. formats and ease of accessing)	☐	☐
Presentation and communication of data and information (e.g. analysis and linking data to policy outcomes)	☐	☐
Quality (e.g. robustness, reliability, relevance, comparability, compatibility) of data and information	☐	☐
Scale of available data (e.g. national, regional, local)	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

15.B What are currently the most important factors related to data and information that support or inhibit the environmental sustainability transitions in your city? ***Please select up to three (3) from each column.***

	Supporting factor	**Inhibiting factor**
Data and information collection practices (e.g. statistical services, qualitative and quantitative data collection)	☐	☐
Data and information sharing practices (e.g. open data)	☐	☐
Accessibility of data and information (e.g. formats and ease of accessing)	☐	☐
Presentation and communication of data and information (e.g. analysis and linking data to policy outcomes)	☐	☐
Quality (e.g. robustness, reliability, relevance, comparability, compatibility) of data and information	☐	☐
Scale of available data (e.g. national, regional, local)	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

Finance

Finance is understood as the provision and management of public/government money and the process of acquiring funds through traditional (e.g. taxes, public-private partnerships) and innovative (e.g. micro-contributions/crowd-funding, land value capture) financial mechanisms to support green investments and the transition towards urban environmental sustainability.

16.A What were the most important factors related to finance that supported or inhibited the environmental sustainability transitions in your city before the Covid-19 pandemic? ***Please select up to five (5) from each column.***

	Supporting factor	**Inhibiting factor**
Level of fiscal decentralisation	☐	☐
Level of own-source revenues (e.g. local taxes, fees, charges)	☐	☐
Level of multilateral EU funding (e.g. European Regional Development Fund)	☐	☐
Level of multilateral international funding (e.g. United Nations Multilateral Fund)	☐	☐
Level of bilateral funding (e.g. from donor countries)	☐	☐
Level of national/state government public funding for environmental sustainability	☐	☐
Level of regional/local funding for environmental sustainability	☐	☐
Level of private sector funding for environmental sustainability	☐	☐
Level of public investment in research and development	☐	☐
Level of private investment in research and development	☐	☐
Level of funding for infrastructure projects (both private and public sources)	☐	☐
Level of funding for public service operations and maintenance (both private and public sources)	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

16.B What are currently the most important factors related to finance that support or inhibit the environmental sustainability transitions in your city? ***Please select up to five (5) from each column.***

	Supporting factor	**Inhibiting factor**
Level of fiscal decentralisation	☐	☐
Level of own-source revenues (e.g. local taxes, fees, charges)	☐	☐
Level of multilateral EU funding (e.g. European Regional Development Fund)	☐	☐
Level of multilateral international funding (e.g. United Nations Multilateral Fund)	☐	☐
Level of bilateral funding (e.g. from donor countries)	☐	☐
Level of national/state government public funding for environmental sustainability	☐	☐
Level of regional/local funding for environmental sustainability	☐	☐
Level of private sector funding for environmental sustainability	☐	☐
Level of public investment in research and development	☐	☐
Level of private investment in research and development	☐	☐
Level of funding for infrastructure projects (both private and public sources)	☐	☐
Level of funding for public service operations and maintenance (both private and public sources)	☐	☐
Other	☐	☐

If other, please specify (*Word limit 20 words)*

17. How has the proportion of your city's budget/expenditure on environmental sustainability measures changed due to the Covid-19 pandemic?

- ☐ Increased significantly
- ☐ Increased slightly
- ☐ Stayed the same
- ☐ Decreased slightly
- ☐ Decreased significantly
- ☐ I don't know

18. What are currently the five most important spending priorities to achieve your city's environmental sustainability objectives? ***Please select from the list below.***

- ☐ Walking and cycling infrastructure
- ☐ Public transport infrastructure
- ☐ Public transport operations and maintenance
- ☐ Other transport innovations (e.g. integrated ticketing, shared mobility offer)
- ☐ Road space reallocation (e.g. traffic calming measures, public realm improvements)
- ☐ Electrification of municipal fleets
- ☐ Electric charging infrastructure
- ☐ Expanding green and blue infrastructure
- ☐ Renewable energy generation
- ☐ Retrofitting buildings
- ☐ Sustainable food systems
- ☐ Environmental education for schools
- ☐ Waste management services (e.g. recycling)
- ☐ Water and wastewater management
- ☐ Other (please specify) (*Word limit 20 words)*

The impact of COVID-19

19. Overall, what impact has the Covid-19 pandemic had on your city's environmental sustainability transition?

☐ Strongly positive (i.e. it has accelerated the transition)
☐ Somewhat positive
☐ Neither positive nor negative
☐ Somewhat negative
☐ Very negative (i.e. it has slowed down the transition)
☐ I don't know

20. To what extent are environmental sustainability objectives integrated into your city's Covid-19 recovery plan(s)?

Significant level of integration between environmental sustainability objectives and recovery plan(s)	☐
Some level of integration between environmental sustainability objectives and recovery plan(s)	☐
Limited level of integration between environmental sustainability objectives and recovery plan(s)	☐
We do not have any recovery plans	☐

21. Looking across the six enabling factors please rank them in order of the degree to which they have changed due to the Covid 19-pandemic on a scale from 1 to 6 (1 — most significant change and 6 — least significant change)

☐ Governance
☐ Culture
☐ Knowledge
☐ Technology
☐ Data and information
☐ Finance

Many thanks for taking the time to contribute to this survey. We really appreciate your time!

Annex 4
Urban environmental sustainability transitions interviews

Selection of cities

Cities were selected in a way that provided a balance in their geographical distribution (across northern, western, eastern and southern Europe) as well as in their size (50,000 to 250,000 inhabitants for smaller cities/towns; over 250,000 inhabitants for larger cities).

Ideally, all the cities that took part in the interviews would have previously completed the survey. However, practicalities (e.g. low survey response rate, availability of city officials) meant that some cities were not able to take part in both. This resulted in some cities being interviewed without completing the survey.

Interview questions

Big picture

1. What would you consider to be the most important achievement(s) of your city to date when it comes to environmental sustainability?

Enabling factors

1. What would you say have been the most significant drivers that have helped in your city's environmental sustainability transition?

2. Are there any drivers or enabling factors you believe have contributed positively to your sustainability transition that make your city stand out from other cities (nationally or within the EU)?

3. Have any of these drivers been either directly or indirectly impacted by the Covid-19 pandemic? If so, can you provide concrete examples?

Barriers

1. What are the biggest challenges or barriers your city has faced when it comes to achieving the transition towards greater environmental sustainability? Would you say that these challenges are mostly political, contextual, technical, financial, cultural or something else?

2. Are there any particular challenges or barriers in your city that have either been worsened or created by Covid-19? If so, what are they, and is your city doing anything to overcome them?

Managing the transition

1. Can you describe in a bit more detail some of the systemic factors (e.g. large governance, economic and cultural shifts) that you believe have contributed the most to the sustainability journey of your city? Have there been any clear catalysts/events that really made a difference?

2. Can you describe how/if your city applies long-term strategic planning to advance towards its sustainability goals? For example, have you significantly changed the way you allocate your budget and other resources or made any other changes, and what difference has that made to the city's progress?

3. Have these longer-term plans been disrupted by the Covid-19 pandemic and, if that is the case, how?

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