



Social approach to the transition to smart cities

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This study explores the main impacts of the smart city transition on our cities and, in particular, on citizens and territories. In our research, we start from an analysis of smart city use cases to identify a set of key challenges, and elaborate on the main accelerating factors that may amplify or contain their impact on particular groups and territories. We then present an account of best practices that can help mitigate or prevent such challenges, and make some general observations on their scalability and replicability. Finally, based on an analysis of EU regulatory frameworks and a mapping of current or upcoming initiatives in the domain of smart city innovation, capacity-building and knowledge capitalisation, we propose six policy options to inform future policy-making at EU level to support a more inclusive smart city transition.

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Executive summary

The smart transition is a reality across cities and communities of all sizes and latitudes and has been for decades. However, its pace has increased in recent years, largely due to the speed of the energy transition to which it is closely linked, as well as the deployment of new ways of working and learning, hastened by the COVID-19 pandemic, which rely heavily on digital tools. Another factor which has accelerated this process is the recognition of the need to build a more inclusive and connected society where civic and social engagement overcomes any distance. However, no transformation comes without costs. This study explores the main impacts of such a transition on our cities and, in particular, on citizens and aims to make a contribution on the identification of policy measures to mitigate such risks and, in turn, to promote practices that allow for a socially responsible transition.

Our starting point was the **smart city concept**, for which several definitions and approaches exist. We make a journey in the evolution of the concept from its more traditional high-tech based conception, to more contemporary approaches that link innovation with sustainability, and finally a concept that takes a more holistic approach encompassing a human and socially centred foundation.

As smart cities are complex and dynamic constructions with no clear boundaries but rather very specific local features, we have developed a framework to deconstruct the concept into five components: **smart & safe living, smart governance and e-citizen, smart mobility, smart environment and smart economy**. For each component, we have analysed a number of specific applications, or use cases. One example includes smart governance, where we have looked at the digitisation of municipalities' internal services, or at the use of citizen portals and e-services for citizens' administrative procedures.

In our analysis we have mapped the impacts of 25 use cases across six domains: economic, environmental, ethical, political/legal, social and technological and observed specific effects on different demographic groups and territorial scales. The main outcome of our analysis on these results has been the identification of 48 risks, which can be clustered under six core macro-challenges:

Six macro-challenges identified



- Loss of human contact and isolation through remote care, work, training and shopping;
- Potential dependency on private technology providers and vendor lock-in.

It is important to note that these challenges and their underlying risks may **impact a city across different layers** – some are specifically relevant for city administrations and local institutions, others affect groups or categories of economic operators and sectors, and several affect individuals, based on their age, digital literacy, societal background, but also simply based on where they live. In that sense, discrepancies in impact cannot be reduced to the dichotomy of city/rural area, because crucial differences can sometimes be observed at a neighbourhood level. This is also due to a **high reliance on private operators** to provide services. We also

observed that some social effects of the transition might be overlooked as they are often an indirect or secondary effect. Finally, we found that experience does not always guard against the negative effects of the transition. Scandinavian countries, which are highly digitalised (from e-governance to e-learning, practices have been in place for decades) still face challenges such as scepticism and lack of trust even across younger generations, or the growing sense of social isolation due to, for instance, prolonged teleworking practices.

Beyond identifying impacts and challenges, we **mapped best practices across European cities** which tackle the above-mentioned challenges. We have identified 27 successful cases, which address each at least one macro challenge, are also affordable for smaller communities and most importantly can be replicated by other cities. Out of these best practices, four particularly representative cases were selected to allow for a more detailed analysis.

In summary, while best practices are a valuable instrument for inspiring and promoting the upscaling or further testing of successful or promising procedures, solutions and approaches, what we found is that:

- Funding sources are diverse, from public funding to venture capital to shared resources by participating companies – however the good news is that several practices are relatively easy to adopt and do not require a high budget;
- There is rarely any monitoring and evaluation structure in place to assess impact and overall evaluate success of these solutions;
- Best practices often remain at a pilot stage, there is generally no scale-up or sustainability strategy in place once they are designed and implemented.

Finally, based on the insights gained from the best practices and building on our understanding of the risks and challenges that cities face, we have **developed a set of policy options to inform EU policy design and legislation**. These options have been designed not only taking the most pressing needs of cities and citizens into account, but also considering current policy initiatives and the legislative framework at the EU level, to ensure they could be fine-tuned and implemented within the existing context. In that respect, we have screened EU legislation, programmes, and initiatives with a focus on policy on privacy and e-identity aspects, or policies directly targeting smart cities such as the recently launched EU mission on climate-neutral and smart cities or the forthcoming European urban initiative and its predecessors. We also considered independent movements such as 'Living in EU' and forward-looking communications and strategies like the New Leipzig Charter or the digital finance strategy for the EU.

We reviewed an initial long list of 15 policy options and combined or shortlisted six based on:

- Whether there is a possibility for policy-makers at the EU level to act upon it;

City layers impacted by identified macro-challenges



- The extent to which the policy option builds upon and integrates the existing policy framework and EU objectives;
- Whether the option has EU added value and its delivery is realistic.

The six options are listed here and described in greater detail in Chapter 4 of this report:

- Set up a supervisory body for certification and quality assurance of the digital infrastructure in cities;
- Strengthen the role of national contact points to better link EU and local realities and support capitalisation and upscale;
- Set up helpdesks for less-digitalised cities;
- Reinforce capacity building of public administrations to strengthen digital skills and promote capitalisation through peer-to-peer learning;
- Research and provide further evidence on the benefits and costs associated with remote working and service provision in cities;
- Create a knowledge platform for best practices to support replicability and scale up of inclusive smart city solutions.

To conclude, we wish to highlight a few final considerations and takeaways from this study:

- **Networks and programmes that promote and enable the exchange of knowledge** and allow cities to work together are greatly appreciated by their members and there is a need to further build on initiatives such as the urban agenda, whose second phase is about to take off, or URBACT, which is about to launch its fourth iteration. The challenge though is to better **engage small and medium-sized cities** (generally considered as having between 50 000 and 500 000 inhabitants) across the EU, and for that adequate funding, capacity building and ad hoc expert support (including to overcome language barriers) is needed;
- While concepts like smart communities and people-centred smart cities have started to emerge, **citizens are not yet protagonists of the transition**. Priority should be placed on **tackling the vast inequalities that still exist** in terms of access to services, digital literacy – and there EU, national and local institutions should take responsibility. What could be further encouraged is the design of participatory approaches such as in the context of the above-mentioned EU smart cities mission and the new European Bauhaus initiative, where residents can make their voice heard, and several stakeholders including from civil society and private sectors co-design solutions that are fit for the urban space;
- Finally, as for the Just Transition, a **more holistic approach that ensures that no one is left behind should be promoted**, the policy guidance at EU level, funding schemes as well as capitalisation activities should take that as guiding principle. The launch of the new programming period and design or reiteration of programmes and initiatives dedicated to cities could provide the right opportunity to embed some of these perspectives and ideas and turn them into action.

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1. Introduction

Ecorys, Fraunhofer FOKUS and IDATE SAS are pleased to present the final report of the study entitled 'Social approach of the transition to smart cities', commissioned by the Panel for the Future of Science and Technology (STOA) of the European Parliament. The aim of this study is to explore how the deployment of technologies, including digitalisation, in the context of smart cities and smart territories, can be implemented in a socially responsible way. In this context, we explore possible **risks for individuals, communities, but also territories of different scale**.

In this final report, we present main findings along the three tasks upon which our methodology was built. In particular:

Figure 1.1 - Objectives of our tasks



Chapter 2 will dive into the evolution of the smart city concept and present our findings in relation to societal challenges of the smart city transition by identifying a set of impacts and risks (Task 1), based on

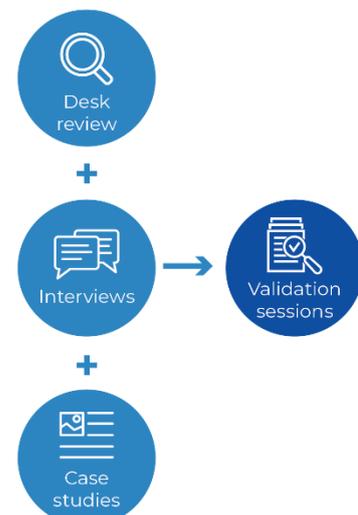
the analysis of smart city use cases. Next, in **Chapter 3**, we will introduce a selection of best practices for the prevention and mitigation of such challenges, as well as detail our approach to shortlist them, our results and a discussion on considerations related to replicability and future use (Task 2). Finally, **Chapter 4** will provide an overview of the EU regulatory context and relevant initiatives for supporting cities in managing their smart city transition in an inclusive and socially responsible way, as well as our approach to identifying and shortlisting potential policy options for EU decision makers, which we then introduce. To make this deliverable compact, we only present main considerations and findings in the body of the report, but have included a number of annexes for those readers that wish to learn more about our methodology, as well as our mapping and desk review outcomes.

1.1. Overview of activities implemented and methodological approach

For this study we have used a **mixed-method approach** based on desk research, interviews, case studies and validation sessions. The team conducted numerous interviews throughout all tasks, with relevant stakeholders from academia, European institutions and city administrations as well as networks and associations.

The interviews were instrumental to help define key challenges by **learning about concrete experiences especially from city officials around Europe**, and to collect views on policy priorities and possible solutions to tackle the main shortcomings or limitations of current approaches to the transition coming from different levels of

Figure 1.2 - Overview of our methods



governance.¹ Since the study aims at defining policy recommendations for EU action to be implemented and have effect at city level, it was essential to adopt a **multi-governance approach** that could capture needs and opportunities at both levels.

In addition, we also organised two validation sessions for a small selection of stakeholders: the first debated our outcomes related to the challenges and main factors mitigating or escalating the risks, as well as provided an opportunity to present best practices per core challenge. The second and last session was instrumental to discussing the proposed policy options and refining their formulation.

We commenced our research with a literature review to identify emerging smart city concepts and trends, classifications and policy approaches to the transition. As a result, we defined our approach to smart city components, which we used for the identification of possible impacts and risks. This review further included the creation of a matrix to examine possible risks posed by concrete use cases under each smart city component. We categorised **48 risks across macro-challenges** and studied their implications across different stakeholders and territories. We then complemented and refined these findings through a number of interviews.

The team also carried out **five short case studies** which looked at experiences from Malaga, Zagreb, Oulu, Vienna and Nantes, to capture insights related to strategies, policy approaches to the transition as well as lessons learned, and complement our research framework, which was based on specific smart city components with some more holistic perspectives.

In parallel, the team also began the desk research for Task 2, regarding the identification of best practices to tackle the potential challenges posed by the smart city transition across European cities. Our research resulted in the shortlisting of **27 best practices** relevant to the macro-challenges identified in Task 1. These best practices were classified based on: i) the macro-challenge they mitigate/prevent, ii) group addressed, iii) digital literacy required, iv) territorial area particularly affected, v) implementation and financing, and vi) implementation conditions.

The team also gathered information on existing regulatory gaps that could potentially be tackled through new action at EU level to overcome those challenges or further support the implementation, upscale and replication of best practices. Out of the 15 policy options that the team collected, we shortlisted a selection based on three main criteria: i) whether there is a possibility for policy-makers at the EU level to act, ii) the extent to which the policy option builds upon and can integrate existing policy frameworks and EU objectives, and iii) whether the option has EU added value and its delivery is realistic. Following this analysis, we recommend **six policy options** for further consideration, which we have crafted based on the outcomes of the previous tasks and on which we have received feedback from a variety of stakeholders also representing cities and EU institutions (primarily European Commission Directorates-General, DG CNECT, DG REGIO and DG RTD).

1.2. Scope and limitations of this study

This is a relatively small study, so it was essential to define a clear scope for research. As the concept of smart cities is rather broad, it was essential to make some choices which we would like to briefly illustrate here by mentioning a few core features of our methodological approach:

- **Generalisation vs territorial specificity:** we recognise that there is no size that fits all and that a specific effect or impact could be more or less relevant depending on the specific territory, city size and geographic location. It should also be noted that some issues might be relevant for a specific territorial reality and have a very large impact there, but not

¹ In that respect, the team also attended the Villes Intelligentes Inclusives conference – hosted on 2 February 2022 by the French Ministry of Foreign Affairs and the National Federation of Urban Agencies.

necessarily for most, which does not mean they are not worth investigating. In this study, we aimed to take into account the territorial scale and dimension of specific impacts as much as possible, however our primary aim was to identify the most common issues and criticalities which could be considered recognisable across cities of differing size and location;

- **Focus on ICT aspects of the transition:** we focused on the smart city transition primarily from an ICT perspective, although we recognise that smart does not necessarily mean digital. In that sense, we have also considered some best practices where the innovation element is not mainly provided through technology. The reason for our emphasis on ICT is that its digital angle remains the most controversial in terms of societal impacts and divide, furthermore, the digital transition is also one of the top European Commission and cohesion policy priorities for the new programming period;
- **Tension between focus on the urban level and policy options for EU decision makers:** while the context of transition is the city itself, this study focused on what is being done, and what additional measures could be introduced at the EU level to steer and support the smart city transition at the local level. We therefore aimed to reconcile this tension by presenting policy options for the EU that could support the needs of local actors, by starting from an understanding of issues, needs and priorities at the city level and keeping a continuous multi-governance focus as part of our interviews and validation sessions.

2. Understanding smart cities, their social impacts and challenges

This chapter provides an account on the evolution of the smart city concept over the last decades, including the emerging term of a socially inclusive smart city. It furthermore identifies the main smart city components, their potential risks and based on that, describes the main social challenges associated with the transition to a smart city.

2.1. Smart city, a living concept

2.1.1. Defining smart cities

Although the smart city concept was initially promoted by large tech companies seeking to apply process optimisation solutions developed in the industrial world to the urban environment, it quickly found an echo in the face of the challenges facing cities, particularly in terms of urban population growth. Information and Communication Technology (ICT) is therefore closely linked to the concept of smart city. The concept of smart cities started to emerge when the rapid population increase experienced by urban centres in the past few decades triggered local governments to start adopting technologies to manage cities more efficiently. One of the main technologies used in that context was and still is Information and Communication Technology (ICT). The relationship between ICT and contemporary urbanism has been conceptualised using different terminology across time, e.g. wired cities, intelligent cities or sentient cities, but 'smart city' has prevailed in recent years as the one that combines all previous terms.

Since the emergence of the concept, many definitions have been proposed to capture it. On the one hand, over the past years and given the increasing political pressure on the need to enforce energy transition-related measures (building retrofitting, cut on emissions etc.), some smart city definitions **seem to predominantly focus on their greening element** and the way they use technologies to create more sustainable cities. For instance, the Amsterdam City Hall defines a smart city as one which uses 'innovative technology and is willing to change behaviour related to energy consumption to tackle climate goals'.²

On the other hand, there is a more nuanced and comprehensive approach to smart cities, not bound to a specific sector or priority and that wishes to encompass under the concept a comprehensive and integrated way of living the city. **This narrative highlights the use of technology to make cities more efficient and enjoyable for their citizens.** This includes the concept of **socially inclusive smart cities** where smart city development is based on a citizen-centric approach, revolving around people's needs and solutions to their problems.

For example, a comprehensive definition of a smart city is used by the European Commission: 'A smart city is a place where traditional networks and services are made more efficient with the use of digital solutions for the benefit of its inhabitants and business.'

Adding to this, the definition continues: '**A smart city goes beyond the use of digital technologies** for better resource use and less emissions. It means smarter urban transport networks, upgraded water supply and waste disposal facilities and more efficient ways to light and heat buildings. It also

² Montes, J. (2020). A Historical View of Smart Cities: Definitions, Features and Tipping Points.

means a more interactive and responsive city administration, safer public spaces and meeting the needs of an ageing population.³

Evidently, a common definition is yet to be developed or might never be in place as it is subject to the interpretation and aspirations of different stakeholders. However, most of the existing projects clearly revolve around **the use of technology to gather and process information for monitoring, optimising, and managing the city**. In particular, seven distinct features of smart cities can be highlighted:⁴

- 1 **Broad use of ICT** as the core element of smart cities as they connect infrastructure and services as well as increase the quality of life of city residents;
- 2 **Use of technologies and innovation** to improve well-being;
- 3 **A business-friendly environment** with a sense of cooperation and consultation between authorities, industry and communities;⁵
- 4 **Openness** through the idea of a smart city as an open innovation platform to foster the empowerment of citizens and communities;
- 5 **Real-time monitoring** and the use of data for city management;
- 6 **Citizen empowerment** as smart cities encourage programs aiming to increase social learning and education, and strengthen social capital;
- 7 **Sustainability** as smart cities also aim to create socially and environmentally sustainable cities by reducing the negative impacts of human activity.

2.1.2. The evolution of the concept

The way we consider smart cities has evolved over time. **Three generations of smart cities** are commonly acknowledged.

The first generation, or **Smart City 1.0**, followed a technology-driven approach promoted by large technology companies that led this movement in urban areas with the intention of selling technological solutions to cities to provide a more efficient way of managing urban challenges and activities. Providers such as IBM or Cisco were amongst the main promoters of this first generation.

The second generation, or **Smart City 2.0**, marked the ambition of city authorities and decision-makers to regain control on the objectives assigned to smart city development on their territory. The main goal was to enhance the quality of life in urban areas by using the beneficial aspects of technologies. This was observed by many researchers, some of which state that stakeholders in smart city 2.0 projects 'employ technical facilities to a great extent, but do not allow technology to expand uncontrollably, dominate urban life, or acquire decision-making authority'.⁶ Others highlight that smart city 2.0 is a new approach to some specific features, such as addressing social challenges, enhancing citizen well-being and public services, as well as focusing on significant endogenous problems and citizen needs that are not directly connected to technologies.⁷

³ European Commission. Smart cities: Cities using technological solutions to improve the management and efficiency of the urban environment. Available via https://ec.europa.eu/info/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en (Accessed on 20 April 2022).

⁴ Montes, J. (2020). A Historical View of Smart Cities: Definitions, Features and Tipping Points.

⁵ A good example of such a cooperation is Malaga's Smart City Cluster – an alliance of more than 190 companies and institutions that improve the quality of life of citizens – as well as Malaga Valley – a project to mirror Silicon Valley. For more info see Annex III on the city case studies.

⁶ Etezadzadeh, C. (2015). Smart city–future city?: Smart city 2.0 as a livable city and future market. Springer.

⁷ Trencher, G. (2019). Towards the smart city 2.0: Empirical evidence of using smartness as a tool for tackling social challenges. *Technological Forecasting and Social Change*, 142, 117-128.

The third generation of smart cities concentrated on the role of citizens in addressing their issues and assisting city managers in solving them.⁸ **Smart city 3.0** highlights the ability of all individuals to share their opinions and help decision-makers find the most reliable and practical solutions for social, environmental, and government challenges in cities.⁹ The focus is shifting towards more socially inclusive smart cities at this stage, where strong emphasis is given on equality. In addition, **it considers smart solutions that are not necessarily tech-driven ideas**. This approves the power of the smart city concept in addressing urban topics without solely focusing on its technological dimensions. However, more effort is still required to foster the inclusion of more groups within society, including people who either do not have the necessary skills to keep up with the technological advancement and/or are resistant to it.

With the growing concern on climate change, we see the **emergence of a fourth generation** of smart cities that will combine the priority of **matching the expected benefit of the digital transition with those of the green transition**. Moreover, we also observe the need for a digital transition that is not limited to urban areas, but rather concerns any community, whatever its size. With the improvement of fixed broadband and mobile networks, thanks to national plans supported by EU funds, all communities in the EU are confronted with the challenge of accompanying the digital transition of their territories, which has led to some proposing the term **smart community** or **smart territory** as an alternative to the city-centric view.

Most recently, COVID-19 has revealed **digital resilience and the ability to continue daily life during a pandemic** as an essential pillar of smart communities. Furthermore, COVID-19 has provided a gain in attractiveness of connected medium-sized cities for teleworkers that could afford to move from large cities. However, simultaneously it has also put further attention to digital inclusiveness as the **pandemic enforced existing social divides** by increasing the need for access to digital equipment, connectivity and skills in order to participate in society through remote working, learning and other digitally supported means. In particular, while the pandemic did not enlarge the digital divide, it heightened its consequences.¹⁰

2.1.3. The emergence and development of smart cities in Europe

The literature suggests that smart cities originally emerged as a response to four forces:¹¹

- The need for better tools to govern and control increasingly populated areas;
- The increasing advancement of computing technologies and ICT;
- The growing interest of large IT companies to deploy their technologies to improve cities' management;
- The increasing citizen interest in digital applications to create more liveable cities.

For over 20 years now, digital transition has taken place in cities across Europe. Digital plans for cities have been implemented since the 1990s, e.g. Amsterdam digital city – De Digital Stad, in 1994 or the first GSM base station in Oulu in 1992, followed by the first urban area free Wi-Fi in Oulu in 2003. However, things speeded up in the mid-2000s when IBM (Smarter Planet) and Cisco (Smart + Connected Communities) joined governmental efforts to improve the quality of life in urban centres, and launched their initiatives.

⁸ Hernández, C. A. (2021). The role of citizens in smart cities and urban infrastructures. In *Solving Urban Infrastructure Problems Using Smart City Technologies* (pp. 213-234). Elsevier.

⁹ Singh, P., Lynch, F., & Helfert, M. (2021). Role of Citizens in the Development of Smart Cities: Benefit of Citizen's Feedback for Improving Quality of Service. In *SMARTGREENS* (pp. 35-44).

¹⁰ IClaves and Esade (2021) Study on post Covid measures to close the digital divide, BEREC.

¹¹ Montes, J. (2020). A Historical View of Smart Cities: Definitions, Features and Tipping Points. Features and Tipping Points (June 1, 2020).

Since 2010, the move towards smart cities accelerated in Europe, as illustrated by the first edition of the Smart City World Congress that took place in Barcelona in 2011. Different initiatives were launched to provide a better view and support on how Smart Cities were developing in Europe. Examples include the setting up of the European Innovation Partnership for Smart Cities and Communities, the establishment of the High-Level Group, as well as the introduction of financing instruments such as the support of Smart City Lighthouse projects on Horizon 2020. Individual cities also increased their efforts, for example Vienna introduced its Smart City Wien Framework Strategy in 2014 and Zagreb initiated the process to develop its own Smart City Framework strategy in 2016 (see [Annex III](#)).

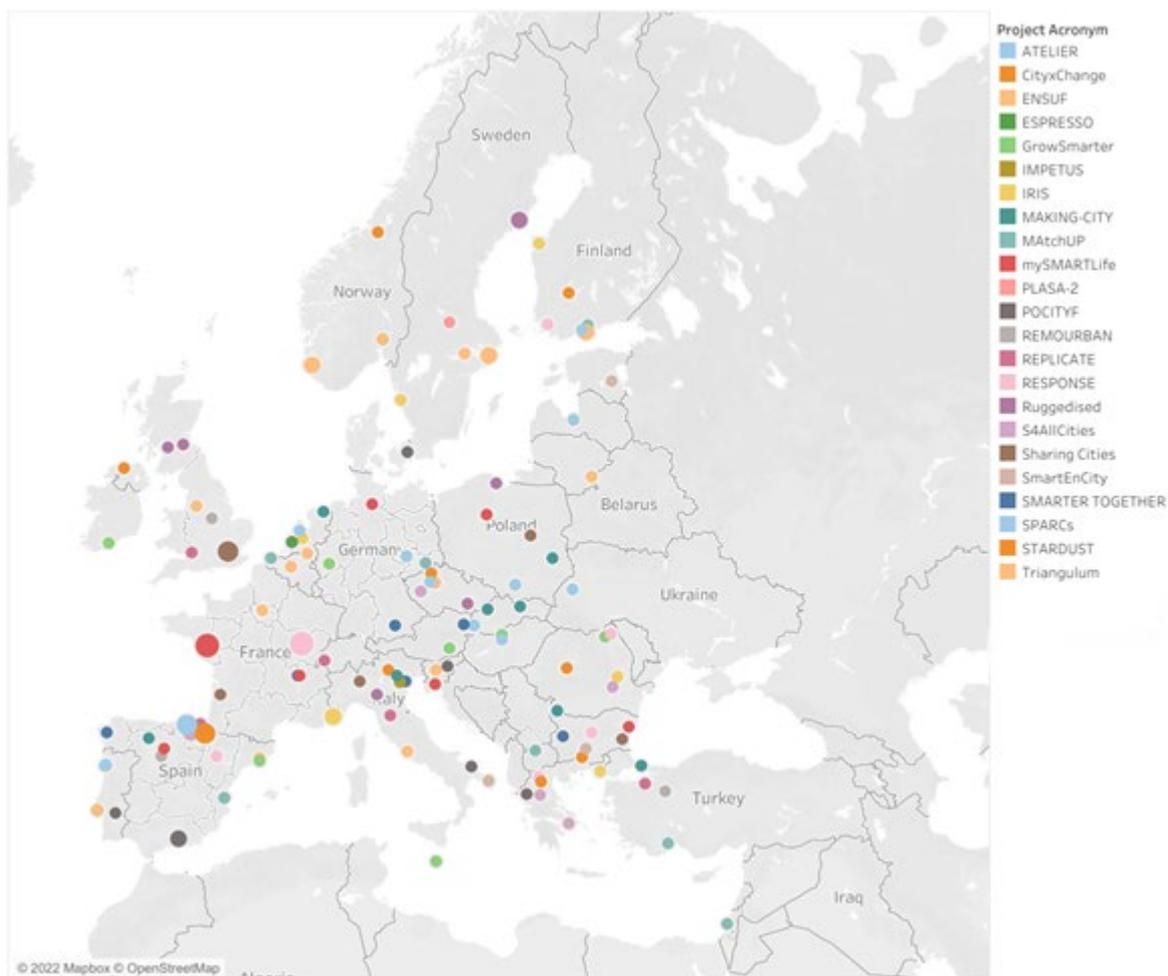
In January 2014, a report published by the European Parliament's Industry Research and Energy Committee examined EU28 cities with at least 100 000 residents under the scope of a smart city definition. This considered that a smart city is a city with at least one initiative addressing one or more of six main characteristics, i.e. Smart Governance, Smart People, Smart Living, Smart Mobility, Smart Economy and Smart Environment; with 'smart' being ICT-based solutions as a key enabler for cities to address challenges in the respective areas.¹²

The report concluded that **51% of all targeted EU28 cities had implemented or proposed smart city initiatives**, and that when following their definition, almost 90% of cities with over 500 000 inhabitants are smart cities. At that date, focus was made on smart city as a large city phenomenon. The report also highlighted the six most successful smart cities: Amsterdam, Barcelona, Copenhagen, Helsinki, Manchester and Vienna. However, often these pictures can be misleading as people tend to focus on the frontrunners at EU level or within Member States (e.g. capital and other major cities).

If we look at the larger picture, then we can see that in the past decades much has happened in the EU across various cities that have participated in lighthouse and other EU smart city projects. Figure 2.1 highlights this by showing the spread of Horizon 2020 projects across European cities.

¹² European Parliament (2014). Mapping smart cities in the EU. IP/A/ITRE/ST/2013-02.

Figure 2.1 - Map of Horizon 2020 Smart City projects



Note: The map shows 22 different Horizon 2020 projects identified by the project team as relevant in regard to smart cities.

More recently, the European Commission supported a collaborative approach to set up a strategic smart city vision in cities across Europe. This is referred to as The Digital Cities Challenge which was implemented in 2017 and encompassed 41 cities and the Intelligent Cities Challenge in 2019 that concerned more than 100 cities.

Figure 2.2 - Overview of participating cities in the Digital and Intelligent Cities Challenge



2.2. The five components of a smart city

Building on the concept of smart cities introduced in the previous section, we decided to de-structure smart cities into five components, each reflecting different aspects of urban life and thereby different domains of application. In selecting these five components we have made use of existing research¹³ and in particular the previously introduced categorisation provided by the European Parliament which classified smart cities along six main dimensions.¹⁴ We have narrowed these down to five components: **Smart & safe living, smart governance and e-citizen, smart mobility, smart environment and smart economy.**

When comparing the six dimensions used by the European Parliament study with our five components, we have decided not to include 'Smart People' in our classification, because since we look in particular into the social impact of the transition (including aspects related to digital literacy among others), we see it as a cross-cutting aspect that is relevant for the inclusiveness and effectiveness of all other components. Moreover, the 'Smart People' aspect of education fits rather

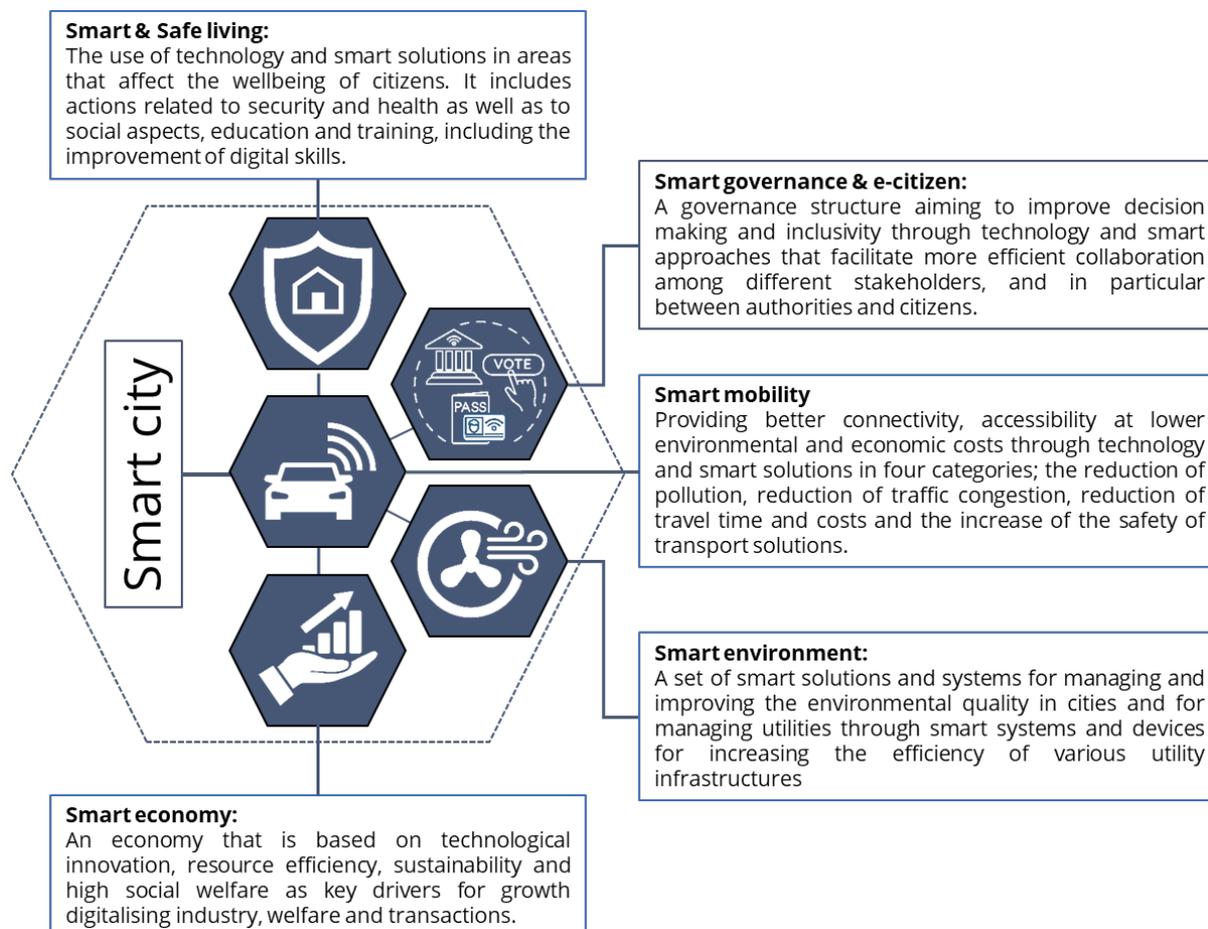
¹³ For example, Ejaz, W.; Anpalagan, A. *Internet of Things for Smart Cities: Technologies, Big Data and Security*; Springer: Berlin/Heidelberg, Germany, 2019; Alberto De Marco, Giulio Mangano, *Evolutionary trends in smart city initiatives, Sustainable Futures, Volume 3, 2021* and Deloitte, *Define your Smart City Strategy: Dive deeper into the six domains of smart cities*, available via <https://www2.deloitte.com/us/en/pages/consulting/solutions/smart-cities-strategies.html>.

¹⁴ European Parliament (2014). Mapping smart cities in the EU. IP/A/ITRE/ST/2013-02.

well under our component of Smart & safe living (Smart Living in the European Parliament study), which encompasses education, health and security.

Figure 2.3 provides an overview of our proposed five components and their definitions.

Figure 2.3 - Components of a smart city



The five smart city components are described in more detail in [Annex I](#).

For the purpose of this study, the five smart city components introduced in the figure above have been selected to reflect the different aspects of urban life influenced by smart city policies as best as possible. However, it should be noted that these components **cannot be considered to be completely independent from each other**. They overlap in different contexts and applications (e.g. on-demand services are relevant for smart economy as well as smart mobility applications), as well as regularly need to interact with each other.

In order to identify potential impacts of a smart city, we have decided to observe the effects of tangible applications, services and tools: we have therefore identified **25 use cases** across smart city components.

Table 2.1 - Overview of selected use cases

Components	Use cases
Smart & Safe living	Telehealth
	CCTV / video surveillance (incl. facial recognition, license plate recognition, etc.)
	Homecare assistance services (incl. remote patient monitoring)
	Learning and training platforms (e-learning)
	Events management and crowd control platforms
Smart governance & e-citizen	Digitisation of municipality's internal services
	Citizen Portal, e-services for citizens' administrative procedures – CRM – front office perspective
	Civic technology to boost citizen participation/engagement (incl. online referral and public petitions)
	Online reporting, e.g. fix my street (communicating to/with your city)
	Open data and/or urban data platform
Smart mobility	Multimodal platform and route/journey planner
	Smart parking – detection of free-available parking places
	Smart traffic management system (incl. traffic data collection/analysis)
	Mobility on demand platform (incl. shared vehicles, Uber like services)
	City toll / car-free zones / low emission zone
Smart environment	Sensors for environmental monitoring (air, water, noise and soil pollution monitoring)
	Risk management platform and alert services (flood, industrial risks...)
	Waste monitoring/management
	Water management (distribution and sanitation)
	Smart grids (incl. grid balancing – flexibility trading)
	Smart meters (energy, water, gas)
Smart economy	E-commerce platforms / apps
	On-demand work through digital platforms
	Sharing economy applications/platforms
	Electronic payments (incl. mobile payments, apps, etc.), i.e. cashless society

[AnnexII](#) provides an overview of the different use cases that have been studied under each and their impact. They have been selected based on the extent to which they are insightful to showcase the direct application of a component. In our choice we have also considered their likelihood to have social impacts and pose risks to citizens, stakeholders and city governments. Since we had to limit our selection, we have prioritised cases which were widely recognisable also for a wider audience, with a broad application and relevance across stakeholders and contexts.

2.3. Smart city components and their related impacts

Following six impact domains (see Table 2.2), we mapped the most significant risks posed by the 25 use cases under the different smart city components. While analysing these, we were particularly interested in uncovering **social impacts and the risks' indirect social implications**. For example, one of them is the cybersecurity risk(s) for essential infrastructure. While this primarily has a technological impact, consequences of a cybersecurity incidence on essential infrastructure would likely affect citizens and thereby also have social impact. It should therefore be noted that while

some risks have a direct social impact, others might have a less visible or indirect effect, but this does not mean that the latter are less significant for assessing societal implications.

Table 2.2 - List of impact domains

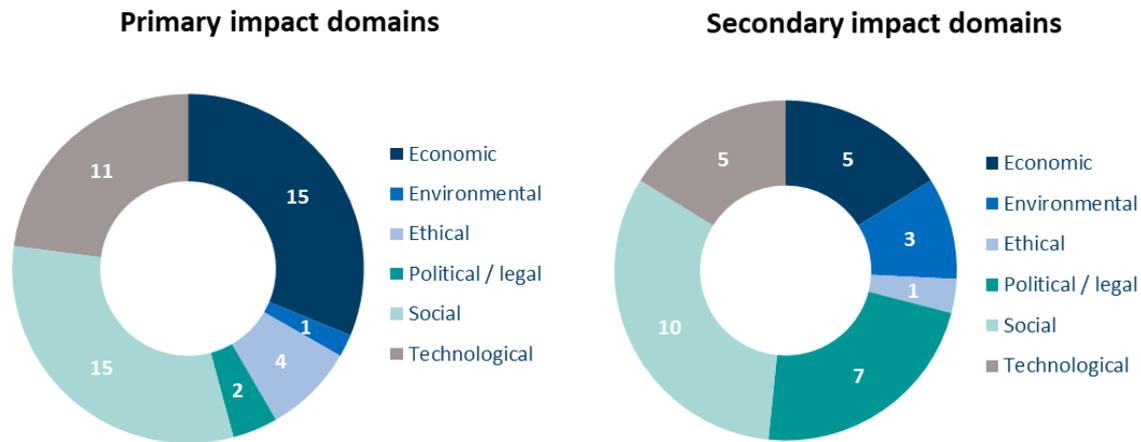
Impact domain	Description
Social	The social impact domain assesses potential impacts smart city policies can have on social disparities and exclusion, social (dis)trust, loss of human contact and impacts related to the physical public space.
Technological	The technological impact domain assesses potential impacts smart city policies can have on cybersecurity and (increased) dependency on well-functioning digital infrastructures and data.
Economic	The economic impact domain assesses potential impacts smart city policies can have on economic disparities, costs for the implementation and maintenance of measures and threats to more traditional economic activities.
Environmental	The environmental impact domain assesses potential impacts smart city policies can have on the ecological environment, for example in the form of (light) pollution or energy consumption of ICT equipment.
Political/legal	The political/legal impact domain assesses potential impacts smart city policies can have on political decision-making processes or potential legal procedures.
Ethical	The ethical impact domain assesses potential impacts smart city policies can have on privacy and data protection as well risks related to discrimination of minority groups.

Our review based on the smart city components and use cases initially unveiled 68 risks with the majority being economic, followed by social and technological. After further review, we narrowed these down to **48 risks** by merging and grouping overlapping impacts. The full matrix can be found in [Annex II](#), while here we would like to provide an extract of our analysis, which was instrumental in order to:

- Determine which impact domains are mostly affected by the use cases;
- Identify main risks and who they primarily affect.

The majority of risks fall under the economic (15), social (15) and technological (11) impact domains. For some use cases, also secondary impact domains were identified, unveiling in particular several social secondary effects, as suggested above. This is already an important finding, as **social effects of smart city transition might often be overlooked as they are not always a direct, but mostly an indirect or secondary effect.**

Figure 2.4- Overview of primary and secondary impact domains



Depending on the types of use case, identified impacts may primarily targeted administrations (e.g. digitisation of internal municipal services) everyday life of ordinary citizens as users, or in some cases economic operators in particular (e.g. on demand platforms). These insights were also captured in the matrix and some of the most relevant findings are presented by smart city component in the following sections.

Table 2.3 provides an extract from our matrix that shows the ten risks we identified to be the most relevant and cross-cutting across the 25 use cases. The table highlights which primary and secondary impact domains for which they are relevant.

In relation to the five smart city components, we summarise our main findings and observations on their main risks thereafter.

Table 2.3 - 10 identified risks applicable to the most use cases

Risk	Description	Impact domain(s)	Component(s)
Dependence on stable and good functioning digital infrastructure	Infrastructure failure can lead to data loss and thereby have economic costs	Technological Economic	All components
Potential dependency on private technology providers and vendor lock-in	Dependency caused by market dominance or lack of standardisation and interoperability of systems leading to overreliance on one or a few providers.	Technological Economic	All components
Potential privacy and data protection concerns and non-compliance with the GDPR	Increased data collection requirements can lead to privacy issue in particular where safety of data is not guaranteed or might be used for commercial purposes or law enforcement.	Ethical Political/Legal	All components but smart environment
Increasing electricity demand driven by ICT deployment causing economic and environmental costs	High electricity demand from equipment and infrastructure (servers, networks) causing economic burden and potential environmental impact depending on the source of electricity.	Environmental Economic	All components
Cybersecurity, attacks on (essential) infrastructure causing its malfunctioning (e.g. DoS or ransomware attacks)	Cities might be targeted by malicious attacks on their essential infrastructure (e.g. utilities, traffic management, government services, electronic payment systems) causing economic and potentially endangering citizens	Technological Political/Legal	All components
User interfaces too complex causing difficulties to request, manage and/or fully utilise the service, platform or integrated offer	Exclusion of people that are less digitally literate or handicapped and therefore have difficulties accessing digital services.	Social Technological	All components but smart environment
High initial investment costs to introduce digitised services / produce open data sets / create digital platform or management system / set up grids or sensors	High initial financial burden on authority (or service provider) to set up the service/platform having an economic impact and potentially jeopardising delivery of other services.	Economic Social	All components but Smart economy

Loss of human contact and isolation through remote care, working, training and shopping	Risk of isolating people, especially those that have a limited social network and that are on the edge of exclusion, e.g. elderly, migrants, etc.	Social Ethical	Smart living and Smart economy
Due to its critical nature, high maintenance costs can be foreseen for large systems (e.g. smart grids or smart traffic management system)	High ongoing financial burden on authority (or service provider) to run the service/platform	Economic N/A	Smart mobility and Smart environment
Lack of digital equipment, skills or connectivity as barrier to user access	Risk of digital divide by excluding people that cannot access for various reasons (e.g. location, income, education) the service/platform.	Technological Social	All components apart from smart environment

Smart & Safe living



As can be expected from its title, the smart solutions developed within the component 'Smart & Safe living' have more significant effect on the everyday life of citizens. As a result, there are more social risks that can be associated with this component.

The most important social risks come with the digital skills that are required by citizens to make use of the smart solutions developed. The interfaces might be too complex for users. As a result, people can have difficulties to request, manage and/or fully utilise the newly developed services and platforms. This could enhance existing social divides, lead to increased social disparities among digital literate and illiterate people and, in turn, result in the loss of social rights. This is particularly of concern when thinking of the various health related smart city solutions, which are often targeted more at the elderly who simultaneously also often have less advanced digital skills, and also the need to apply for social assistance via digital platforms.

Not only the level of digital skills forms a risk, also potential low trust in newly developed smart solutions among certain social groups could represent an obstacle as either trust and awareness would need to be established or alternative non-digital solutions would need to be provided. Finally, many of the developed smart solutions within this component aim at increasing efficiency of services by removing human contact (e.g. Telehealth, public administration or education platforms). This loss of human contact can increase solitude among groups that already suffer from social exclusion.

Next to the social risks, there are also technological and ethical risks. The main technological risks relate to the increased dependency on stable and good functioning digital infrastructure and additional risks related to cybersecurity. On an ethical level, risks related to the loss of privacy and uncontrolled data collection are of particular concern.

Smart governance & e-citizen



The 'smart governance & e-citizen' component has a more limited effect on the everyday life of citizens, but is still very important given its potential to bolster inclusiveness through civic participation and facilitate everyday life through e-services. Similarly to 'smart & safe living' there are some obstacles related to the (lack of) digital skills (required by citizens to make use of smart solutions within this component) as well as risks related to trust, awareness and willingness to participate by citizens.

In fact, participatory measures if not promoted and offered properly may run the risk to disadvantage citizens that lack the time, awareness or drive to engage in these processes. It is therefore important to be aware of the risk of excluding certain groups (unintentionally), since smart solutions within this component involve the risk of improving the participation of those already participating or those with more time to participate, thus increasing social differences.

More specific risks related to this component deal with the lack of internal digital competences within government bodies that are responsible for implementing the smart solutions. Such competences will need to be built either internally, which takes time and creates costs, or acquired externally, which also creates costs and potential dependencies with technology providers. In addition, legacy systems are often difficult to replace and can involve a long and arduous process that often also raises reluctance by employees to embrace changes. Finally, there are risks related to discrimination. For example, inadequate provision of in-person alternatives can lead to discriminatory treatment between residents who can access the e-services and those who cannot. Another example is discrimination in solving reported problems: for instance, unequal treatment between city districts based on population density or distribution of facilities.

In addition, a number of technological risks can be observed. In line with the previous components, cybersecurity is a significant issue. Smart solutions within this component require the gathering of sensitive data from citizens, while cybersecurity is addressed by (local) governments in different degrees. In particular, targeted attacks or use of 'trolling' techniques could jeopardise participatory initiatives. Another technological risk relates to a potential lack of interoperability between services and platforms that are created by government institutions.

Smart mobility



While access and use of public transportation has important social implications, generally social risks linked to the introduction of 'smart mobility' solutions are limited. Nevertheless, there are a few potential issues to consider. For example, smart parking solutions or restricting vehicle types from entering the city centre can be beneficial for the local environment, but can discriminate the owners of such vehicles at the same time. Since electric cars are generally more expensive than traditional vehicles with combustion engines, this tends to be detrimental for low-income groups.

Other important risks apply to shared vehicles. They include, for instance, safety issues due to the unfamiliarity of users with the vehicle. In addition, shared mobility services can also negatively affect the state of the public spaces, with scooters and bicycles not being parked in the designated zones but instead being parked on sidewalks and in parks.

There are also significant economic risks that can be observed, which could have indirect social impacts. Shared mobility services can endanger the existence of more traditional mobility providers such as local taxi companies, and the people that offer their services through on-demand platforms often face poor working conditions.

Lastly, smart mobility services are, at the moment, mostly provided within large city areas, leading to the risk of setting the small and medium cities¹⁵ apart from benefits of new smart mobility services.

Smart environment



Arguably, 'smart environment' might be the component with the least observed social risks out of our list. Smart solutions included in the 'smart environment' component require the least interaction from average citizens, and have therefore limited consequences on people's everyday lives.

Consequently, the most frequent risks observed are mainly of technological and economic nature. Cyber-attacks are a major threat to all smart solutions, but can have a devastating impact if targeting utilities. For instance, state-led or terroristic cyber-attacks on public infrastructure, including smart grids and water management platforms, could lead to issues of national danger. Furthermore, defective technology in waste management or environmental monitoring sensors could potentially lead to inaccuracies in data and subsequently lead to social frictions (e.g. if waste is not picked up).

At the same time, the economic burden of transitioning to such technologies can be rather high. The digital infrastructure required for such a transition is quite costly and the process to acquire it is not always cost-effective. For instance, the infrastructure for risk management platforms or smart grids is expensive and time-consuming to obtain. The quality of environmental monitoring sensors also increases with their cost, which could mean significantly higher costs for city authorities which need to find the right balance between accuracy and quality and expenditure. Decisions on

¹⁵ Following the OECD, generally considered as urban areas between 50 000 and 200 000, and between 200 000 and 500 000 inhabitants, respectively, <https://data.oecd.org/popregion/urban-population-by-city-size.htm>.

technologies by authorities could also lead to vendor lock-in whereas authorities rely on technology providers to maintain and update their systems.

Smart economy



As can be expected, many economic risks can be observed when looking at the 'smart economy' component. These mainly affect smaller businesses, that might face unfair competition with large companies driven by e-commerce platforms, as well as additional costs that come with cashless payment options. Another economic risk relates to disadvantageous and uncertain employment conditions such as short-term contracts that come with on-demand working platforms.

But there are also direct social risks that can be identified. These include nuisance in city centres from neighbours renting out their apartments, increased traffic from delivery services as well as the aforementioned 'wild parking' of shared vehicles in the public space. For example, in popular tourist destinations, platforms like Airbnb result in increased house prices.¹⁶ Many European cities are struggling to manage the continuous growth of Short Term Holiday Rentals offered by online platforms and ask for a stronger European regulation; notably in 2020, under the preparation of the Digital Services Act, 22 cities from Eurocities presented a position paper to the European Commission asking for reinforcing the EU regulation and easing the access to data.¹⁷ The liveability of urban centres is also affected by the potentially increased vacancy of physical shops, as a result of the competition with e-commerce companies. Social risks such as loss of human contact and digital exclusion, which can be observed in the abovementioned components, also apply to 'smart economy'. In particular, the pandemic has shown that many people can easily work and shop from home and as a consequence see their social interactions reduced.

As with the other components, technological risks also apply, such as the dependency on digital infrastructure and additional risks related to cybersecurity. A particular technological risk for 'smart economy' is the potential malfunctions in digital payment systems, which could in a cashless society bring life to a still stand.

2.4. Clustering risks around main challenges: synthesis of our findings

Based on our review of use cases of the five smart city components, we have explored in more detail the 48 risks that were identified and shortlisted them based on:

- their relevance: how significant they are, do they have a societal impact even indirectly? Some challenges were very specific to, for instance, a professional group or a specific sector;
- their pertinence: with regards to the study and also applicability to more cities and territories, so we avoided to include too context specific challenges;
- their consistency: we merged some challenges and got rid of overlaps.

The selected risks have thereafter been clustered in six groups, which we call macro-challenges. It should be noted that most of these challenges are crosscutting to the components as well as to the

¹⁶ Koster, H., van Ommeren, J., & Volkhausen, N. (2019). Short-term rentals and the housing market: Quasi-experimental evidence from Airbnb in Los Angeles. Centre for Economic Policy Research (CEPR). https://cepr.org/active/publications/discussion_papers/dp.php?dpno=13094.

¹⁷ See more at <https://eurocities.eu/latest/short-term-holiday-rentals-large-european-cities-seek-eu-cooperation/>.

impact domains identified above. Through our synthesis work we have therefore categorised them as follows (see Figure 2.5).

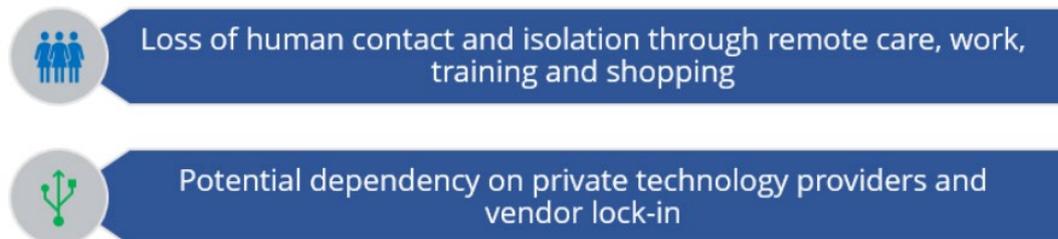
Figure 2.5 - The six macro challenges identified



Beyond these six macro-challenges, there are also two crosscutting challenges which are transversal to all and concern two particular risks that come with the transition towards smart cities and in particular an increased reliance on digital technologies. To be clear these two challenges apply across not only multiple smart city components but also are a result and implication of risks already captured under the other 6 challenges and for this reason are considered as crosscutting.

These two challenges are presented in Figure 2.6 below and thereafter in the text.

Figure 2.6 - The two cross-cutting challenges



Loss of human contact and isolation through remote lifestyle – Lessons from the COVID-19 lockdown have shown that digital services have facilitated the continuity of service for most of the population, however socially fragile groups encounter difficulties in many aspects of their daily life (access to social rights, access to education, isolation of fragile categories, etc.) and loss of human interaction only exacerbates such difficulties. Interpersonal contacts can be observed across various domains and age groups; think about the relationship doctor-patient, the interactions between pupils and teachers, the interactions between colleagues in offices or simply the weekly interactions at the grocery store.

Digitalisation and the possibilities offered by moving much of our life remotely can make many of these interactions more efficient and allows their functioning throughout a pandemic. However, **the risk of human isolation due to remote interaction** is a serious challenge that deserves consideration in the transition to smart cities across several domains and with specific focus on public services.

Potential dependency on private technology providers – Dependencies on private technology providers and even vendor lock-in can have cascading effects across all dimensions including phases of development from an overall poor smart city project conception (irrelevant solutions to

big problems, wrong priorities missing the real ones, metrics of success not related to actual objectives, etc.), over costly implementation, to difficulties with non-interoperable solutions or in changing solution providers.

Ultimately, **the risk is that essential services are increasingly in the hands of private companies.** If there is no public control in place, there is a risk these would operate solely according to market logics of maximising profits and efficiency, potentially disregarding public interest, equity and fairness considerations. Authorities may end up in a situation where they fully rely on these third parties in maintaining and updating their services and have limited alternative options as switching from one solution to another might be too costly. This can be the case especially if appropriate regulations are not in place and if there are no standards facilitating the interoperability of technological features.

2.4.1. Macro-challenges and related risks

In this section, we provide a short account for each of the six macro-challenge and describe the specific risks we have identified.

Privacy, surveillance, cybersecurity and safety aspects

This category includes specific risks related to cyber security and privacy, as well as risks for the safety of individuals (primarily when it comes to the mobility component). It is also important to stress that cybersecurity risks might be targeting different levels and notably:

- 1 City/institutions and public authorities;
- 2 Service providers, especially when it comes to public interest services;
- 3 Citizens and individuals directly.

The following risks have been identified:

Figure 2.7 - Risks related to privacy, surveillance, cybersecurity and safety aspects

	Privacy, surveillance, cybersecurity and safety aspects
	<ul style="list-style-type: none"> • Cybersecurity, attacks on (essential) infrastructure, traffic management systems; malfunctioning (e.g. DoS or ransomware attacks). • Cybersecurity attacks on individuals, loss of personal data, fraud and other criminal activities. • Content tampering & validation (i.e. hackers changing materials to wrong information). • Increased cybersecurity risks originating from IoT with compromised devices providing access to sensitive devices or services, such as mobile phones, computers, security cameras, smart locks, or public web services. • Potential privacy and data protection concerns and non-compliance with the GDPR. • Pervasive and invasive surveillance of people and/or locations required for optimal functionality. • Potential safety issues for passengers with shared vehicles (linked to robbery, abuses and well as unfamiliarity with the vehicles).¹⁸ • Potential negative impact of the shared vehicles on side-walks, public areas or in the streets (scooters lying around, scooters moving too fast in pedestrian zones etc.).¹⁹

¹⁸ As an example, Blablacar in France recently sent around a warning message to protect users against potential scam/fraud from drivers sharing links outside the platforms that could be redirected to fraudulent sites. This risk could be extended to any digital platforms available in a smart city.

¹⁹ The issue of shared mobility goes beyond the question of digital solutions that give access to a multiple offer and is more on the new rules to be defined to allow the coexistence between all. After taking actions to limit the problem of scooters lying around, some cities ask scooter operators to restrict the speed.

Data loss, lack of reliability, and interoperability issues

This category groups a number of risks related to the heavy reliance of data and applications, standardisation and interoperability issues and more generally related to unreliability of data/systems and applications. While these risks primarily have a technical application, they can have significant social repercussions at least under two dimensions:

- At the level of individuals and their safety and wellbeing, because decisions related to their health (e.g. diagnostics from health solutions) for example, might be too dependent on estimates and results originated by a machine, which can be subject to mistakes, interpretations, loss of data that cannot be restored;
- At the broader level, this is significant because the ownership of the data, the maintenance and supervision of systems could be subject to private interest and therefore public good may not always be at the centre.

Figure 2.8 - Risks related to data loss, inaccuracy, lack of reliability and interoperability

	Data loss, inaccuracy, lack of reliability and interoperability issues
	<ul style="list-style-type: none"> • Wrong decisions or discrimination based on data analytics / AI (incl. legal consequences); • Dependence on stable and good functioning digital infrastructure;²⁰ • Lack of interoperability between apps, information systems, platforms hindering workflow/communication between citizen-municipality / companies; • Readings from environmental monitoring stations are extremely sensitive to changes in temperature and humidity amongst other factors. Therefore, sensors that are not properly tested in all settings may yield inaccurate readings; • Issues related to standardisation, data obtained from different sources might not be comparable, given differences in the methods used to collect them; • Technical malfunctions as a risk if dependent on electronic payment methods.

Digital inequality and exclusion

This group covers discriminatory treatment and the digital divide either created by the requirement of too sophisticated digital skills or related to sub group of residents who might:

- Not have the required skills/ have no access to the education to gain those skills;
- Lack the equipment, connectivity or even option to access the service because it is not provided for them or in the area where they live.

This category is particularly relevant for its implications on the different stakeholder groups and territorial levels as both different stakeholder groups (e.g. elderly, low-income households, migrants) as well as certain territorial areas (e.g. rural areas) will be particularly affected.

²⁰ For instance, defect sensors could lead to waste not being picked up, thus causing environmental damage or social friction.

Figure 2.9 - Risks related to digital inequality and exclusion

	Digital inequality and exclusion
<ul style="list-style-type: none"> • User interfaces too complex for average user or user category could have difficulties to request, manage and/or fully utilise the service/platform/integrated offer; • Risk of excluding people from the political participation and administrative services that cannot access technology for various reasons (lack of skills or devices required); • E-participation is limited to activists' groups of population, results of e-participation is thus biased; • Inadequate provision of in-person alternatives leading to discriminatory treatment between residents who can access the e-services and those who cannot; • Cashless society could make income and spending for people relying on cash (e.g. irregular workers/migrants/elderly) difficult and thereby excludes them from society; • 'Unseen people': not on the radar to benefit from digital inclusion actions; • Lack of digital equipment and connectivity as barrier to user access; • Discrimination in solving reported problems: for instance, unequal treatment between city districts based on population density/distribution of facilities; • Restriction in access to space e.g. restrictions to parking lots in certain areas implemented through the smart parking system (e.g. 'VIP parking spots' or EV only); • Unequal service distribution (e.g. fibre network roll-out) across peri-urban/rural areas or even across neighbourhoods because they are determined by market/for profit logics. 	

Financial (or other) burden for authorities and service providers

Municipalities are often bound to (strict) budgets, resulting in (partial) failures of initiatives or in missed opportunities. This limitation in resources makes it difficult to implement large smart city projects, especially if these have uncertain outcomes. This could lead to a lack of scale-up of projects or of high investment costs that might affect budgets in other areas (e.g. social affairs). This limitation can also have an impact on the quality of the goods and services provided, which is sometimes proportional to their costs, with ultimate impact on the citizens living in a less 'affluent' community or neighbourhood.

Figure 2.10 - Risks related to financial (or other) burden for authorities and service providers

	Financial (or other) burden for authorities and service providers
<ul style="list-style-type: none"> • High initial investment costs to introduce digitized services / produce open data sets / create digital platform or management system / set up grids or sensors; • Lack of visibility on the return of investment of an urban data platform; • Due to its critical nature, high maintenance costs can be foreseen for a smart traffic management system (incl. traffic data collection / analysis) or other critical systems (e.g. smart grids); • Tampering with sensors could cause economic costs to the city. Sensors' quality increases together with their cost, so cities need to decide how to best balance the accuracy of environmental monitoring by understanding what the data will be used for, against the cost; • Economic Costs for Third Parties: i.e. Tax evasion, increased property prices, and adverse effects for other markets; • Costs associated with setting up cashless payment options (e.g. fees towards card providers, card readers) in particular impact smaller shops; • On-demand service offers can fail (e.g. too high prices, lack of demand); 	



Financial (or other) burden for authorities and service providers

- Lack of internal digital skills to develop the solution, produce/update/re-use the data sets;
- Increasing electricity demand driven by ICT deployment causing economic and environmental costs.

Economic damage and inequalities

For this macro-challenge, we refer to impact in at least two categories, whereas the first relates to the impact on economic activities and businesses in terms of restrictions introduced as well as new business models competing with older business models and whereas the second refers to residents and individuals being impacted in terms of their income, working conditions and economic possibilities.

Figure 2.11 - Risks related to economic damage and inequalities



Economic damage and inequalities

- New platforms and services can endanger the existence of traditional offers and businesses (taxi, public transportation, commerce, restaurants, etc.);
- Restriction to traffic in certain areas could lead to economic issues for residents, professionals and businesses;
- The alternative modes of transportation are overloaded;
- Local small business may lose income at the expense of large (inter)national companies (e.g. Amazon);
- Ecommerce can result in high vacancy level of physical shops. This negatively affects the liveability of city centres, especially in smaller towns and cities;
- Economic Costs for Participants: providers suffer from disadvantageous and uncertain employment conditions such as short-term contracts;
- People who cannot afford the latest green technologies (e.g. vehicles) could be having issues accessing the area which could lead to a potential social divide;
- Mobility transition (with the direct effect of restricting access of the city to individual cars and raising prices) can create new social divides.

Lack of trust or approval in the service and/or the service provider

This category comprises issues related to resistance by citizens toward, for instance, the use of certain systems or introduction of new tools. Reasons for this resistance vary, but include the involvement of personal data, general mistrust in new technologies or technology providers. For example, there has been a public debate in European cities about deployment of 5G where some residents were asking for a moratorium on 5G deployment as a response to citizens' concern on environmental and health issues. The category also reflects the potential reluctance by the workforce to switch from their legacy system to new technologies and comply with new digital requirements and standards, which is a widely diffused issue especially across local public administrations.

Recently, the issue of digital sobriety has emerged in Europe as around the world in connection with the growing awareness of the climate emergency and may question the real and intended value of some digital services and smart city approaches.

Figure 2.12 - Risks related to the lack of trust or approval to the service and/or the service provider

	Lack of trust or approval in the service and/or service provider
	<ul style="list-style-type: none"> • Limited trust by citizens/resistance towards technological change; • Employees' reluctance to embrace change; • Lack of citizen participation in using the services produced or in accessing the urban data because there is no awareness on their existence and value; • Nuisance for uninvolved third parties: e.g. nuisance for neighbours by tourists renting 'normal' apartments, users 'wild parking' shared scooters or bikes; • Disillusionment and frustration of citizen with local government if participation or reporting by citizen is not followed up with for various reasons (e.g. budget constraints); • In the context of on-demand work through digital platforms: potential risk of quality of work not being sufficient for the end customer due to low entry barriers for workers.

2.4.2. Accelerating and decelerating factors for the risks identified

When focussing on the specific use cases and their associated risks, we have also analysed main internal and external factors that could accelerate or mitigate the identified impacts. In particular, internal factors relate to those aspects that are dependent on the use case design and application, while the external ones are more related to the context in which they are applied and underlying conditions. We here provide our reflections regarding emerging factors we have observed in our research, further details can be found in [AnnexII](#).

For what concerns internal factors, there are clearly two that have wide relevance: the user-friendliness and accessibility of the applications and the awareness raised on their existence and added value.

Having **user-friendly and intuitive applications** is essential to mitigate the risk of excluding less digitally literate people. Sometimes complex and time-consuming log-in or access procedure can also discourage even the most advanced users. This is unfortunately quite common, for instance, when it comes to e-administration or e-banking, where notably there are also provisions to ensure privacy and safety that might require multiple steps and therefore complicate the process. Often, these complicated procedures are the result of stricter regulations related to security and privacy. In cases of more technological complex solutions, supervision by trained staff is also key (e.g. in the area of remote patient monitoring). However, in recent years, we have seen new initiatives in the public sector to set up co-design models involving end users when developing new digital services (an example is the network of Public Innovation Labs in France).

Furthermore, applications and services are in some cases still developed without considering mobile devices and are therefore not optimised for accessing them through such devices. Finally, while accessibility rules are enshrined in the EU Web Accessibility Directive, not all public administrations are aware of their guidelines and rules for making web services accessible to people with disabilities.

Next to this, **awareness** is also crucial, as sometimes services or opportunities are available but they are simply not known. This is particularly the case for new public services and participatory tools, where resources would be required to advertise these among the wider public. However, a general awareness campaign rarely works for all target groups. While for instance a large segment of society can be engaged through social media and via expert/sectorial channels, others might need to be reached through more traditional tools, such as TV, printed paper and even in person engagement. Cities like Nantes, in France, can offer quite some examples on how to make sure through different communication tools their elderly population is actually aware of the many opportunities that city

puts at their disposal. Awareness is also crucial to clarify doubts and build trust, especially toward those individuals or constituencies that fear the side effects or unveiled threats posed by digital innovation.

Another important factor are the **existing data protection and cybersecurity standards** and their application for a particular smart city solution. Trust in the data protection and a high cybersecurity standard are essential to mitigate adverse effects and risks as well as regulate the implementation of certain applications and the use of data. For instance, the overall successful deployment of smart meters highly depends on regulatory arrangements, as well as how they guarantee data privacy and security.

In terms of external factors, there are of course economic or social transformations boosting the speed of certain processes, as it happened with the Covid-19 pandemic, which dramatically accelerated the transition to remote working, e-learning as well as increased the share of e-businesses without taking into account possible repercussions and mitigating measures. Of course, these changes were introduced at this pace and degree of intensity because of an emergency situation; it has to be seen the extent to which these changes will persist once the pandemic is over. We note that several companies have now adopted a hybrid working policy and have already reconverted office spaces to accommodate the new way of working. In some cases, working stations have simply been reduced to save space and costs, in others the strategy has been to transform the office into a meeting place, conducive for co-working and exchanges among colleagues.

In cases where solutions require user interaction, a key external factor is the general level of **digital skills of the expected users**. Negative outcomes are more likely when users are not familiar with the solution and the technology and therefore are not able to use it or use it not optimally. As discussed above, user friendly design can, to some extent and in some cases, help mitigate this issue. This aspect is discussed further below in the section on the demographic dimension.

The aspect of **governance structure** within a city is also key. Especially larger metropolitan areas might struggle with a multilevel governance set-up that lacks clear leadership on these topics or strategic direction. Conversely, in other contexts local institutions have no direct competence or authority and decisions as well as budget allocations are decided largely at national or regional levels and thus often not taking into account the territorial specificities and needs. Our city case studies highlight the importance of providing a **political framework** (e.g. the Smart City Wien Framework Strategy). This needs to be combined with a strong **political vision**.²¹

In addition, the **role of leadership** and the designation of a clear responsible person or unit for the smart city strategy design and implementation is key.²² It was pointed out by experts that an essential requirement for success is to have a **clear process owner** who is coordinating and developing the whole smart city system. Such a process owner must be close to the leadership of a city and must be visible so they can act as an enabler and can be easily approached by others actors. Similarly, cities such as Vienna have set up a dedicated company, which is responsible for the overall management in partnership with local public agencies and academia, while receiving input through a structured consultation process with stakeholders including two permanent councils made up of local stakeholders. The engagement and consultation of citizens and local constituencies is, in fact, also essential and clear leadership should not imply lack of bottom-up participation and active engagement of citizens in both design and implementation phases.

Linked to trust and participatory aspects, another factor is the (perceived) **transparency and accountability of local governments and service providers**, notably regarding the use and

²¹ This was brought up by several experts we engaged as part of this study as a key condition.

²² A good example is the mayor of Málaga who took a central role in setting up their smart city strategy, following up on it and connecting relevant actors in their city. For more information see [Annex III](#).

sharing of data, as well as the previous account of how e-participation has contributed to decision-making. An example of this being an issue can be found in Zagreb, where the mayor who initiated the city's smart city project was mired in charges of embezzlement, which led to an environment of widespread mistrust towards city policies (see [Annex III](#)). This factor in particular affects the macro-challenge of lack of trust or approval in the service and/or service provider.

Other interesting factors are related to the **territorial conditions and accessibility**. This refers to access in remote areas. For instance, the Finnish government has been forced to promote the use of smart learning and working for more than 20 years now, to mitigate the risks linked to the isolation as well as exclusion of certain communities. One example includes those living in the far north which otherwise could not have access to those services or would have been forced to relocate. Accessibility can however also be an issue in urban areas if access to internet or equipment is not ensured for all parts of a community. To address this, the city of Oulu offers free Wi-Fi across its urban area including the territories of all the municipalities of the larger Oulu urban area (see [Annex III](#)). In addition, due to the support of the EU and National governments across Europe, the broadband roll-out is accelerating and the level of connectivity should be improved for most of EU citizens in the coming years.

Some factors are more specific to certain domains, for instance when it comes to measures in the domain of mobility, much depends on traffic conditions, availability of spaces to create parking spots and install electric facilities. For environment, a major influencing factor is the **attitude of citizens towards environmental issues**, i.e. support or opposition for environmental restrictive measures which very much vary across contexts.

Finally, what should be considered are **national or EU level regulations or strategies** which, for example, promote the renovation of buildings to support energy efficiency or restrict access to cars within the city (e.g. low-zero emission zones). These will lead also to an increase in smart solutions supporting policy objectives enshrined in the regulations. In turn, and related to the internal data protection and cybersecurity standards of a solution, the existence of strong legal requirements for data protection and cybersecurity encourages the uptake of solutions with less potential risks in these areas.

2.5. Impact variation across territories and stakeholder groups

Clearly not all societal groups are impacted by smart city transition in the same way. Impacts often vary depending on age, social and economic status but are also based on location. Looking more closely at these aspects allows for a better understanding of how the impact of smart city policies differ across different types of territory and the various population segments. The following sections provide some insights on how territorial and demographic features might influence impacts and in particular what population groups might be more (negatively) affected by the transition, further details can be found in [Annex II](#).

2.5.1. The territorial dimension

The territorial scale is an important dimension to consider when studying the impacts of smart city innovation. In many ways, smart city developments can be positive in this aspect as they reduce isolation substantially and can better connect remote areas. However, **European urban areas differ significantly when it comes to size, structure, access to funding and population density**.²³ In particular, experts whom we interviewed pointed out that it is easy for those cities which are front-

²³ For a discussion on the development of urban areas in the EU (e.g. in terms of density, prevalence of manufacturing and industry, transport connectivity, etc.), see EIB (2018) [The Story of Your City: Europe and its Urban Development, 1970 to 2020](#).

runners and which have sufficient resources to be part of processes. However, support is needed for those that lack these resources. Differences in such characteristics can influence demand and offer of services and in particular when service provision is purely in the hands of private actors can lead to a service offer that follows demand and thereby population density.

For this reason, this study seeks not only to consider impact for large and densely populated urban centres, but to also explore the impacts in surrounding areas. In order to make this analysis, a distinction is made between three different territorial levels. They are introduced in the table below. The definition of these territorial areas is largely based on the EU-OECD definition of a functional urban area.²⁴

Table 2.4 - Territorial impacts

Territorial area	Description
Urban centre	A set of contiguous, high density (1 500 residents per square kilometre) grid cells with a population of 50 000 in the contiguous cells
Functional urban area	A functional urban area consists of a city and its commuting zone. Both are characterised as follows: <ul style="list-style-type: none"> • A city: one or more local units that have at least 50% of their residents inside an urban centre; • A commuting zone: a set of contiguous local units that have at least 15% of their employed residents working in the city.
Rural area	Rural areas are all areas outside the Functional urban areas.

Beyond density of population, city size also makes a difference. For example, in general, **small- and medium-sized cities have a more limited access to resources to promote smart city solutions.** This relates not only to financial resources available, but also to the capacity in terms of adequately skilled personnel. Further, **each European Member State provides a different level of autonomy for their urban authorities,** which can hinder or favour the extent to which they can implement local policies autonomously. For example, our case study on the city of Oulu revealed that city authorities benefit from a form of governance in Finland which involves a great amount of autonomous governance by municipalities, including through direct taxes providing sufficient financial resources to implement change.

Across EU Member States there are significant differences in the **extent of financial resources available** to cities to implement smart city policies and, more importantly, to mitigate their (social) effects. This is best illustrated when it comes to government revenue that is accessible to authorities under the national level. Not only does the total amount of revenue differ between Member States depending on how affluent the country is, but also the amount that is allocated to local and regional authorities differs widely between EU Member States. Data from the OECD²⁵ shows that the share of public revenue²⁶ at subnational government level (this may include also states and regional governments) ranges from 7.5% in Greece and 8.4% in Ireland to 55.1% in Spain²⁷ and 65% in

²⁴ Dijkstra, L., H. Poelman and P. Veneri (2019), 'The EU-OECD definition of a functional urban area', *OECD Regional Development Working Papers*, No. 2019/11, OECD Publishing, Paris, <https://doi.org/10.1787/d58cb34d-en>.

²⁵ Subnational government revenue, % of public revenue, 2017 data, taken from OECD (2018) [Key Data on Local and Regional Governments in the European Union](#).

²⁶ Comprises tax revenue, transfers (current and capital grants and subsidies), tariffs and fees, property income and social contributions.

²⁷ This number drops to 16.8% if only local governments and not the Spanish provinces are considered.

Denmark. These numbers show that budgetary decision making is not always decentralised in the same way or extent.

Depending on the city, and even more when we talk about metropolitan areas, **large differences can be observed at the level of the individual municipality** (see Brussels capital region for instance) but also at the **neighbourhood level**. Certain services for instance in the domain of smart mobility can be widely available in a central or particularly dynamic neighbourhood (e.g. where business/office or affluent residential areas are situated) compared to low income or more peripheral neighbourhoods where the demand would still be considerable but not as high to justify investments and guarantee adequate profits.

It was also pointed out to us in an interview with an EU level association that the term smart city can be misleading as cities, and especially metropolitan areas, can be quite diverse and significant discrepancies can be observed at the neighbourhood level. In addition, the digital transition is also taking hold at rural level and therefore **the term of smart communities** has been proposed as a better descriptor for the transition.

2.5.2. The demographic dimension

In order to gain an understanding of how smart city policies affect the different stakeholder groups, our study dissects the groups into different sub-categories and analyses the potential impacts. We categorise these groups based on several criteria, including age, socioeconomic status, and digital literacy level, as shown in the table below. Beyond these, other categorisations are also relevant. One example is residential status, which has a potential impact on several groups as commuters, city residents and tourists might experience and benefit from smart cities and their provisions differently. Finally, professional status also makes a difference, as white-collar work can be undertaken remotely more easily as compared to physical labour.

By looking at the demographic dimension, we gain a better understanding of the extent in which certain demographic groups experience impacts related to smart city solutions. Some smart city solutions may result in a small impact across all demographic groups within societies, while others may have a significant impact, but for a smaller group. For example, the inadequate provision of in-person alternatives for government services can lead to discrimination and strongly affect a small portion of a community that for various reasons cannot access the e-services.

Table 2.5 - Stakeholder groups impacted

Stakeholder group	Description
Age	Age group categorised in elderly, youth and children.
Socio-economic group	Defined based on the level of income and/or education.
Minority group	Whether one is part of a minority group or not, e.g. refugees/migrants.
Digital literacy	Categorised based on the level of digital literacy.
Other groups	This category includes residency status (e.g. citizens, commuters, tourists) and work type (e.g. office jobs generally facilitate remote working compared to other occupations), among others.

Smart city policies impact different groups within societies in diverse ways. For instance, smart solutions that require greater citizen interaction and a certain level of digital skills might have a **negative impact on less digitally-educated individuals** who are unable to make use of them.

Most commonly, the **elderly** fall under this category. They tend to experience greater difficulties with using certain ICT applications, because they either do not own a smart device and/or due to their relatively low digital literacy.

Digital proficiency does not always imply easier access to smart city services. For example, based on interviews we learned that **young people** might have no knowledge at all about availability and access to e-administration services. Simultaneously, younger generations are also **more exposed to digital applications** and therefore might be more exposed to their adverse effects (e.g. in regard to privacy concerns, cybercrime, etc.).

Beyond age and digital skills, income can also play a factor. For example, lower-income households may benefit from additional job opportunities created through platform work and employment in delivery or mobility services. On the other hand, they would also be more exposed to potential negative impacts of such flexible work arrangements, which often come with disadvantageous employment conditions. In addition, households at a lower socio-economic level could be negatively affected by automated decision-making processes or by the lack of personal interactions with authorities making it difficult to access services for lack of understanding on their rights to certain services or benefits.

Residential status is also a factor to consider. Residents might experience impacts differently than commuters or tourists. For example, commuters might see their possibilities to travel limited by environmental restrictions, residents could be negatively affected by an increasing service offer through on-demand mobility and service platforms leading to increased traffic. Tourists on the other hand, benefit from additional services offered through shared services and platforms providing alternative options for finding temporary accommodations.

Finally, **entrepreneurs and owners of small businesses** are also differently affected. They might benefit from additional ways to service their customers and market their products through e-commerce and platforms, however this could also create a reliance on using these platforms, which come with their own fees and which require adapting one business model such as a restaurant that has to accommodate more delivery orders. Moreover, traditional businesses also face increasing competition through these platforms from larger companies (e.g. large e-commerce platform replacing smaller businesses) as well as new start-ups (e.g. traditional mobility providers versus shared services).

In general, though, **the cause for disadvantages or exclusion lies often in a combination of factors across demographic categories.** For example, the previously noted risk of a lack of understanding of digital services and their benefits would be heightened for a migrant as also a potential language barrier would affect that person's ability to understand the digital services and thereby access and use them, if these are only provided in the local language.

3. Identification of best practices for mitigating the associated risks of the transition towards smart cities

Based on the list of macro-challenges and risks identified in the context of our first task, we have researched best practices (BPs) experimented across European cities to prevent or mitigate them. Through the analysis of such practices, we have also identified some recurring trends and common issues that may limit or jeopardise their implementation and upscale.

3.1. Approach to best practices identification

In the scope of this study, a **best practice indicates a well-received action or activity that was implemented by at least one city to tackle a specific challenge related to the transition towards smart cities**. Best practices were identified during desk research and stakeholder interviews with city representatives, academia, and industry. To select concrete cases from the wide number of case studies and possible best practices available in the field of smart transition, we focused on practices that were relevant to the six main macro-challenges, that were proven to be successful/well-received and showed a high potential to be adaptable to other local contexts. We did not collect specific best practices for the two crosscutting ones which, as explained in chapter 2 have a transversal and often implicit nature; however we have considered them in the design of the policy options in light of their strategic impact and relevance.

There was a double objective in this task: firstly to identify and shortlist most promising cases, which resulted in **a list of 27 best practices**. The initial selection was based on the following criteria:

- 1 Mitigation or prevention of at least one macro challenge;
- 2 Demonstrated effectiveness with corresponding documentation to validate insights;
- 3 Inclusion of at least one group at risk;
- 4 Affordability;
- 5 Replicability potential;
- 6 No focus on technology only but rather on the broader implication on society.

Secondly, once we had our best practices selection in place, we developed a methodology to assess the **validity** of all 27 best practices. This was based on the **CITYkeys assessment framework used for** measuring the success and replicability of smart city projects. This EU-funded project was conceived as a 'horizontal activity' of the Smart Cities and Communities Lighthouse projects (EU-H2020-SCC1) supporting smart city project evaluation and monitoring.²⁸ The five main topics used for assessing validity are **people, planet, prosperity, governance, and propagation** and are explained in Table 3.1.

²⁸ Bosch, P. Jongeneel, S., Rovers, V., Neumann, H. M., Airaksinen, M., Huovila, A. (2017). CITYkeys indicators for smart city projects and smart cities. Available at: <https://nws.euocities.eu/MediaShell/media/CITYkeysD14Indicatorsforsmartcityprojectsandsmartcities.pdf> [Last access: 27.04.2022].

Table 3.1 - Topics used for validating selected best practices

Topic	Explanation ²⁹	Specific aspects
People 	This topic refers to the long-term attractiveness of cities for a wide range of inhabitants and users. Aspects include quality of living for everyone, education, health care, social inclusion, etc.	<ul style="list-style-type: none"> • Access to services • Education • Diversity and social
Planet 	This topic refers to higher resource efficiency and biodiversity and being better adapted to impacts of future climate change such as increased flooding risk, more frequent heat waves or droughts. Among others, less consumption of fossil fuels and more generation and use of renewable energy, lower waste generation and less air pollution are important aspects.	<ul style="list-style-type: none"> • Climate resilience
Prosperity 	This topic refers to contributing to a prosperous and equal society and supporting affordable, green, and smart solutions. On the project level, <i>Prosperity</i> stands for economic viability and the value of a smart city project for a neighbourhood, for its users and its stakeholders, and even its indirect economic effect on other entities. Economic or financial indicators often need to be accompanied with an in-depth description of the business case, as single indicators are insufficient to evaluate (e.g. the distribution of costs and investments).	<ul style="list-style-type: none"> • Economic impact • Attractiveness and competitiveness
Governance 	This topic refers to contributing to a successful process of project implementation as well as to a city with an efficient administration and a well-developed local democracy, thereby engaging citizens proactively in innovative ways.	<ul style="list-style-type: none"> • Organisation and regulatory constraints • Community involvement • Multi-level governance
Propagation 	This refers to improving the replicability and scalability of smart city project solutions at wider city scale. <i>Propagation</i> is about the potential for dissemination to other locations, other contexts, and other cities. <i>Propagation</i> - both transfer to other locations and countries, and upscaling from small single projects - depends in the first place on inherent characteristics of the (innovative) smart city project. In practice propagation also depends on external factors such as market conditions.	<ul style="list-style-type: none"> • Scalability • Replicability

The topics were aligned according to their relevance within the social approaches and impact when implementing smart city solutions. Social and governance aspects in particular play an important role as they capture the main challenges when engaging citizens and communities, and how direction, decision-making procedures and metrics support the implementation respectively. On a second level, *Prosperity* captures economic sustainability and the value impact, while *Propagation* is

²⁹ Ibid.

related to the potential for further application in other cities and contexts. Finally, the category *Planet* includes the contribution the practice brings in terms of supporting the solutions on improving the sustainability of the urban environment.

As noted, we assessed the validity of all 27 best practices hereby verifying that the latter qualify against the five topics. In the scope of this validation exercise, main aspects considered per topic are also listed in the table above.

It is important to note here that another valid selection of best practices or criteria for validation could have been made thereby emphasising another point for further research: **the need for an objective evaluation framework for smart city activities** – which is able to consider the uniqueness and territorial specificity of each experience. Some of the questions that emerged for us in that sense are: Is it possible to objectively validate smart city projects and their impacts, outcomes, etc.? How to compare the results while respecting the peculiarities of each and its territorial linkages? While some qualitative assessment is possible, we still feel an overarching and widely recognised framework is still missing.

3.2. The results of our best practice mapping

We have started our research with a comparative review of studies and compilations of best practices in the domain of smart transition. Important observations and principles, which we believe are very important to retain and that have paved the way for our own mapping can be found in [Annex IV](#) as we have no space here to elaborate on them.

Afterwards, we started mapping potential best practices relevant for our macro challenges. The best practices were **organised in a matrix** which classifies them according to some key prerequisites that are of relevance to this study:

- 1 Macro-challenge they mitigate or prevent;
- 2 Addressed group (age, socioeconomic, minority, etc.);
- 3 Digital literacy required;
- 4 Territorial area particularly affected;
- 5 Implementation and financing;
- 6 Implementation conditions (like budget, time needed, challenges and limitations etc.).

Table 3.2 lists the best practices that were identified and researched during this study. The practices cover all macro challenges. However, the one under which we have identified the highest number of BP is 'digital inequality/exclusion'. Full details on our mapping exercise outcomes can be found in [Annex V](#).

Table 3.2 - List of identified best practices

Name	Relevant challenge
Digital inclusion for refugees and non-native speaking population (Luxembourg)	Digital inequality/exclusion
Empowerment of digital skills for youth (Hungary)	Digital inequality/exclusion
Support of socially disadvantaged households and families (Belgium)	Digital inequality/exclusion

Name	Relevant challenge
Empowerment of digital skills for youth (Germany, Spain, Czech Republic)	Digital inequality/exclusion
Libraries as a place for reducing digital divide (Lithuania)	Digital inequality/exclusion
Social and digital inclusion of disabled people (Belgium, Ireland, Spain, UK)	Digital inequality/exclusion
Digital inclusion for women (Ireland)	Digital inequality/exclusion
Local support to e-inclusion ecosystem (Belgium)	Digital inequality/exclusion
Publicly available key vision and related strategy documents (Stavanger, Leipzig, Hamburg, etc.)	Lack of trust or approval in the service and/or service provider
Education of the citizens on implementation benefits (Vienna)	Lack of trust or approval in the service and/or service provider
Transparency and education on offered solutions (Vienna)	Lack of trust or approval in the service and/or service provider
Neutral third-party controls of service providers (Legal Equalizer, US)	Lack of trust or approval in the service and/or service provider
Education of community on privacy, security and safety aspects (TRANSFORM project - Amsterdam, Copenhagen, Genoa, Hamburg, Vienna, Lyon)	Privacy, surveillance, cybersecurity and safety aspects
Development of an overarching ICT concept for the city (including security and privacy aspects) (Haßfurt)	Privacy, surveillance, cybersecurity and safety aspects
Conduct regularly external (security) audits (e.g IT service provider or transportation provider) (multi-country)	Privacy, surveillance, cybersecurity and safety aspects
Creation of an ICT concept and ecosystem based on systems/components built on open and well-defined standards (Hamburg)	Data loss, inaccuracy, lack of reliability and interoperability issues
A certification scheme for Smart City solutions (applicable to Europe, implementing party: Bable)	Data loss, inaccuracy, lack of reliability and interoperability issues
Set up and follow project coordination process for Smart City planning (STEEP project - San Sebastian (Spain), Bristol (United Kingdom) and Florence (Italy))	Data loss, inaccuracy, lack of reliability and interoperability issues
Free public transport for residents (Tallinn)	Economic damage and inequalities
Amsterdam's Taxi Policy (Amsterdam)	Economic damage and inequalities
Ecommerce support to small local businesses (Ireland)	Economic damage and inequalities
Transformation of shopping mall into apartments (Rhode Island)	Economic damage and inequalities
Ad-funded models - LinkNYC (New York)	Financial (or other) burden for authorities

Name	Relevant challenge
'Crowdfunding' / Collective financing - Onze Energie (Amsterdam)	Financial (or other) burden for authorities
'Crowdfunding' / Collective financing - CN Smart L'Hub (Milan)	Financial (or other) burden for authorities
Public-private Partnerships - City Data Exchange (Copenhagen)	Financial (or other) burden for authorities
Public-private Partnerships - Smart City Living Lab (Alabama)	Financial (or other) burden for authorities

In the following paragraphs, four out of the 27 best practices are presented. We selected these four best practices, as they best help us showcase some key observations that came out from our comparative analysis. Further, each of them should be considered highly relevant and worth being highlighted because it:

- has a high potential to be replicated by other cities;
- was successful/well-received;
- supports directly or indirectly the inclusion of groups at risk by supporting them directly or providing relevant information to increase trust in public authorities;
- has a different financing scheme thereby highlighting the diversity of approaches;
- offers access to services crucial for the city's sustainable development.

Here below we provide a brief legend for the icons that have been included in each best practice representation.

Table 3.3 - Legend for best practices icons

Addressed aspect	Icon	Explanation
Targeted age group		Refers to a best practice which does not have a specific targeted age group meaning that it is relevant for all groups.
		Refers to a best practice that has female children and young adolescents as a targeted age group.
		Refers to a best practice that has adults as a targeted age group.
Digital skills required		Refers to the needed digital skills in order to make use of this best practice. In more detail, this icon refers to the fact that only basic digital skills are needed.
Estimated budget		Refers to a best practice that has an estimated budget of less than 100 000 €.

		Refers to a best practice that has an estimated budget of more than 100 000 €.
Implementation time		Refers to the time needed to have a first functional version of a best practice. If available, the estimated implementation time is written next to the icon.
General		Refers to the prerequisites of a best practice.
		Refers to the best practice's aspects to be adapted to the local context
		Refers to the identified KPIs of a best practice

3.2.1. Best practice 1: 'Digital inclusion for women'

Figure 3.1 - The 'Digital inclusion for women' best practice



Introduction: Figure 3.1 illustrates the best practice on 'Digital inclusion for women' with the corresponding prerequisites on the left as well as the aspects to adapt and possible KPIs on the right. This best practice was implemented in Ireland (Carlow, Cork, Clare, Dublin, Galway/Mayo, Limerick, Longford, Roscommon, Sligo and Tipperary) and aims at supporting women to enter the domain of STEM (Science, Technology, Engineering, Maths) professions. Thereby, this best practice partially addresses the Smart City impact of 'Digital inequality/exclusion' while aiming at the larger vision of integrating a certain societal group into the domains of STEM professions. Clearly, many of these STEM professions are linked to digital skills and require the further development of digital and ICT concepts besides being often based on fundamental scientific knowledge and education.

Short description: The best practice (also named Teen-Turn) aims especially at female teenagers and young adolescents allowing them to enjoy two weeks work placements in STEM related

companies. In addition, it offers additional courses and seminars as well as exam support, when it comes to school or further educational aspects. The goal is to allow the participants (young women) to picture themselves in a STEM working environment and to support them in pursuing this professional path.

Target groups: The target groups are young and teenage women from disadvantaged and underrepresented communities.

Territorial focus: The best practice was implemented in the whole of Ireland targeting regions and urban areas in parallel.

Budget: The financing was acquired through the involved companies, which were also seeing it as an opportunity to win future specialists for their business development.

Topics: It has a clear focus on the topics *People*, *Prosperity*, and *Propagation* hereby strengthening the long-term attractiveness of cities, as well as equality of citizens. In addition, this best practice is highly replicable not requiring specific adaptations.

3.2.2. Best practice 2: 'Local support to e-inclusion ecosystem'

Figure 3.2 - The 'Local support to e-inclusion ecosystem' best practice



Introduction: The next practice is the 'Local support to e-inclusion ecosystem'. This practice has been mainly implemented in the Brussels Capital Region, but was also extended to Flanders as the Flemish speaking region adjacent to Brussels. In Figure 3.2 it is visible that this best practice has no specific prerequisites, which is due to the fact that it targets a wide range of citizens without any restrictions and can actually be applied to any context, where digital skills and understanding – a pillar in our modern societies – could need any improvement. Furthermore, it was very difficult to identify and abstract metrics from this practice – we observed that mostly the contributions and created structures were reported. Thus, it seems that the impact of the measures seems too difficult to quantify. However, qualitative evaluations could have been conducted in the context of this best practice and were not publicly reported.

Short description: The best practice is implemented by Mediawijs, the Flemish Knowledge Centre for Digital and Media Literacy established at Imec, which is one of largest government funded

research and development centres for electronics and ICT in Europe. Its activity aims at supporting the structuration of digital inclusion network in Flanders by providing useful resources to stakeholders. Through the materials - published in the scope of this activity – professionals and associations working in the field of digital inclusion can improve the way they address residents of the Flanders region and Brussels to better deal with digital technology and media (Quite similar resources centres have been implemented in France over the last three years at regional level to boost digital inclusion – French digital inclusion hubs).

Target groups: professionals and associations in the field of digital inclusion and all citizens – especially those in need of improving their digital skills.

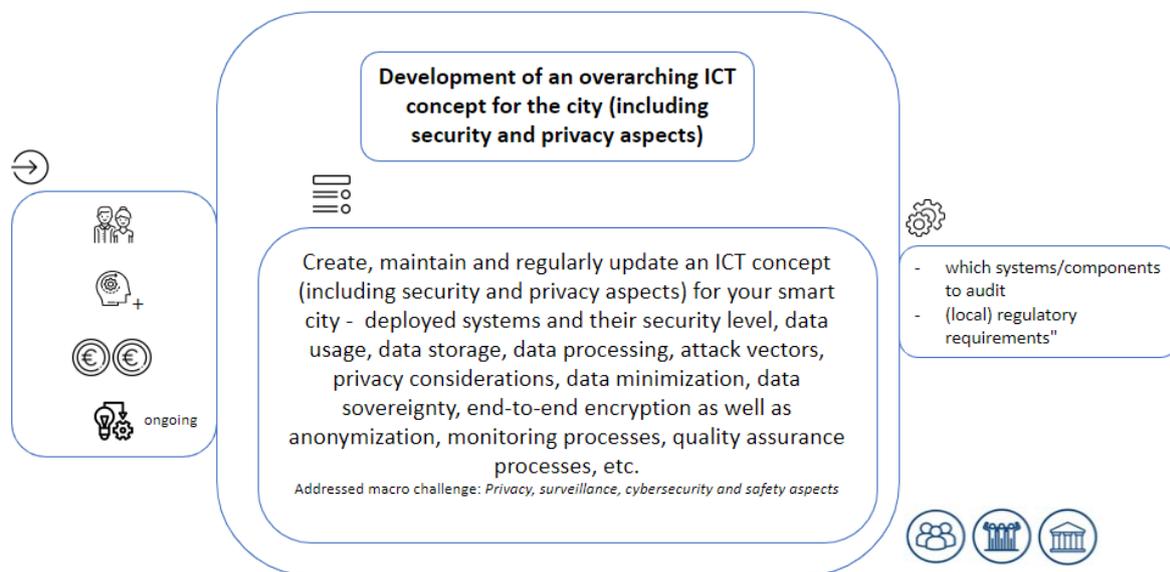
Territorial focus: cities and regions.

Budget: The belonging Knowledge Centre (Medjawijs) and the best practice are established at Imec and are correspondingly supported by governmental funding.

Topics: As described, the best practice has a clear focus on the topic *People* hereby trying to achieve equal quality of life for all citizens. A nuanced focus is also on the topic *Propagation*. In addition, this best practice seems to be replicable without many needed modifications.

3.2.3. Best practice 3: 'Development of an ICT concept'

Figure 3.3 - The 'Development of an ICT concept' best practice



Introduction: Given that ICT is a crucial part of the smart city transition, a holistic approach regarding ICT including the consideration of IT security and privacy is of utmost importance. This initiative deals with this aspect and addresses the macro challenge of 'privacy, surveillance, cybersecurity, and safety aspects' by enforcing an ICT concept that both ensures security/privacy while at the same time informing citizens about data processing and other aspects. In addition, this concept enables cities to conduct audits of most critical systems in order to ensure their proper functioning.

Short description: As mentioned several times throughout this study, ICT plays an important role in the smart city transition, being both an enabler but also a potential cause for exclusion or

challenges. Privacy, surveillance, cybersecurity, and safety are relevant aspects when talking about impacts of ICT. An overarching ICT concept that addresses the fundamental aspects of communication, cybersecurity and privacy serves two main purposes: 1) it enables the authorities and responsible parties to have a complete understanding of the deployed systems, their security implications as well as the communication between systems, and 2) it facilitates the dialogue between citizens and local authorities when provided information are available and updated regularly hereby increasing the trust in the city and its deployed systems.

Target groups: The target groups are both authorities and residents hereby highlighting the importance of ICT and related security/privacy aspects, promoting use of safe and secure best practices, and informing citizens about relevant processes and mitigation measures which may lead to increased trust.

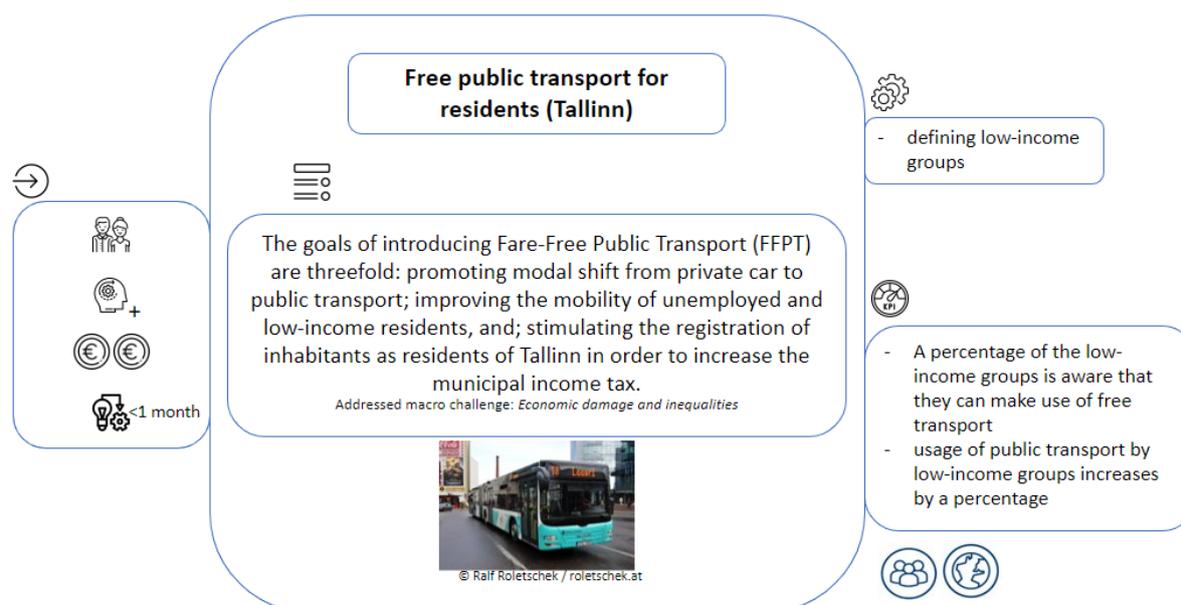
Functional area: The whole city.

Budget: Estimated by interviewees and based on literature research, a budget of less than €100 000 is needed to create this ICT concept appropriately and promote contained information accordingly. In addition, a recurring budget of less than €500 000 should be allocated to regular audits of the most critical systems in order to ensure that they are working securely.

Topics: It has a strong focus on the topic *Governance* hereby aiming to create a city with an efficient administration which engages with its citizens proactively. A smaller emphasis is put on the topics *People* and *Prosperity* which can be explained by the direct and indirect involvement of citizens as well as the implications of this best practice on the citizens.

3.2.4. Best practice 4: 'Free public transport for residents'

Figure 3.4- The 'Free public transport for residents' best practice



Introduction: This best practice was implemented in Tallinn, Estonia and aims at providing fare-free public transport to all residents. It mainly addresses the macro-challenge of 'economic damage and inequalities' by supporting citizens with low-income and enabling them to partake in public

activities in their city by increasing their mobility. The system worked so well that it spread across most of Estonia and has enabled local authorities to reinvest in public transport.

Short description: After the 2008 financial crisis, the transport system in Tallinn was brought in and integrated. Originally, the focus was to offer public transport to citizens with low-income who needed to spend a significant part of their budget on public transport. In addition, the main goals of introducing Fare-Free Public Transport (FFPT) were: (1) promoting modal shift from private car to public transport; (2) improving the mobility of unemployed and low-income residents, and (3) stimulating the registration of inhabitants as residents of Tallinn to increase the municipal income tax with which the new system is paid. Regarding (1), a study in 2014 showed a significant reduction in trips made by residents on foot (40%) whereas the number of trips by car was only decreased by 5% hereby showing that the implicitly expected effect on emissions appeared to be nowhere near as huge as hoped.³⁰ Nevertheless, it was shown that the large majority of the residents of Tallinn are satisfied with their public transport system.³¹

Target groups: The target groups are all residents, but especially those with low-income.

Territorial focus: The best practice was implemented in the city of Tallinn with a focus on the functional urban area.

Budget: The public transport tickets are free; they are subsidised through parts of the income tax of all residents of Tallinn.

Topics: The best practice is particularly relevant under the topic *People* hereby aiming to create equal quality of living for all citizens. As described, the best practice also aims to strengthen the topic *Planet* by reducing the amount of individual traffic and increasing the use of public transport.

3.3. Discussion

We would like to present some key findings emerged during the process of best practice identification, analysis and validation. The first observation worth mentioning is that **budget and costs for the different best practices vary strongly** depending on the investment willingness and the readiness of the processes and technologies. The above examples illustrate this well by coming with budgets that vary from under €100 000 up to €500 000. Some of the identified best practices (not presented in the examples list – hence, see [Annex V](#)) were even consuming budgets of a few thousand euros per item (e.g. business entity) whilst others had estimated budgets of more than one million euros.

Funding sources also vary, ranging from public funding, venture capital investments and direct investments from companies as can be seen above. For example, the best practice 'Local support to e-inclusion ecosystem', 'Free public transport for residents', and 'Development of an ICT concept' involve public funding, while 'Digital inclusion for women' is based on direct contributions from the participating companies. Notably most of the case studies on digital inclusion showed a fragility with regard to the sustainability of funding.

Another critical observation is that 'most of the best practices are not applied on large scale but **remain on the level of trials or short-term initiatives**'. This is valid for most of the examples above and it was also recognised by the experts we engaged as a trend encouraged by the focus of EU funding in this field on innovation and prototyping. Most of them remain limited in scope also in terms of the population and stakeholders targeted. This implies that their scale-up and replication

³⁰ Cats, O., Susilo, Y. O., & Reimal, T. (2017). The prospects of fare-free public transport: evidence from Tallinn. *Transportation*, 44(5), 1083-1104.

³¹ [Use of Tallinn public transport increases by 10% in 2018](#) as of 05.05.2022.

is also very limited. To enable the replication of best practices, a potential acceleration could be achieved through the **establishment of accessible platforms and processes for the sharing and exchange of best practices and related experiences between cities and regions**. This can lead to an iterative process, where each replication of a given best practice can capitalise on results and achievements and further fine-tune and improve processes and features.

In addition, several best practices are targeting **the inclusion of minorities or special social groups**. This is valid for all the above examples except for the 'Development of an ICT concept' one. Furthermore, for some there is a risk that people with low digital skills are left behind – this is valid for the majority of tools that might require advanced digital skills or access to special equipment for using related services.

Three out of the four examples we showcase **are ICT based to a large extent** (i.e. they use ICT technology as a main module), which is another key observation to flag. Again, this is linked to the focus of our study and the identified challenges but does not mean that all valid smart city related solutions need to have an IT or digital focus.

Finally, it can be emphasised that there are **no established convincing monitoring procedures for the majority of best practices**. There is mostly no or limited impact monitoring, mainly focussing on some immediate results. What is also observable is that there are no unified abstract evaluation criteria and frameworks for impact monitoring. In most of the cases, the best practice comes with its own specific and often limited metrics, which are mostly filled based on the instant observable results. As mentioned above, most of the best practices are based on ICT technology, which can provide an extra opportunity for efficiently gathering statistics and monitoring data, while of course it is important to consider all GDPR and data protection aspects when involving data generated by citizens in this process.

4. Overview of the multilevel regulatory context and policy options

This chapter presents the regulatory context and identifies key actions taken at the EU level in the domain of smart cities. This review provided the foundation for us to start developing proposed policy options that could be considered of interest for EU policy-makers, also in light of their complementarity with already existing or upcoming EU initiatives and actions.

4.1. Overview of the main EU legislative framework and initiatives in the domain of smart transition

In the past, the EU has been active in paving the way for the transition toward smart cities across its Member States. **Multiple legislative packages have been rolled out to steer and regulate the digital transformation** and its increased importance in every aspect of daily life. In this context, it is important to flag the intrinsic tension between EU policy-making and the fact that most actions to implement and steer the transition are being taken by local policy-makers and other actors (many also private). This means that, although the EU is setting standards, providing an overarching legal framework in a key digital domain, and fostering cooperation between local governments across the EU, **the depth and speed at which urban areas are transforming is in the hands of local and regional policy-makers**, and depends heavily on local circumstances and dynamics.

As part of this study, we collected relevant information on the existing policy frameworks at the EU level in the domain of smart city transition. While the bulk of existing legislation covers digital aspects,³² multiple relevant programmes and initiatives have also been launched and implemented in recent years to foster a more human centric transition. Given the scope of this study we focused primarily on those which could have a relevance for tackling the risks and challenges we had identified as part of our first task. The review covers most recent and relevant initiatives, programmes that were concluded and that were not prolonged or replaced have been included in the list, if deemed relevant to showcase possible gaps or bottleneck in EU action.

The complete overview of relevant legislation, programmes, and initiatives, which includes thematic issues (e.g. privacy³³ and e-identity³⁴), initiatives and programmes directly targeting smart cities (from EU missions³⁵ to urban innovative actions³⁶ and independent movements such as Living-in EU³⁷), and forward-looking communication and strategies (e.g. the New Leipzig Charter³⁸ or the digital finance strategy for the EU³⁹), is included in [Annex VI](#).

³² The focus on ICT aspects of the transition has also been highlighted in the scope and limitation of this study (see Chapter 1).

³³ [Regulation \(EU\) 2016/679](#) on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation).

³⁴ [COM\(2021\) 281](#) Proposal for a Regulation amending Regulation (EU) No 910/2014 as regards establishing a framework for a European Digital Identity.

³⁵ [COM\(2021\)609](#) Communication on European Missions.

³⁶ [Urban innovative actions](#) (UIA) is an initiative of the European Union that provides urban areas throughout Europe with resources to test new and unproven solutions to address urban challenges.

³⁷ EU cities, regions and Member States are in the process of signing a [political declaration 'Living-in.eu'](#), subscribing to a set of principles and commitments, aiming to deploy standards based interoperable local data platforms and other urban solutions.

³⁸ [New Leipzig Charter](#) – The transformative power of cities for the common good.

³⁹ [COM\(2020\) 591](#) Communication on a Digital Finance Strategy for the EU.

However, a few aspects deserve to be highlighted for further consideration, also in light of potential future policy action. They are presented in the box below.

4.2. Our approach to the identification and shortlisting of policy options

Comprehensive and coherent framework around the use of data

Comprehensive legislation on the processing, storing, and sharing of personal, non-personal, industrial, and open data will provide a **sound framework for the deployment of data-intensive smart cities technologies in the years to come**. Those measures will reduce the risks related to privacy infringements and unlawful surveillance, which in turn could facilitate the acceptance of innovative smart cities technologies by the general public. Clear rules, applicable across the EU, will also facilitate the sharing of best practices across cities, as the same legislation will be applicable.

Standardisation across the digital single market

A central theme in the EU policy discourse in recent years is the **push toward enhanced standardisation**, and the advantages of limiting fragmentation of the internal markets along Member State lines. Among those measures we can identify a recent communication on standardisation,^{*} proposals to develop an EU wide cybersecurity certification,^{**} and similar discussion in the field of artificial intelligence (AI) applications.^{***} Standardisation allows cities and local governments to select trustworthy technologies and applications, which can be marketed across the EU, **facilitating the replication of success stories from cities located in different Member States**.

Pivotal EU action in supporting the establishment of networks, platforms, and joint forces

Another important avenue where the EU has been active, is in the facilitation of networks, platforms, and joint forces for cities across the EU to exchange best practices, ideas, and facilitate mutual learning. Those initiatives are key to connecting individual cities across the EU, e.g. via physically visiting other cities from which to learn from. One of the main limitations of such an approach, however, is that those activities can be costly for local authorities with constrained budgets. Furthermore, smaller cities or towns currently not part of those networks, might not have the means, nor the information, to join them. The risk, therefore, is to promote networks that mostly benefit cities already invested in the smart transition.

* [COM\(2022\) 31 Communication](#) on EU Strategy on Standardisation.

** [Regulation \(EU\) 2019/881](#) on information and communications technology cybersecurity certification.

*** [COM\(2021\) 206](#) Proposal for a Regulation on Artificial Intelligence Act.

Throughout the delivery of this study, the research team focused on identifying gaps and possible avenues for future action to face the challenges identified in the first stage of the project as well as the shortcomings that emerged from the analysis of the best practices. The teams also took note of possible policy options discussed by stakeholder or in position papers and other sources including as part of the interviews and first validation session hosted by the team to discuss challenges and best practices implications. All those insights resulted in a first list of potential policy options, which have been collected here in a single document (see [Annex VII](#)), and are briefly summarised in Table 4.1 below. For each option, we also indicate relevant challenges that they would help to tackle.

Table 4.1 - The 15 policy options collected

Policy option	Description
1. Set up a supervisory body for certification and quality assurance of the digital infrastructure in cities;	To tackle privacy, surveillance, cybersecurity and safety aspects in particular when it comes to data loss and reliability. It would further help promote citizens' trust and buy-in in service providers as well as in public institutions.
2. Develop an urban data community at the European level;	Tackle fragmentation and build synergy across cities by sharing resources. This option may be relevant for multiple challenges, including interoperability, data protection and allowing cities (including smaller ones) to get access to expertise and therefore face issues linked to financial burden and digital exclusion.
3. Support the establishment of local networks, coalitions, and joint ventures among cities and regions;	Tackle fragmentation and build synergies across cities by sharing knowledge. This option can address the financial burden for local communities, e.g. reducing the costs via common procurement and the pooling of resources and expertise.
4. Strengthen the role of national contact points to further link EU and local realities and support capitalisation and upscale;	Tackle fragmentation between EU, cross-national initiatives, and the local authorities across the EU. It would facilitate the exchange of information between different levels of governance and provide an accessible entry point for communities that are currently excluded by existing initiatives. It would thus help reduce digital exclusion and reduce financial burdens for local authorities.
5. Set up helpdesks and pools of experts for less-digitalised cities (pilot project for technical support);	Reduce digital exclusion and inequalities, and lower the burden for local authorities by helping smaller communities in setting the first steps for their smart transition. Support could encompass both how to integrate citizens in the decision-making process and how to technically implement smart solutions. Ultimately, this can improve the acceptance of smart solutions.
6. Reinforce capacity building of public administrations to strengthen digital skills and promote capitalisation through peer-to-peer learning (staff training and staff exchange);	Reduce digital exclusion and inequalities, and lower the burden for local authorities by providing more training for local administrators, and supporting them in taking advantage of smart solutions. This can lead to increased trust in smart solutions and improve the mutual learning between cities across the EU.
7. Capitalise activities across EU-funded programmes working on different aspects of the smart transition;	Supporting capitalisation activities across EU-funded programmes can reduce the fragmentation of approaches to smart transition. A more holistic approach can help reduce fragmentation and inequalities, while increasing trust and acceptance of the smart transition.
8. Integrate citizens into design approaches to transition and promote bottom-up solutions;	Promoting bottom-up approaches across policy measures can help increase the trust and acceptance of smart solutions across the EU, and decrease economic inequalities.
9. Research and provide further evidence on the benefits and costs associated with remote working and service provision in cities;	Comparative studies could be launched to understand the approaches experimented across the EU in relation to COVID-19, and its impact on urban areas. Sharing knowledge can provide better information, improving policy-making, reducing burdens for authorities, and fostering the acceptance of smart solutions, as they would be backed by sound analyses.

Policy option	Description
10. Assess existing legislation on energy efficiency in the built environment against the impact of remote working;	A comprehensive assessment of the environmental impact of ICT in general, and smart city solutions in particular could guide future policy-making, reducing burdens for local authorities and inequalities across the EU. Future legislation on energy efficiency for building and urban planning could concentrate on the relevant aspects of the smart transition.
11. Increase efforts to provide fixed and mobile broadband connectivity to all cities and communities across the EU;	To reduce the risk of digital inequality and exclusion, providing connectivity could become an even stronger priority for the EU than at present. Expanding connectivity to all areas of the EU would also limit economic damage to people who do not have access to connectivity, and increase the approval in the provision of smart services, as more citizens could benefit from them.
12. Support the constitution of networks for local stakeholders involved in digital inclusion;	To tackle the risk of digital exclusion, networks for local stakeholders, e.g. cities elaborating digital inclusion strategies, could be envisaged. Exchanging information and knowledge could help reduce the burden on local authorities while increasing the acceptance of digital solutions for the target groups.
13. Support communities and local and traditional product or service providers to survive competition from online platforms;	Supporting traditional products and services via funding and sharing of knowledge will reduce the risk of economic damage and inequality, preserving activities that might be facing structural disadvantages against online competitors.
14. Declare connectivity a right and regulate the provision of essential services	To tackle the issue of digital exclusion and vendor lock-in, especially in peripheral areas of the EU where competition is limited, this option proposes the regulation of essential services, preventing companies from following a purely market logic.
15. Create a knowledge platform for best practices to support replicability and scale up of inclusive smart city solutions.	To support the free exchange of knowledge of socially inclusive smart city solutions and practices, the creation of a knowledge platform with instructions and details on implementation can reduce the burden on local authorities, facilitate the sharing of knowledge, reduce inequality and exclusion, and spur citizen involvement in decision-making, and consequently their support for the proposed solutions.

These options stem from the findings of the previous chapters of this study, responding to the risks categorised in Chapter 2, and based on the lessons learnt from the experience of best practices across the EU. The aforementioned options have been further analysed, in some cases combined and then shortlisted based on three main criteria which are:

- **Whether there is a possibility for policy-makers at the EU level to act:** This first aspect deals with the tension – discussed at the beginning of this study (see Chapter 1) between the focus on the urban level and the tailoring of policy options for EU policy-makers. In some cases, it was unclear whether the EU had competences to act, and especially what could have been proposed at the EU level to tackle a local (albeit widespread) issue. We excluded options where we could not find, based on our aforementioned review of the EU policy and legislative framework, a concrete opportunity for intervention;
- **The extent to which the policy option builds upon and can integrate existing policy framework and EU objectives:** This second aspect deals with focusing on policy options

that can further develop, improve, or strengthen existing legislation and ongoing programmes. Given the small size of the study, and the vast number of actions already undertaken by the EU, we focused our attention – where possible – on further strengthening or complementing existing initiatives or ongoing programmes – thus also avoiding unnecessary replication;

- **Whether the option has EU added value and its delivery is realistic:** This final aspect deals with two interlocked aspects, i.e. whether a policy option provides benefits in being implemented at the EU level, and whether implementing such policy can be done at acceptable timescale and costs.

4.3. Presenting our policy options

As previously discussed, multiple initiatives have been launched at the European level to support the transition to smart cities across the continent. Nonetheless, throughout this study, we identified a number of gaps and avenues for further action. We therefore present a selection of six policy options that could assist cities across the EU in their smart transition. It should be noted that each option can be considered and implemented as stand-alone, but where possible we have also highlighted possible links between these options and avenues where they can mutually reinforce each other.

Following the three criteria described above, the research team shortlisted six policy options to support the transition to smart cities:

- **Policy option 1:** Set up a supervisory body for certification and quality assurance of the digital infrastructure in cities;
- **Policy option 2:** Strengthen the role of national contact points to further link EU and local realities and support capitalisation and upscaling;
- **Policy option 3:** Set up helpdesks for less-digitalised cities;
- **Policy option 4:** Reinforce capacity building of public administrations to strengthen digital skills and promote capitalisation through peer-to-peer learning;
- **Policy option 5:** Research and provide evidence on the benefits and costs of remote working and service provision in cities;
- **Policy option 6:** Create a knowledge platform for best practices to support replicability and scale up of inclusive smart city solutions.

4.3.1. Policy option 1: Set up an independent body for certification and quality assurance of the digital infrastructure in cities

In line with recent proposals on cybersecurity certifications (see [Annex VI](#)), and existing certifications for compliance with the General Data Protection Regulation (GDPR), new certification could be developed specifically for digital infrastructures and smart city products and solutions.

As for the telecom sector,⁴⁰ a supervisory **body could be established to certify the resilience of the digital infrastructure in cities according to defined standards**. This could also be complemented with audits on cybersecurity, data protection, and data quality. Such a body could provide base tests, against which providers of smart city solutions would advertise. **Such base**

⁴⁰ The Body of European Regulators for Electronic Communications (BEREC) 'aims at fostering the independent, consistent and high-quality regulation of digital markets for the benefit of Europe and its citizens', as noted in its [strategy 2021-2025](#). Among the tasks of the body, according to the [European Electronic Communication Code](#) (EECC), BEREC issues 'guidelines on several topics, reporting on technical matters, keeps registers, lists or databases and delivers opinions on internal market procedures for draft national measures on market regulation' as stated on its [website](#).

testing and certification would increase the understanding of the fitness of a proposed solution to tackle a city's need.

Furthermore, the proposed certification could have multiple positive impacts. First, reducing market fragmentation could facilitate the upscaling of innovative solutions. Second, widespread use of the proposed certification would support cities across the EU to adopt best practices introduced elsewhere, knowing that such a solution would comply with the standards set by an EU-wide independent body. Finally – providing the certification – an independent body would reduce asymmetries of information between providers of smart city solutions and city officials. A better understanding of the solutions offered and of the quality of the infrastructure could increase the debate around their adoption, spurring citizen participation in decision-making, better acceptance of the chosen solutions, and possibly increasing trust in smart solutions.

One of the options discussed in the course of our validation session on the proposed policy options was **to create such a body through a bottom-up and collaborative approach, and thus trying to find common standards across cities and regional authorities rather than imposing them top-down**. This could help improve the relevance and applicability of the provisions and create buy in. The body should include representatives of the Member States and local officials.⁴¹ It would operate across the EU, so as to reduce the risk of regulatory fragmentation.

EU legislation could be introduced to set-up, fund, and manage such a body. The legislator could:

- Recommend the use of certified products, allowing city officials and private providers to freely adhere to such certification;
- Tie EU funding for the deployment of smart city solutions and products only to solutions which have been certified by such a body;
- Enforce the exclusive use of products and technologies certified by this body across the EU.

Table 4.2 - Assessment criteria for policy option 1

Criterion	Description
Cost and benefits	The EU could bear the cost of setting up and running the body. Member States could provide staffers and appoint national certification centres to increase the speed of the certification process. The benefits are widespread: city officials would have transparent information on solutions offered to them; competition might increase due to more transparency on the quality of various solutions on the market.
Feasibility and effectiveness	The establishment of an independent body for certification is not unprecedented. Its effectiveness could vary, depending on whether such certificate would be mandatory or voluntary, and on its uptake in the latter case. Coordination across Member States and arrangements to also ensure multilevel governance at international level is very important.
Risks and uncertainties	Mandatory certificates could slow down innovation from smaller companies due to the higher costs of compliance. Also, the set-up of independent bottom-up solutions often does not take sufficiently take the experiences and needs of the local institutions into account, which is why

⁴¹ The governance of the body could include by default a defined number of local representatives per Member State. Alternatively, representatives from a network of cities could be included among the members.

Criterion	Description
	we recommend to also ensure a collaborative approach to standard setting.
Coherence with EU objectives	The option is in line with the objectives of the 2030 digital compass. ⁴²
Relevant governance level and decision-makers	Such an option could be introduced at the EU level, to avoid the risk of regulatory fragmentation in case of national action. Local and city authorities could be represented in this body to allow for an efficient feedback loop and should be involved in defining common standards.
Potential ethical, social and regulatory aspects	Attention would be needed to avoid overlaps with GDPR certification, cybersecurity and possibly AI solution certification.

4.3.2. Policy option 2: Strengthen the role of national contact points to further link EU and local realities and support capitalisation and upscaling

To connect smaller, less-digitalised cities and communities to European networks, initiatives, and funded projects, this policy option proposes to increase the use of national contact points, to **help raise awareness about initiatives and opportunities but also adopting and promoting practices, solutions and ideas from the local level and thus facilitating top-down and bottom-up sharing**. Their role could be particularly important in bringing **grass-root initiatives from local groups or individuals** to light that have proven valuable at local level and deserve to be promoted. Eliminating linguistic barriers and providing information across programmes, they could facilitate the involvement of all EU territories, reducing exclusion and inequalities in smaller cities and peripheral areas.

National contact points have already been established and proved effective, for example within URBACT.⁴³ One possibility to explore could be that, in the framework of the upcoming European urban initiative (EUI),⁴⁴ one of the core tasks of its network of contact points may be to further advance knowledge sharing in the domain of socially inclusive smart cities. Depending on how they will be structured, an option could be to **set up a dedicated workstream (or function) to focus on themes related to socially responsible smart transition**. The contact points could provide information on relevant existing and upcoming legislation and calls for funding. They would also be tasked with supporting and propagating awareness across the EU of existing networks of cities, which play a key role in the sharing of best practices and fostering the uptake of innovative solutions (as previously discussed in this chapter). Finally, providing a dedicated contact point for local authorities to gather information on funds, initiatives, networks of cities, and upcoming EU programmes, could help reduce the fragmentation of different programmes and projects, fostering the links between regional and European funding on digital and R&I.

⁴² [COM\(2021\) 118 Communication](#) on 2030 Digital Compass: the European way for the Digital Decade.

⁴³ [URBACT](#) is the European Territorial Cooperation programme aiming to foster sustainable integrated urban development in cities across Europe. The launch of the first calls under [URBACT IV](#) is expected to be launched in Autumn 2022.

⁴⁴ The overall objectives of the [European urban initiative](#) are to strengthen integrated and participatory approaches to sustainable urban development, and to provide a stronger link to EU policies, and in particular to cohesion policy and investments in urban areas.

As part of its focus on knowledge capitalisation, we could also see the value of the EUI designing a special capitalisation activity aiming to **identify and bridge lessons across the many domains which have a relevance to smart transition** (from employment to environment to digital). To be noted as inspiration – the work done by urban innovative actions, among others, for collecting knowledge and good practice on the Just Transition.⁴⁵

One of the main difficulties discussed and recognised by stakeholders and policy-makers at multiple levels of governance, is connecting smaller, less-digitalised cities and communities to European networks, initiatives, and funded projects. Such difficulties are explained by a variety of factors, including not having the linguistic skills needed to obtain information, the budget to employ staff or advisers capable of navigating the multiple projects and initiatives being launched at the EU level, or lacking the skill to apply for grants and other funding schemes.

To that end, this policy option proposes to increase the use of national contact points, that could be tasked with **supporting smaller cities and raising awareness of initiatives and opportunities through campaigns but could also adopt and promote practices, solutions and ideas from the local level and thus facilitate top-down and bottom-up sharing**. They could **operate in the local language of the Member State** hosting them. Eliminating linguistic barriers and providing information across programmes could facilitate the involvement of all EU territories, reducing exclusion and inequalities.

The proposed dedicated units – or task forces – could provide information on existing and upcoming relevant legislation and calls for funding. They would also be tasked with supporting and propagating awareness across the EU of existing networks of cities, which play a key role in the sharing of best practices and fostering the uptake of innovative solutions (as previously discussed in this chapter). Finally, providing a dedicated contact point for local authorities to gather information on funds, initiatives, networks of cities, and upcoming EU programmes, could help reduce the fragmentation of different programmes and projects, fostering the links between regional and European funding on digital and R&I.

Table 4.3 - Assessment criteria for policy option 2

Criterion	Description
Costs and benefits	Depending on the design chosen by the legislator, the cost can be contained if existing NCPs are expanded and entrusted with cross-cutting scope. Further synergies can be found when implementing options 3 and 6 concurrently.
Feasibility and effectiveness	The value of NCPs for urban policy has been demonstrated by practice – and the decision of the EUI to have such a network as part of the initiative is proof. For instance, positive feedback from URBACT suggest they could be beneficial and add value both as conduits for propagating experiences and knowledge from the local level and to promote dissemination and reach out to national and local communities.
Risks and uncertainties	N/A
Coherence with EU objectives	The option is line with existing programmes and initiatives at the EU level, as it could foster the uptake of such initiatives, while increasing

⁴⁵ UIA capitalisation work on the Just Transition can be found on the programme's [website](#).

Criterion	Description
	synergies across actions and would also respond to cohesion policy objective 5 – 'A Europe Closer to Citizens'.
Relevant governance level and decision-makers	Each Member State could delegate such a role to knowledge institutes, independent associations, or a network. Minimum requirements could be set to ensure consistency across the EU.
Potential ethical, social and regulatory aspects	N/A

4.3.3. Policy option 3: Set up helpdesks and pools of experts for less-digitalised cities (pilot project for technical support)

Digital helpdesks could be established to support smaller, newly connected and less-digitalised cities, whose officials might lack the necessary digital literacy and funding to adopt digital solutions. **Support would be needed in, for instance, identifying first steps and facilitating the prioritisation of solutions to be implemented, being mindful of constrained budgets.** This policy option tends to reduce the issue faced by multiple cities across the EU, which cannot easily find qualified experts and technicians due to the specific skills required, and the relative competitiveness of the private sector in attracting such profiles. Ideally, **hands-on technical support could be provided to requesting cities both on technical aspects**, but also on methodologies and approaches, to **engage and involve citizens, set up and manage multistakeholder partnerships** (including academia, private sector) etc. Such support could be offered under two different pillars, responding to specific needs. Under pillar one, city officials from EU cities that already implemented smart solutions could offer **mentoring and coaching**. They could, for example, share their expertise in how to support those innovations politically, **include citizens in the decision-making processes**, and discuss lessons learned from an administrative standpoint. Under pillar two, a pool of **experts and technical advisers could provide hands-on support in the implementation of smart solutions**, via demonstrations, guidelines, and the developments of plans for the incremental adoption of different smart solutions. The proposed helpdesks could, after an initial assessment of the needs of the interested city, manage the matchmaking between the city and an expert with the specific technical skills needed. Such technical support, included under 'pillar two', could initially be launched as an EU pilot project, to cap its costs and allow policy-makers time to evaluate its effectiveness. Its format could take the ASTON Network⁴⁶ as an example. Based on its results, technical support could be expanded and consolidated into an EU programme, similar to the Technical Support Instrument under DG REFORM.⁴⁷

Table 4.4 - Assessment criteria for policy option 3

Criterion	Description
Costs and benefits	The pool of experts could be mobilised upon request. The EU could fund the cost of the programme, without co-financing by Member States or concerned local authorities. To avoid crowding-out of investments,

⁴⁶ The [ASTON Network](#) is designed for African cities but based on methodologies developed and tested in Europe. For less digitalised cities some elements from its format could be relevant.

⁴⁷ The [Technical Support Instrument](#) provides tailor-made technical expertise to EU Member States to design and implement reforms.

Criterion	Description
	strong eligibility criteria could be developed, to ensure that eligible cities are only those who lack the resources and skill to implement smart solutions independently (see footnote 48 below for a discussion on eligibility criteria).
Feasibility and effectiveness	The proposed initial phase of the pilot project would allow EU policy-makers to test the effectiveness of the option before committing increased resources. Also, in this case, alignment with DG REGIO on the setting up of the EUI and the role of its expert database could be discussed.
Risks and uncertainties	Possible risks include crowding-out Member State funding. Clear eligibility criteria ⁴⁸ could reduce the risk of local authorities relying on EU funding for projects they would have implemented autonomously. Risks related to local realities and possible language barriers could be mitigated if this option was implemented together with option 2.
Coherence with EU objectives	Similar hands-on support has been used by the urban agenda, urban innovative actions, and URBACT. The objective is to foster territorial cohesion and reduce economic disparities across cities and municipalities in the EU.
Relevant governance level and decision-makers	To ensure widespread access to communities across the continent, the EU could run such expert support. Local authorities would be tasked with initiating the request presenting their problems and needs. Such an approach would be demand-driven and could foster citizens' involvement in the decision-making process.
Potential ethical, social and regulatory aspects	N/A

4.3.4. Policy option 4: Reinforce capacity building of public administrations to strengthen digital skills and promote capitalisation through peer-to-peer (staff training and staff exchange)

Digital competences and life-long learning remain a priority for public administrations' capacity building, especially in less-developed regions and municipalities. While valuable instruments, such as the Joint Assistance to Support Projects in European Regions (JASPERS), have proven valuable in supporting local authorities in designing and implementing their smart projects, **often external advice and traditional technical assistance support is not sufficient to create lasting competences as organisational changes, new learning methods and mechanisms to attract and retain qualified staff are needed.** In addition, some **issues cannot be tackled at the city level alone, but require a synergetic action across more cities.** For instance, the deployment of digital solutions in the domain of air quality, water management, or traffic control would require neighbouring cities to act jointly. If only one municipality is in the position of deploying such tools,

⁴⁸ While at the Member State level the [Digital Economy and Society Index](#) (DESI) summarises indicators on Member States' digital performance, similar indicators are not yet available for the local level. Currently, the [Local and Regional Digital Indicators](#) (LORDI) framework is being developed within the [Living-in EU movement](#) to benchmark the local and regional level. If LORDI testing is successful, it could be used as a metric for eligibility. It could help filter technical support toward cities that need it the most.

the benefits of doing so would be highly reduced. This, in turn, can further limit the success of replication or implementation of best practices across cities.

While multiple technical assistance programmes are in place, and national and regional governments are investing in the upskilling of their work-force, it is noted that more support is needed to avoid exacerbating existing differences between EU regions. Therefore, this policy option proposes the **inclusion, in technical assistance programmes, of more twinning of local public administrations and peer to peer exchanges**, replicating an exercise already experimented in programmes such as international urban and regional cooperation, or TAIX-REGIO Peer2Peer.⁴⁹

The use of **Erasmus+ for staff exchange between public administrations could also be promoted with a special focus on small cities as well as for cross-border regions where administrations need to learn to work in synergy**. Favouring the immersion of public administrators into a different environment, where comparable processes are tackled differently, can foster mutual learning and increase the adoption and replication of best practices, competences and working approaches across cities. To be successful, **such a scheme would need to provide clear incentives for local administrations and staff members to join the programme**, for example labels of recognition for hosting cities. This option could be linked to option 3, as the matchmaking exercise under pillar one could also provide guidance for the set-up of peer-to-peer exchanges and not just mentoring.

Table 4.5 - Assessment criteria for policy option 4

Criterion	Description
Costs and benefits	Civil servants would continue to receive salaries paid by their home employers during the exchange period. The EU could finance the gap in case a similar position is remunerated differently in the hosting Member State. Costs would otherwise be limited to the running of the programme. It should also be noted that 20% of the funding earmarked from the Recovery and Resilience Facility of the NextGenerationEU for digital transition is reserved for activities pertinent to cities.
Feasibility and effectiveness	The programme would be voluntary. Cities could become signatories and civil servants could apply for an exchange freely. Effectiveness would depend on the number of participating cities and the digital skills and processes implemented in the hosting cities.
Risks and uncertainties	The lack of interest of highly digitalised cities in participating in the programme could strongly undermine its effectiveness. Incentives for hosting authorities could be envisaged to mitigate this risk.
Coherence with EU objectives	The programme would improve the quality of local administration and reduce disparities between cities across the EU. Peer-to-peer is promoted by programmes such as TAIX REGIO peer-to-peer for the

⁴⁹ The [International Urban and Regional Cooperation](#) aims at developing a form of decentralised international urban and regional cooperation focused around sustainable development and innovation in key countries and regions, in line with the external dimension of 'Europe 2020'.

	management of Cohesion Funds. ⁵⁰ The EUI should also plan a peer-to-peer exchange scheme for city officials.
Relevant governance level and decision-makers	While the EU could launch and run the framework, the success of the programme would depend on local governments agreeing on participating both as hosting and sending parties.
Potential ethical, social and regulatory aspects	N/A

4.3.5. Policy option 5: Research and provide further evidence on the benefits and costs associated with remote working and service provision in cities

This policy option proposes to fund research to gather more evidence on the costs and benefits of remote working, e-commerce, and the provision of services in cities.

The COVID-19 pandemic is accelerating profound societal changes across the EU, amongst others, in the way people work. Discussions are ongoing in virtually every Member State on how to regulate smart-working. While research is flourishing on the impact of COVID-19 on industry, supply chains and trade among other things, more research is needed to understand the local dimension, i.e. the impact of COVID-19 on cities. More research is needed on the benefits and costs of remote working and service provision in cities. **Comparative studies across Member States could be launched, assessing different approaches, to provide initial insights into the risks, mitigation measures, and successful approaches experimented across EU cities since 2020.** Such research could help to understand how the urban space has or could be redesigned and organised to accommodate these new trends (such as smart-working) and how they could be regulated.

Studies could be envisaged on different aspects of remote-working and service provision (especially due to the revolution accelerated in many Member States by the COVID-19 pandemic), to better inform EU and local policy-making alike. A proposed topic to explore further, in line with existing EU priorities, could be **better understanding of the energy efficiency aspects of remote working.** Residential areas have become temporary (or semi-permanent) office spaces, meaning that heating is often used all day long. The possible savings due to better insulated residential areas could be estimated, and policy action could be taken in consequence, if deemed necessary. Such new knowledge and outcomes could inform technical assistance programmes and peer-to-peer set-up - see policy option 4.

Table 4.6 - Assessment criteria for policy option 5

Criterion	Description
Costs and benefits	The cost of the proposed studies would be limited and their findings could provide EU, national, and local policy-makers alike with new evidence for future policy action.
Feasibility and effectiveness	Research, both in terms of studies and of applied experimentation is at the core of EU policy-making. Within most existing programmes it

⁵⁰ [TAIEX-REGIO PEER 2 PEER](#) facilitates exchanges between the national and regional bodies that manage and administer funds from the European Regional Development Fund (ERDF) and the Cohesion Fund. It helps civil servants share knowledge, good practice and practical approaches with their peers in other EU countries. This way they upgrade their administrative capacity, thereby improving EU investment outcomes.

Criterion	Description
	could be possible to expand the city dimension. Furthermore, ESPON could launch a targeted analysis on this topic. ⁵¹
Risks and uncertainties	N/A
Coherence with EU objectives	As per the example on energy efficiency, promoting research on multiple aspects of remote-working can inform and support EU policy-makers in reaching EU objectives.
Relevant governance level and decision-makers	The European Parliament and European Commission could both increase the focus on the city dimension in upcoming research.
Potential ethical, social and regulatory aspects	Research could help shed a light on potential ethical, social, and regulatory aspects related to remote working.

4.3.6. Policy option 6: Create a knowledge platform for best practices to support replicability and scale up of inclusive smart city solutions

To support free exchange of knowledge of socially inclusive smart city solutions and practices we propose the creation of a semi-formal, multilingual platform or catalogue for best practices that can be regularly updated by its users and rather than remaining a simple repository, provide a laboratory for testing and knowledge capitalisation. The platform could include best practices and relevant information for replicability also coming from existing repositories such as the DG RTD yearly mapping repository, the EU missions knowledge portfolio as well as UA, UIA, URBACT and the JRC. The platform should be **freely accessible in all EU official languages**, to ensure that even smaller local authorities across the EU could benefit. The entity managing it should be able to select and gather experiences and cases already available across these existing initiatives as well as be able to cater for the participation of local actors through a bottom-up data collection effort. **Every time a best practice from the platform is implemented, the city that implemented it could include the refinements and possible further developments they introduced, providing a feedback loop that enriches the value of the platform itself and allows consolidation of the practices.** Such a platform could be advertised by the NCPs introduced in policy option 2 to increase awareness and should gather and broker knowledge collected across EU-funded projects and locally funded initiatives. The platform could also provide methodological guidance and standards to uniform assessment and monitoring practices, advice on scalability and replication and training materials of general interest. The platform could be **intended not only for city officials but also for companies and individuals/community representatives** who have a solution to offer (a prior quality check should be performed before upload). Furthermore, **this platform could be used by local users as a first step in understanding what possible solutions could address their needs.** For that reason, the platform should include specific parameters to facilitate the users' task in searching the catalogue. In a second phase, if more support is needed, e.g. in designing a plan for rolling out the chosen solution, cities could require support from experts, as introduced in policy option 3.

⁵¹ The [European Spatial Planning Observation Network](#) (ESPON) is an applied research programme aimed at supporting the formulation of territorial development policies in Europe. To this end, the programme produces wide-ranging and systematic data on territorial trends related to various economic, social and environmental aspects, with a view to identifying the potential of regions, cities and larger territories and the economic challenges they face.

Table 4.7 - Assessment criteria for policy option 6

Criterion	Description
Cost and benefits	The EU could support such a platform financially, and could facilitate the replication and adaptation process through different events (see policy options 2 and 3). A core unit able to manage content, collect cases and moderate interaction will be essential. For such a platform to be of added value, cooperation at EU and national level is essential and therefore it requires a joint effort across EU institutions/DGs and participation by national and local bodies.
Feasibility and effectiveness	Similar initiatives were already launched and were successful, for example as part of the 'living-in EU' movement. An important factor is multilingualism, enabling more cities to participate. What should distinguish this platform from existing repositories is the participatory approach and engagement of users, who are asked to provide feedback and further contribute to the fine-tuning of best practices based on their experience.
Risks and uncertainties	Risk of replication of existing knowledge platforms and repositories. This platform should not collect and gather new knowledge but act as a brokering tool and be connected and work in synergy with EU repositories and initiatives, as well as be able to connect to local realities (e.g. through the NCPs or local affiliated networks).
Coherence with EU objectives	The policy option is aligned with EU initiatives such as scalable cities. ⁵² More repositories of best practices are also already in place or will be set up. In that sense, synergy with content coming from – for instance, the upcoming EUI knowledge-sharing platform, new European Bauhaus-related initiatives, or the EU mission on climate neutral and smart cities would be essential.
Relevant governance level and decision-makers	While the EU could launch and run the platform, its success would depend on local authorities participating and sharing knowledge. The smart cities marketplace could perhaps help as a catalyst to attract and disseminate knowledge from the platform and NCPs could promote participation locally.
Potential ethical, social and regulatory aspects	N/A

4.4. Discussion

As a final step, we would like to present a few final considerations that we consider useful sharing as they touch upon overarching issues that could serve as inputs for future policy debate.

⁵² The role of [scalable cities](#) is to identify and promote solutions and business models that can be scaled up and replicated across Europe and lead to measurable outcomes such as new jobs and energy savings.

Need to establish more networks to connect local realities across the EU and promote bottom-up action

As noted in this study, there are multiple examples of successful networks at local, national, and EU level.⁵³ These initiatives can promote the union of municipalities or regional governments to tackle the transition, paying attention to homogeneous territorial development, thus better including rural and peri-urban areas. They can foster inclusion, reduce costs for local authorities via the exchange of best practices and success stories. Furthermore, by fostering the ties between cities and other municipal areas, such networks can increase acceptance of new technologies. The main force of local networks, in this context, is their closeness to citizens and the urban realities they represent, meaning that acceptance of new technologies would be driven by their main users and recipients, instead of being agreed upon and promoted top-down.

As noted in a recent report, while direct engagement of civil society stakeholders in strategy building, policy making and public service design and delivery is vital for the creation of a 'digital government ecosystem', **small towns are the least involved** in external networks.⁵⁴ This could be explained by their lower level of available resources. Therefore, to **develop inclusive networks across the EU**, adequate funding, capacity building and ad hoc expert support (including to overcome language barriers) might be needed.

Focus on new governance models putting the city and its citizens at the centre

As noted in this chapter, projects have been launched at the EU level with a focus on new governance models. For example, the recently announced EU mission on smart cities is bound to shift the paradigm of research and innovation by **involving more actively multiple stakeholders encompassing a big share of society**. Another promising example is the work surrounding the new European Bauhaus movement.⁵⁵ Using local digital twins, policy-makers experiment with digital urban planning, e.g. giving a virtual reality tour to groups of citizens, showing them the results of proposed planning and including them in the decision process.

These new forms of citizen involvement can also be complemented by the allocation of specific lines of funding directly available for citizens to support bottom-up small-scale smart solutions for localised needs. This will **facilitate the tailoring of solutions for particular needs, in a way that is approved and welcomed by the relevant stakeholders**, due to the proximity between the designing of a solution and the reality in which it needs to be implemented.

The need to further involve citizens in the development and fine-tuning of policy decisions related to the smart transition is well understood by all local stakeholders and decision-makers consulted during this study. Their inclusion is critical for the successful roll out and widespread acceptance of smart city technologies, and it needs to be incrementally included in each level of governance.

Multilevel governance however also means **looking beyond EU boundaries**, especially in a field such as the smart and digital transition; working with and learning from other realities is essential. Therefore, peer-to-peer cooperation, such as that promoted in the context of the IURC – international urban and regional cooperation, but also at a higher-level, and close alignment with the actions brought forward by, for instance, the UN HABITAT people-centred smart cities program, is highly recommended.

⁵³ Examples include: the Spanish [smart cities cluster](#), the [Allied ICT Finland](#), and the [international Cities coalition for digital rights](#).

⁵⁴ [ESPON](#), The territorial and urban dimension of the digital transition of public services, 2017.

⁵⁵ [COM\(2021\) 573](#) Communication on New European Bauhaus.

Need to think about smart cities in a holistic way

To promote a more sustainable and inclusive approach to smart cities, it is fundamental to overcome silos and realise that innovation is not simply about digital tools, mobility, or environmental issues on their own. Urban planning, how such tools are to be deployed and integration with existing infrastructure, also need to be taken into account. As for the Just Transition, the EU and its Member States need to **move toward a more human and community-based notion of smart cities that ensure no one is left behind**. This requires more thinking on how the smart city transition is designed and the **strategy behind it** – an aspect and phase of the process that is still often overlooked and where more knowledge, advice and guidance can be provided.

It is therefore essential to concentrate funding innovation and capitalisation measures able to bring these fields together and foster more integrated solutions. In line with the new policy objective 5 – 'Europe closer to citizens',⁵⁶ the future of smart and inclusive cities and societies lies in the ability to put the citizens at the centre and make them the actors and not just the recipients of the smart transition.⁵⁷ The road toward a socially inclusive smart transition is long and requires further action. Evidence of the positive contribution of smart city services to inclusive and socially responsible cities should be highly promoted, so that smart transition becomes anchored in the daily life of cities. To succeed, it is paramount that the EU works together with city governments and takes their needs into full consideration. The main challenge ahead will be reaching out and engaging with all cities across the EU to prevent disparities. That is where we feel the EU should invest its efforts in the years to come.

⁵⁶ Details can be found [here](#).

⁵⁷ As also presented when describing new modes of governance, such as in the case of Bauhaus projects.

Annex I – The components of a smart city

In the following pages, we shortly describe each of the five components of a smart city. As introduced in chapter 2, these five components are:

- Smart & safe living
- Smart governance and e-citizen
- Smart mobility
- Smart environment
- Smart economy

Each of these components is described in the following sections with a particular focus on exemplary use cases, the objectives and stakeholders involved as well as an example of a particular technology being used in a city.

Smart & safe living



The smart and safe living component of smart cities encompasses actions that directly affect the wellbeing of citizens. It includes actions related to security and health as well as to social aspects, education and training, including the improvement of digital skills. Smart city actions related to smart and safe living primarily affect the social, technological, and ethical impact domains. Links to the political / legal, economic and environmental domains are less evident.

Objectives	Stakeholders involved
<ul style="list-style-type: none"> • Improvement of public security; • Better access to health and social care; • Better access to education and training; • Reduction of digital divide and improvement of digital skills (digital empowerment). 	<ul style="list-style-type: none"> • National and local authorities; • Police; • Healthcare providers; • Education and training institutions; • Social actors; • NGOs; • Civil society.

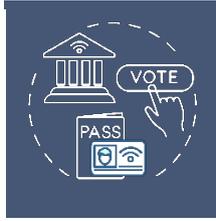
There are various applications in the smart and safe living component, these include for example in the area of security, video surveillance systems and crowd control platforms; In the area of health, homecare assistance services and telehealth applications; and finally for education, learning and training platforms. The box hereunder presents a particular example in the health area focusing on city responses to pandemics.

Smart city technologies to prevent the spread of diseases

During COVID-19, various technologies were used to combat the spread of the pandemic, for example Bluetooth- or GPS-enabled apps have been used for contact tracing and detecting exposure to infected people. Additionally, the use of telemedicine has become more widespread globally as it reduces the need for face-to-face contacts thereby expediting service provision, addressing staff shortages, preventing overcrowding in hospitals, and reducing additional health costs and waiting times. For example, a COVID-19 self-checker tool was designed by the US Center for Disease Control and Prevention and Microsoft, which allows users to self-assess and recommends them a suitable course of action.

Source:: Sharifi, A.; Khavarian-Garmsir, A.R.; Kummitha, R.K.R. [Contributions of Smart City Solutions and Technologies to Resilience against the COVID-19 Pandemic: A Literature Review](#). Sustainability 2021, 13, 8018.

Smart governance and e-citizen



Smart governance can be defined as a governance structure aiming to improve decision making and inclusivity through technology and smart approaches that facilitate more efficient collaboration among different stakeholders, and in particular between authorities and citizens. As such, the use of ICT enables increased citizen engagement and provides potential for transparent collaborative governance practices. Smart governance practices can lead to three types of improvements: Administrative efficiency and interoperability, and service improvement. In terms of risks, impacts fall in the political/legal, ethical and social domains. Technological impacts due to the reliance on digital infrastructure are also prevalent. Not so prevalent are economic or environmental impacts.

Objectives	Stakeholders involved
<ul style="list-style-type: none"> • Efficiency, through modernisation of local public administration; • Accessibility of government services • Inclusivity through improvement of citizen's participation. 	<ul style="list-style-type: none"> • National and local authorities; • Civil society and citizens; • Public service providers; • Platform providers.

The smart governance and e-citizen component has various applications. The digitisation of municipality's internal services or open data and urban data platforms to improve administrative efficiency happen often unbeknownst to citizens. However, applications targeted at service improvements, such as the implementation of a web or mobile citizen portal, online reporting tools, and other e-services that enables citizen to interact with their local administrations can have a direct impact on citizens and require considerations for inclusivity. Moreover, civic technology aimed at boosting citizen participation in decision-making facilitate but also require active citizen participation. The box below, showcases an example from Lyon using an open data platform and a one-stop shop for e-services.

Smart city ICT application for increased efficiency of e-services across multiple municipalities.

Comprised of 59 communities, the Lyon urban zone (*Métropole Grand Lyon*) is the second largest agglomeration in France with a population of 870,000 in 2017. As a result of pursuing an agenda of digital innovation with the objective of enhancing the efficiency and effectiveness of public services, the Grand Lyon administrative region has implemented an open data platform in which the various communities have gained access to information and resources for various e-services across different municipalities and communities. This one-stop platform called Toodego, helps citizens to find various urban services in different domains such as public administrative services, transportation, waste management, leisure, health, services for the elderly or persons with disabilities.

Source: Becker, S.; Slobodova, O. [Zooming Into the Ecosystem: Agency and Politics Around Open Data Platforms in Lyon and Berlin](#). *Front. Sustain. Cities* 2020, 2, 20

Smart mobility



Smart mobility can be defined as the use of technology and smart solutions to improve the mobility system. Improvements can be roughly grouped in four categories; the reduction of pollution, reduction of traffic congestion, reduction of travel time and costs and the increase of the safety of transport solutions. As a result, smart mobility solutions have the potential to lead to better connectivity and accessibility, at lower environmental and economic cost. The risks we identified fall under the economic and social impact domains. Less

often smart mobility applications might have technological, environmental, ethical and political/legal consequences.

Objectives	Stakeholders involved
<ul style="list-style-type: none"> • Increase of the safety of transport; • Reduction of travel time and costs for goods and people; • Reduction of pollution; • Promotion of alternative mobility means & public transport. 	<ul style="list-style-type: none"> • National and local authorities; • Road/rail management; • (Public) transport companies; • Vehicle manufacturers; • Mobility platforms.

Smart mobility use cases include solutions that aim at improving the mobility service offer for example through mobility on demand platforms and shared vehicles. In cities, initiatives such as car-sharing or, more recently, shared electric scooters are rapidly being deployed. They also address interoperability and efficiency aspects of transport modes through multimodal platforms, journey planners and smart traffic management systems. Finally, they aim at addressing environmental and quality of life impacts of traffic through smart parking, city tolls and low emission zones. A specific example would be the mobility on-demand platform developed by the Deutsche Bahn, presented in the box hereunder.

Smart mobility efficiency by integrating on-demand services into public transportation.

The Deutsche Bahn (DB) has developed with its subsidiary ioki, a mobility on-demand platform where different third parties such as cities, transport companies and local transport authorities can operate and provide different user with efficient transportation services. Through a mobile app for passengers and for mobility providers detailed information and resources about scheduled services, mass transport networks and mixed transportation solutions can be accessed. ioki's operating system for digital and on-demand mobility enables the optimisation and digitalisation of all transportation offerings resulting in more efficient and effective transportations methods.

Source: Stehlin, J., Hodson, M., & McMeekin, A. [Platform Mobilities and the production of urban space: Toward a typology of platformization trajectories](#). *Environment and Planning A: Economy and Space*, 2020, 52,7

Smart environment



Smart environment can be defined as a set of smart solutions and systems for managing and improving utilities as well as environmental quality in cities allowing to adjust to specific environmental scenarios. It includes the use of smart devices and monitoring systems to safeguard the health of a city's population against negative externalities of urbanisation such as pollution as well as to increase the efficiency of various utility infrastructures such as waste management, electricity, gas and water usage. Risks and impact domains

concerned encompass economic and technological ones due to high costs associated and cybersecurity risks.

Objectives	Stakeholders involved
<ul style="list-style-type: none"> • Attaining environmental targets • Improvement of risk management and pollution management • Improvement of city infrastructures • Increased efficiency in electricity, gas, water and waste management • Increased stability and safety in utility services 	<ul style="list-style-type: none"> • National and local authorities • NGOs • Civil society • Utility providers • Building owners and managers

The rapid growth of cities and their digital transition to a smart city is accompanied by a range of sustainability challenges that need to be addressed. Consequently, smart environment solutions are being adopted across smart cities to tackle those challenges and protect and preserve the environment for example through risk and disaster management platforms and sensors for monitoring of weather, waste and environmental quality. An example for the latter is presented with the Breathe London pilot in the box below. Furthermore, smart environment solutions create cities that are conducive to improving citizens' quality of life, as well as increase efficiency in the use of resources and energy by improving utilities through smart grids, smart meters or water and waste management/monitoring solutions.

Implementation of smart solutions to fight air pollution

Urbanisation and economic growth have resulted in large increases in vehicle use, industrial activities and energy consumption in cities around the world, leading to pervasive urban air pollution. Many cities have therefore integrated air quality sensors into existing infrastructure in order to monitor the air quality in key areas and intervene or provide advice to the public on which areas to avoid. For example, the city of London has an extensive network of air quality monitors and is engaged in introducing policies aimed at reducing air pollution. The Breathe London pilot sought to provide valuable insights on the differences in air quality throughout the day, key hotspots for air pollution and to evaluate the impact of city intervention.

Source: Fonseca, E., & Whitney, M. [New Monitoring Technologies can help cities combat air pollution](#). World Economic Forum. 2021

Smart economy



A **smart economy** can be defined as an economy that is based on technological innovation, resource efficiency, sustainability and high social welfare as key drivers for growth. It adopts innovation in the areas of industry, welfare and transactions to facilitate new entrepreneurial initiatives, increases productivity and competitiveness. In addition, environmental considerations are often taken into account in a smart economy, leading to products and services with a lower environmental footprint. As such, for smart economy we identified risks

associated with the economic, social and to some extent environmental and technological impact domains.

Objectives	Stakeholders involved
<ul style="list-style-type: none"> • Economic growth, competitiveness and adaptability through technological innovation • Resource efficiency and sustainable growth • Improved social welfare 	<ul style="list-style-type: none"> • Companies, SMEs and employers • Consumers and employees • Banks and local authorities • Financial institutions

A smart economy consists of the three sub-dimensions of industry, welfare and transactions. It includes solutions aimed at creating favourable conditions for economic growth and new employment modes, for example through platforms for e-commerce and on-demand work. It also aims at efficiency increases for example through electronic and mobile payment forms. Finally, new economic models are developed through applications and platforms promoting a sharing economy. In particular, the rise of on-demand work and flexible employment has provided many opportunities but also concerns on precarious working conditions as is outlined further in the box hereunder.

The rise of on-demand work through online platforms and apps

The rise of online social platforms and digitalisation has had a considerable impact on the labour market of countries and regions as an increasingly number of apps and websites are providing matching services between employment-seekers and companies or private individuals. Examples of such platforms include *Taskrabbit*, *Handy*, *Wonolo*, and *Innocentive*. Employments contracts offered on these online platforms often consist of short term assignments and cover a wide variety of areas and fields. As a result, such marketplaces deliver significant opportunities for flexible employment as it increases the efficiency of delivering and offering work and ensures transparent transactions and employment contracts, positively stimulating economic growth and welfare.

Source: Aloisi, A. [Commoditized workers. Case study research on labor law issues arising from a set of on-demand/gig economy platforms](#). *Comparative Labor Law & Policy Journal*, 2016, 37,3

Annex II – Matrix of impacts and use cases

The matrix of impacts and use cases was used to identify use case specific impacts and based on that come to conclusions of relevant impacts across smart city components and the macro challenges. The complete matrix provides an overview over all five smart city components, 25 use cases, 48 impacts, and the 6 macro challenges and 2 crosscutting ones (i.e. impact groups).

The starting point of the matrix is the first sheet, labelled 'Matrix', which presents the 25 uses cases in separate rows. For each use case, the columns present its smart city component(s), a general description, identified negative impacts (or risks), potential opportunities or best practices (link to task 2), the stakeholder groups impacted and the territorial dimension of the use case. The second sheet, labelled 'Impacts', provides an overview over the impacts summarised, grouped and merged based on the findings in sheet one. It also presents impact groups (macro challenges), and the impact domains.

The full matrix is available as a [separate Excel file](#) (tabs 'use cases' and 'impacts') to allow for easier consultation, accessible alongside the study online.

As an example, the **use case 'Sharing economy applications/platforms'** (row 26) links to the smart city components 'Smart economy' and 'Smart Mobility'. It is described as an economic/social model that broad sectors of the population can employ to collaboratively make use of under-utilised assets, in which supply and demand are interacting for the supply side to directly provide products/services. Specific risks identified under this use case include:

- Technological: The on-demand business model has caused privacy and safety concerns for both customers and contractors. This type of sharing economy requires people to give up some of their privacy;
- Social: Nuisance for uninvolved third parties: e.g. nuisance for neighbours by tourists renting 'normal' apartments, users 'wild parking' share scooters/bikes;
- Economic: Economic Costs for Participants, i.e. providers suffer from disadvantageous employment conditions;
- Economic: Economic costs for third parties, e.g. through tax evasion, increased property prices, and adverse effects for other markets.

The digital literacy required to access sharing apps and platforms can be considered low. There are however **social groups particularly affected** by this use case, namely people with a lower income or education as they might more often make use of these platforms for access to cheaper good or for extra income. Furthermore, platform-mediated trust mechanisms in the sharing economy also bring about and perpetuate discrimination. Whether they are drivers on ride-sharing platforms or hosts on peer-to-peer accommodation platforms, for identical services, minority-group providers could have to charge lower prices than non-minorities.

An **external factor** accelerating the use of sharing economy applications is the perception of consumers on benefits (and disadvantages) of the sharing economy. An **internal factor** linked to specific sharing economy applications is the trust consumers have towards them.

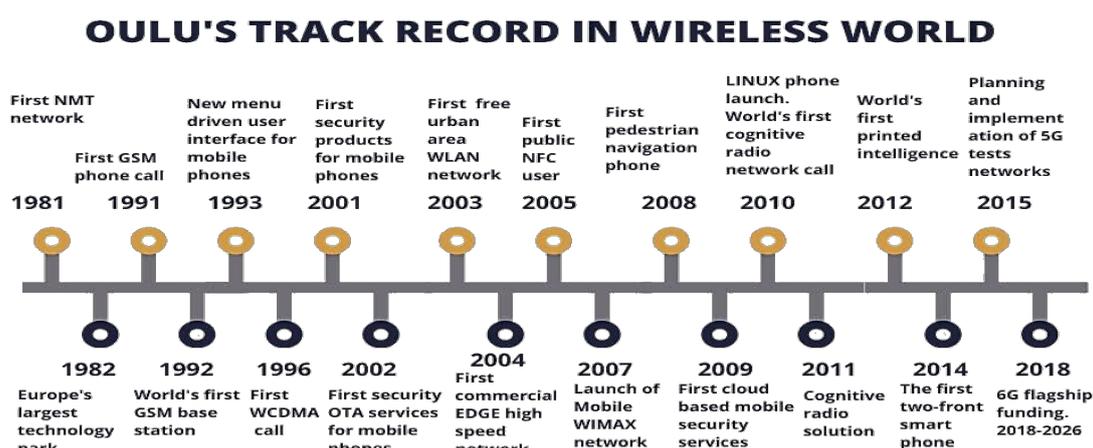
Annex III – City case studies

Oulu

[Oulu](#) is the northernmost port-city on the west coast of Finland with a population of approximately 260 000 in the functional urban area, including 210 000 in Oulu city itself. It is a mid-size town by EU standards but it is the 4th most populated urban area of the country and, by far, the largest urban area in the very sparsely populated northern half of Finland.

Oulu is a university town with students representing 10% of the population. The two universities are among the largest employers in the area and active stakeholders in the digital transformation of the city.

Figure A.1 - Oulu's decades-long specialisation in wireless technology



Source: *City on the edge* by *Business Oulu* via *Omnitele*

Oulu's specialisation in ICT stems from its early role as the centre for radio equipment for the Finland's military and further deepened through Nokia's decades of growth. Nokia's equipment R&D and engineering functions centred in Oulu meant high-skills highly paid employment opportunities throughout the ecosystem, including the universities.

At its peak, in the first decade of this century, Nokia and its ecosystem represented the largest source of employment in the area. The struggles of Nokia following the 2008 crisis caused successive reorganisations and plants closures, directly impacting the city.

It is partly in response to this situation that local and regional authorities took an active role in developing and spearheading the digital transformation strategy currently being implemented in Oulu. Oulu's model of smart city is among the most comprehensive in its scope and reach.

Governance and main actors

More than a single Smart-city project, the digital transformation of Oulu is achieved through a set of initiatives aimed at different functions and/or different publics through a combination of thematic platforms and more targeted projects.

These are led by the local and regional authorities with active support from the Centre for Economic Development, Transport and the Environment (ELY Centre), a regional agency operating on delegated powers from the national government and functioning as the managing entity for the European structural and investment funds. City authorities and their partners benefit from the

peculiar form of governance in Finland which involves a great amount of autonomous governance by Municipalities, including through direct taxes. Another helpful feature is the practice of deep cooperation (horizontally and vertically) between different levels of governing authorities. This cooperation manifest through joint participation in consortiums that channel funds, manage platforms and implement projects.

The local digital transformation effort appears closely aligned with a national strategy to 'digitalise' the relationship between the citizen and the public administration. At national level, the move involves deliberate focus on expanding the availability of services rather than merely substituting the in-person service by a digital one. For Oulu, this means local services can be built on top that national infrastructure. The nationwide deployment of digital identity in particular, is an important enabler of local eGovernment services.

Private sector participation is intense but no single large corporation dominate despite many global players being represented locally. This is in part the result of successive forced disengagements of the national champion Nokia through the 2010s. The current decade opens with a promising reversal of that trend. Having recovered from a decade of crisis, Nokia recently announce its plans to open a new R&D centre in Oulu.

Relevant smart city applications

eHealth: The Oulu Health platform

Among the [many projects](#) ongoing, those related to Oulu Health, which are merely starting, illustrates the twin challenge of seeking to stimulate innovation and address population aging. The former is promising but highly uncertain, the latter is enormously impactful and inevitable. Part of the funding will come from the European structural and investment funds for the current programming period (2021-2027).

Figure A.2 - Oulu Health, Partners



<p>Smart RDI: A new RDI environment of the OuluHealth ecosystem to promote digitalization and support the co-development of wireless technologies and virtual solutions, such as VR / AR devices and mobile services. This will be achieved with a strategic approach involving partnership between several target groups. The project activities bring together companies, researchers, developers and healthcare providers.</p>	<p>DIGIHEALTH: Digital Health (DigiHealth) looks at international breakthroughs in development and application of novel digitalised solutions to predict progression of diseases and in offering personalised therapies in a cost-effective and patient-centric way. In addition to the university and Oulu University Hospital, OAMK (Oulu University of Applied Sciences) also participates in DigiHealth activities.</p>
<p>NACCOP: NACCOP (Nordic Arctic Co-creation Platform) project's target is to strengthen the innovation work of SMEs in healthcare and wellbeing by developing an Arctic platform for the Nordic countries to co-operate through quadruple helix model.</p>	<p>POPSOTE: It is the regional implementation of the national reform of health and social services in the Northern Ostrobothnia region. All of the municipalities and the health and social service organizations are part of the project.</p>

<p>FUTURE HOSPITAL 2030: project is to modernise Oulu University Hospital (OYS) in such a way that it becomes the smartest hospital in the world, utilising the most advanced technologies and providing personalised and effective healthcare services. The Future Hospital project also brings business opportunities for health technology companies that provide innovative health solutions.</p>	<p>EHEALTH RESEARCH IN VIRTUAL HOSPITAL: This project refers to a national network of researchers who work in the e-health domain and focus on the new digital health services provided by Virtual Hospital 2.0. The e-health researcher network shares results and best practices. It also facilitates collaboration in research.</p>
<p>HEALTH TECHNOLOGY ASSESMENT (HTA): The Finnish Coordinating Centre for Health Technology Assessment (FinCCHTA) is located at the Oulu University Hospital (OYS). The objective of the unit is to coordinate Health Technology Assessment (HTA) in Finland as well as to cooperate with international HTA bodies. Other key objectives are to develop HTA methodological training and strengthen its related research.</p>	<p>DIGIHEALTH HUB: The DigiHealth Hub initiative creates competence networks to identify and spread the knowledge and best practices of exploiting health data and to study the impact of implementation of digital health solutions.</p>
<p>Digi-HTA: University of Oulu and FinCCHTA: Digi-HTA provides evidence-based information about new digital healthcare solutions, such as mobile applications and artificial intelligence and robotics solutions.</p>	<p>Extract from source: https://ouluhealth.fi/projects/</p>

Main risks and challenges observed

The main challenge in the coming decades for Oulu will be to address the needs of a growing portion of the population *aged 75 and older*, while sustaining services and infrastructures serving the needs of a decreasing share of young adults. The focus on eHealth as one of the ongoing priorities is in part the reflection of keen awareness of the changing needs of an aging population. Whether the current approach will produce results serving the local residents needs or mainly generate a stream of new services and products to be acquired or implemented elsewhere is hard to say at this point.

The two universities contribute actively to several projects and will need a steady stream of students for their own existence and to train students to take-up specialised skills positions which the digitalised local economy will require. The problem is shared by many cities in Europe but more acute for Oulu since the large region around it is not very populated. Competing with university towns in the denser southern part of the country is not a solution since it would work against the coherence and synchronisation with national programmes and ongoing cooperation with other regions. Furthermore, formerly separate fields and industry segments (such as Communications and Computing) continue to converge meaning Oulu, Tampere and Espoo will increasingly compete for the same students and workers.

Finally, Oulu faces two challenges that the digitalisation measures will not resolve and may even exacerbate. One is the availability of energy supply at manageable costs and the second is dependency on a reliable supply chain for electronic components. Here also, Oulu is not unique but many of its ongoing efforts could be threatened, should either one of those fail.

Lessons learned

Many projects involve a dedicated portion of the efforts and/or resources assigned to measures enabling innovation. These measures are targeted at a specific demographic or socio-economic

group while extending the invitation and funding to participants of the same group coming from other parts of Finland or abroad. Doing so, it obviously benefits participants and serves as one more action in support of the city's campaign to attract future residents and create personal connections across borders. The multiplication of short training programmes aimed at students and young professionals is a long practiced and effective mean of achieving these goals.

Free Wi-Fi is available across the urban area including the territories of all the municipalities of the larger Oulu urban area. Doing so, it removes a basic barrier to equal access for eGovernment services.

The digitalising of Oulu, and that of Finland overall, was enabled by the prominence of Nokia and the spread of its ecosystem. The Nokia crisis affected the entire country. When it had to be addressed, public authorities at national, regional, and local level successfully coordinated their strategies. Resources were adequately distributed to match their ambition. This appears to have paid off.

Policy insights

EU cities survey data from the 2016 Urban Europe report shows a higher proportion of people living in Oulu felt they could trust others than in most cities surveyed. Oulu also rated high in the ranking for a number of metrics including perceived affordability of housing. These opinions were collected in the early days of the digitalisation efforts. They would not constitute an outcome but may well be a critical set of enabling conditions.

The city of Oulu has made an oversize effort at representation and participation in EU and international fora. As early as 2012, it was a signatory to the EU Green Digital Charter, which played an active role in shaping the EU contribution to the UN. In addition, Oulu city has participated in EU R&D consortiums including a H2020 project dedicated to smart city developments, [Making City](#) due to conclude in 2023.

Beyond a 'branding' exercise, this gives Oulu an opportunity to influence the still evolving definition and scope of Smart Cities. Public Authorities from similar mid-size cities in many other EU countries may emulate this approach by actively participating where they can since they remain largely invisible in international fora, where large corporations and the largest metropolises still dominate.

Nantes-Metropole

[Nantes Métropole](#) located in western France, 50km from the Atlantic Ocean, is one of the fastest growing urban communities in France.

Nearly half of its population lives in the city of Nantes, the largest of its 24 municipalities. The decades-old cooperation structure between the 24 – already called Nantes Metropole - was formally turned into a Metropolitan Public Authority on the 1st of January 2015.

The metropolitan area had a total population of 656 275 inhabitants in 2021, having gained more than 50 000 since 2015. Nantes ranks third among large urban areas by its growth rate, behind Toulouse and Rennes. The population of the surrounding municipalities is also growing and broader entity -department of Loire-Atlantique– has an estimated population of 1.36 million.

Positive socio-economic indicators and residents' opinion surveys rank it near the top of France's metropolises for quality-of-life and it is the least unequal metropole in France. Environmental and Climate goals receive broad support from the population.

The same focus is also strong among elected officials whether they belong to a green party or win on a 'green' agenda. In 2013, already, the Nantes municipality earned the label 'European green capital' for its sustainable transport policy which reduced air pollution and CO2 emissions. Nantes was the first city in Europe to reintroduce the electric tram networks as core public transport infrastructure. It did so in 1985.

One downside is the pressure on housing availability and price which has pushed families with young children to relocate in the peripheries of Nantes Metropole while commuting daily for work.

Public administration, higher Education and Research are the largest employer in the city. Nantes-Métropole has 135 000 students registered across 181 higher education institutions mostly located within the municipality of Nantes. But only 50 000 of them reside on the same territory. Others commute from surrounding areas.

Governance and main actors

The Metropole is now in charge of urban planning, waste, energy and infrastructure management and innovation measures. Its role also extends beyond its territorial limits to include a shared responsibility over the Port of Nantes-st Nazaire Authority, headquartered in Nantes. Nantes-st Nazaire is the 4th largest trading port in France where the Loire connects Nantes to the Atlantic ocean.

Nantes owes much of its historical prosperity to international trade. This, in turn, means local authorities treat international partnerships and support to trade as a key part of their role. The city of Nantes and now, Nantes-Metropole participate in multiple transnational networks of Cities including through an active role in Eurocities.



The first explicit smart city initiative for Nantes is its role as one of 3 'lighthouse cities' within the very large EU H2020 mysmartlife.eu project starting in 2016. Both Nantes Municipality and the Metropole took on a substantial roles in the very large project as consortium partners. The project concluded in 2019.

Other members involved in actions deployed in Nantes included: two major French energy utilities (Engie and Enedis), a national public body set up to assist local authorities' infrastructure planning (CEREMA).

<p>mySMARTLife project</p> <p>6 Cities, 27 Partners, budget of 21 Meuros</p> <p>150 actions in the areas of energy, mobility and ICT</p> <ul style="list-style-type: none"> • Reducing CO2 emissions in cities. • Using renewable energy sources in cities. • Involving citizens in the transformation process of cities. • Increasing the level of digitalisation of the cities. 	<p>Interventions in NANTES</p> <ul style="list-style-type: none"> ▪ Ile de Nantes - Retrofitting Actions ▪ Renewable Energy Production and Management ▪ City Infrastructure (Lighting & Smart Meters) ▪ E-Mobility ▪ District Heating Optimisation ▪ Energy Data Lab & Energy Planning & Monitoring ▪ Nantes Urban Platform
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Source: <https://mysmartlife.eu/>

Research oriented partners were [IMT](#) and its Contract Research non-profit ARMIN. IMT is a major higher education public body in France, originating from the first telecom engineering school, and its focus includes the digitalization of infrastructures. IMT has a large student body and research community in Nantes itself. Its role in the project focused on Data and modelling. Another partner was Nobatek, a French private non-profit technological research centre working to promote innovation in sustainable development and energy efficiency in building technology, architecture and urban planning. Nobatek is itself linked to the University of Bordeaux.

The city and metropole went on to expand their smart cities initiatives to include EV testing, Smart Mobility, Energy Efficiency measures and an extensive set of open data and API resources, these initiatives typically involved different configurations of these and similarly recurrent partners and, for some, also received EU funding through both innovation and regional policy funds. Sources in support of digitalisation are varied in purpose, length and amount and uncertain when allocated on a competitive basis as is increasingly the case, also at national level.

Long cooperation with the many institutional stakeholders in its territory has contributed to densify and extend the range of services and resources made available to residents, businesses, newcomers and external stakeholders.

Most of the higher education sector, from engineering schools to the universities, also offer a large range of digital, data and infrastructure expertise, knowledge or access to publics and for purposes well beyond their student body. These activities are coordinated and collectively promoted with the local authorities through local non-profit collectives developed for such specific purposes.

The metropole and city services expanded the roles and resources of the services involved (ex Nantes Habitat) and created a new one: Département des Ressources Numériques (Department of Digital Resources), employing 169 persons full time in the Metropole and a network of correspondents. The service has responsibility for a wide range of strategic and operational duties related to the open data sets, live data streams and the corresponding equipment.

Relevant smart city components

There are about 50 000 persons commuting in and out of Nantes-Metropole daily according to an INSEE estimate of 2013.⁵⁸ It draws in those daily commuters from well beyond the territorial limits of the Metropole. Figures for 2020 still show 70% of those travelling to work use their vehicle. The impact of private vehicle use on air quality and CO2 is only one of the undesirable results. With the continued population growth, understanding and addressing what will help people switch to

⁵⁸ [1]Nantes Métropole: 50 000 personnes supplémentaires entre 8 heures et midi - Étude | Insee.
<https://www.insee.fr/fr/statistiques/1291065> (accessed Feb. 25, 2022).

preferable alternatives and making these accessible is the goal shared by many actions deployed in Nantes. Here are just two of those actions:

Nantes: cross-modal mobility observatory

One major ICT action of mySMARTLife in Nantes is the cross-modal observatory on mobility. It aims at improving the overall capacity of delivering KPIs on mobility public policies. This task is the 'tip of the iceberg' of mobility data management. This action included tasks such as switching to another Geographical Information System (GIS) software, redesigning GIS infrastructure, collecting new field data, implementing data management, working on data standardisation, to finally offer dashboards with mobility policy KPIs. Major improvements are data historicization, data collection (field inventory), global access to KPIs, better appropriation of data through custom dashboards and synthetic infographic publication.

The process of collecting data to extract meaning for policy design purposes had been applied for a similar initiative called 'observatoire des parking' in 2013, also addressing mobility purposes.

Nantes city lab

Launched in March 2017 with an investment of nearly €700 000, it oversees the implementation of innovative 'test' projects, potentially deployable on a large scale. Through [Nantes city lab](#), innovation is intended to be multi-sectoral and involves multiple players from the public and private sectors working collaboratively: associations, companies, laboratories, students, etc.

Main risks and challenges observed

Funding sources in support of digitalisation are varied in purpose, length and amount and uncertain when allocated on a competitive basis as is increasingly the case, also at national level. The asynchronous effect of funding long term measures through short term budgets can cause otherwise promising plans to fail. Nantes has, so far, managed to ensure continuity and coherence over a much longer period than the typical funding duration for most projects. It was sufficiently advanced in its plans to take advantage of competitive calls for innovation or digitalisation funding without losing track of its own objectives. Cities without these pre-existing structures, relationships and expertise would find it a much bigger challenge.

Lessons learned

Data Governance

The city of Nantes stands out for its ambitious data strategy in the public interest. It is also one of the first metropolitan areas in France to have developed an [open-data portal](#) (1 000 data sets available).

Charte Metropolitaine de La donnée

A set of clearly explained and comprehensive commitments regarding ethical data practices to which the public authority commits to adhere. [The text](#) explicitly relates the commitments to their legal basis – including GDPR – relating these commitments to the rights of individual which the legislation provides for, in a language that is also much clearer.

The charter was adopted in 2019. The report of its first year of application is also published.

Nantes Algorithm Registry

This is the one outcome of the data charter in its first year of application (2020). For algorithms employed in the course of services to the residents, the repository provides access to 3 items: the source code, specifications flowchart, and it also includes a brief description. More information can be found [here](#). The repository currently details two algorithms:

- Social water pricing;
- Solidarity transport pricing.

Solidarity transport pricing

Description (translated)

Nantes Métropole has developed an algorithm that determines eligibility for free or a reduction on unlimited Tan formulas to travel on the Nantes metropolitan transport network. The calculation of this aid takes into account household income and family composition. Users make their request at the town hall. The agents collect their supporting documents and enter the information required by the algorithm in software developed by Nantes Métropole (Deltas software). Users are immediately notified of the result by the agent at the town hall.

Málaga

With 580 000 inhabitants according to the 2020 census, the city of Malaga is the sixth largest in Spain, the second in Andalusia after Seville. Including its urban area and its outskirts, Malaga is home to almost one million inhabitants and 1.6 million for the broader province.

The city is heavily reliant on tourism and receives an estimated 10 million visitors every year. In addition, its port has one of the largest frequentations by cruise ships in the EU. According to Malaga port authorities, in 2019, cruises made 288 stopovers, with a combined total 476 973 passengers. Of these, 31% were passengers on base, beginning or ending their itinerary in Málaga. As with all other major tourist venues in the EU, the need to diversify the local economy was made all the more pressing by the interruption of travels caused by the pandemics.

Building on its role as a trade node, the city of Málaga's efforts to diversify its economy focus on transport logistics and digitalisation. Since 2007, it has been connected to Madrid by high-speed rail. It also has an international airport with direct connections to many cities across Europe. The role of Malaga as a key node in export and trade for the broader region relies on the substantial volume of trade transiting through its port. One of its goals is to develop business activities and attract foreign investments around its logistics sector including high technology services that come with the digitalisation of the sector.

Overall Andalusia started out with substantial challenges as a region, with greater poverty and lower educational attainment comparatively to other EU regions. From the time Spain joined the EU and until the 2004 enlargement, Andalucía was eligible for the highest level of support from regional policy funds. On the one hand this meant higher level of funding available than elsewhere, notably for infrastructural investments. On the other hand, this required ambitious strategies and extensive planning at national, regional and local level to generate projects which could absorb those funds in a way that would be coherent, exploit synergies and be sustainable overtime.

The Málaga metropolitan area is the major economic centre of Andalusia. Despite its economic influence over the region, the political power is formally held within the regional capital, Seville. This has had particular relevance to the ambitious smart-city plans of the city. The natural competition between the two cities has at times been a barrier to exploiting synergies, especially with regards to development plans. At this point, the model developed in Malaga appears to be supported region-wide.

Being the last element in the decision chain, the local authority has had to take into account priorities and decision-time of those institutions above it from the EU to the national and regional authorities. Matching those requirements with a plan serving the priorities and needs of the local community is a challenge for all local authorities as readily acknowledged across reports on regional policy issued by the European Commission. This is perhaps more pronounced for regions receiving the largest allocation of the funds. Indeed, in an analysis produced in 2021, the EC notes that a substantial share of the funds earmarked for Andalucía for the 2006-2013 period was still being paid out as late as 2018.⁵⁹

Governance and main actors

The smart city developments in Malaga are more than a decade old and have now expanded in one of the more complete and complex development strategy of the kind in Europe. Because of its early start, Malaga had the opportunity to define the concept of Smart City for itself in a way that is more relevant to other local authorities than that modelled by the global corporations promoting it. In several respects, the developments in Malaga parallel those of Nantes with a similar success. The specificity of the Malaga strategy is that it articulates the ambition of becoming the European

⁵⁹ <https://cohesiondata.ec.europa.eu/stories/s/Historic-EU-payments-by-region-1988-2018/47md-x4nq>.

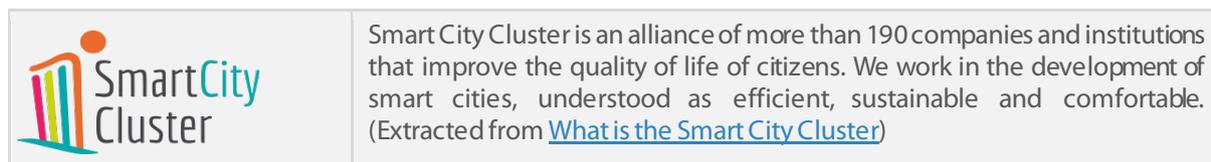
equivalent of Silicon Valley through the growth of its own 'digital valley' and substantial investments in urban infrastructure aimed at improving the quality of life of residents and thus, its attractiveness to newcomers.

The most determinant factor to this success appears to be the governance part and in particular, the role of the mayor and his team. Francisco de la Torre Prados has been mayor of Malaga continuously for 20 years, enjoying broad support which got him returned to his role of Mayor even as his party lost the majority. Born locally, he has a doctorate in agronomy and degrees in sociology and regional development (from Rennes University, France). Before his long tenure of the mayorship, Francisco de la Torre Prados had several decades of involvement with a number of the local and regional bodies including five years as councillor for Urban Planning, Housing, Works, Territorial Development and Transport under his predecessor.

According to those involved, in addition to the background and experience of the mayor, a key part of the governance is the team assembled by the mayor to develop the blueprint for the strategy. The document and extensions by sectors are continually refined and serve as reference for decisions and other documents such as proposals submitted to competitive calls for funding.

Overtime, the structure has evolved and the dimension of the smart-city supporting the development of a digital sector is now handled by a separate legal entity, an association set up in 2014, the Smart City Cluster which includes as members both public institutions, including the University of Malaga, and business organisations. The involvement of members of the original team, including in the structure representing the cluster, along with the reliance on the shared blueprint – also for the cluster – contribute to the continuity and coherence of the implementation.

Figure A.3 - Málaga Smart City Cluster



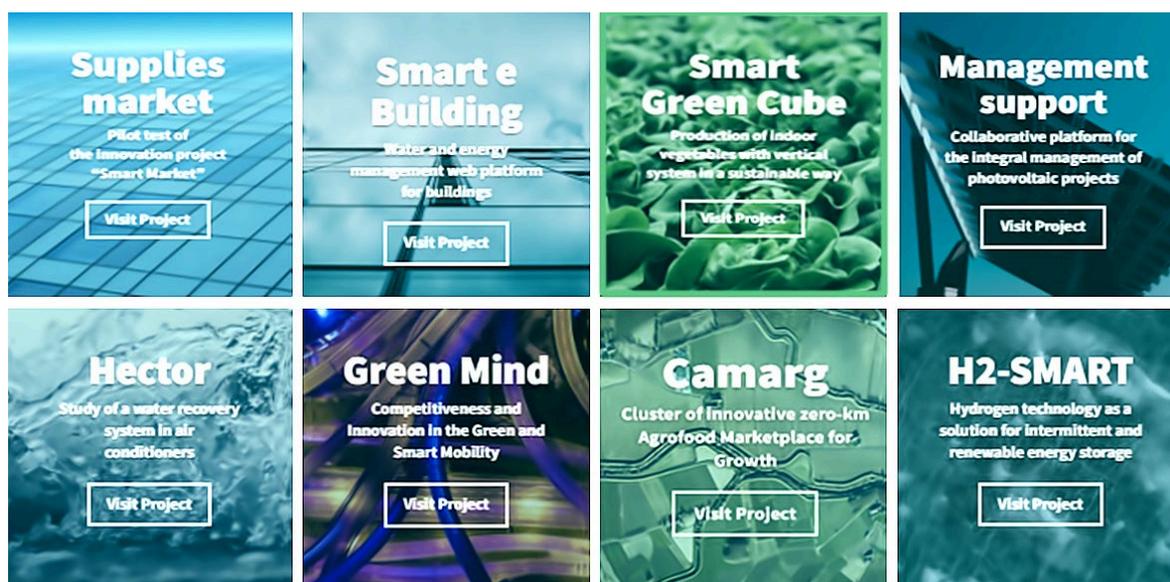
Relevant smart city components

Urban Sustainability Projects

With two decades of planning and nearly 15 years of implementation, the range of discreet components adopted is large. One notable part is the choice made by the local authority to invest in urban sustainability projects that explicitly include the testing and demonstration of innovative solutions. Beyond any direct benefit derived from these projects, their broader relevance comes from the appropriate choice of metrics and the systematic publication of results. This is perhaps the most relevant aspect for other local authorities looking for models to inform their own.

The first large one of these is the Smart city Malaga project, starting in 2009, focused on Energy Efficiency. Its budget of 31 million euros was funded through a national programme and implemented by a consortium led by Endesa. It involved the deployment of smart solutions, energy storage capacities, wind and sun-based electricity generation and renewable integration through a smart grid. The project involved public and private buildings as well as hotels for a total of 11 000 residential, 900 services and 300 industrial users. This first project concluded in 2013.

Figure A.4 - Sample of projects



Source: Smart City Cluster website

Since then, a number of other collaborative projects have received funding, including through the EU H2020 programme. The domains of interventions range from water, food production and distribution to mobility and energy. In addition to the local authority, the overall impetus and follow up now also comes from the *Smart City Cluster* structure. The cluster contributes by building consortiums from within its own members and beyond, ensures coherence with the overall blueprint and promotes the results to other public authorities, business sectors and the general public internationally.

Malaga Valley

The other focus of the city's development strategy and a part of its approach to smart-city is the development of its digital business sector, including new businesses and start-ups along with large corporations. The city makes a special effort at enticing international firms to choose the site as one of their international locations. The high quality of life is an important part of its 'selling' proposition to those interlocutors. The Smart City Cluster operations contribute to achieve this. The city itself also has a dedicated investor office. Altogether, the city has managed to attract a number of the world's largest electronics and digital sector corporations. The initiative also serves the broader metropolitan area and supports coordination with local authorities beyond its territorial limits.

Unlike many other technology parks, this particular initiative is explicitly focused on 'smart city' related development and production activities such as, for example, business activities related to IoT. The cluster team works to ensure that the developments are coherent with the overall objectives of the area, including by advising neighbouring authorities on the suitability of partnerships.

Eurostat [data available](#) at Metropolitan area level on the demography of companies that are also employers, reveal that for Málaga, all non-agricultural sectors saw an increase of the number of employer -companies between 2014 and 2018. But the fastest increase was observed in the Information and Communication sector which jumped by an extra 25%.

Main risks and challenges observed

Apart from disruptions in international trade, there are few risks specific to the Málaga case. Among them, the risk to the continuity and coherence of the broader project that the eventual retirement

of the mayor may cause, given his unusually influential role. The second is the risk of the departure of one of the larger employers among the international corporations now located in Málaga.

Lessons learned

One characteristic stands out from Málaga. It is the judicious exploitation of synergies. While there are other instances, one example is the participation of the local authority in successful bids for competitive calls for Innovation projects funding. This approach and its success serve a number of the objectives of Málaga simultaneously including visibility, investment in infrastructures, building partnerships and, obviously sustainability. But it also had the advantage of providing the city with an extra margin of flexibility in implementing its own plan which the sole reliance on regional policy funding, however substantial, may not have permitted.

Zagreb

Zagreb is the capital city of Croatia. It is also a political, administrative and economic centre, a university centre and the city of culture and arts. According to the population estimate at mid-2020, there were 809 268 inhabitants in Zagreb, accounting for 20% of the total population of the Republic of Croatia and 30% of its GDP.

Croatia is one of the safest places in Europe. According to the results of the EU-SILC 2016 survey, only 3% of Croatia's population claimed to have experienced the problem of crime, violence and vandalism in the area where they live compared to 13% on average in the EU.

The large reliance on tourism makes Croatia highly vulnerable to adverse external shocks such as the current pandemic. GDP contraction in Croatia in 2020, at - 8.4%, was one of the largest in the European Union. Zagreb suffered substantially from the loss of tourism. In addition to holiday visits the city suffered from the restrictions on international travels from the pandemic as venue of choice for international events and trade fairs.

Under the 2014-2020 period, the Zagreb region and the whole of Croatia qualified for cohesion funds attributed to regions with a GDP per capita under 75% of the EU average.

On 22 March 2020, an earthquake of magnitude 5.3 hit Zagreb, with its epicentre 7 kilometres north of the city centre, which caused damage to about 30 000 buildings, 1 900 of which became unusable.

Following the Zagreb earthquake, Croatia submitted an application for a contribution from the European Union Solidarity Fund (EUSF) and received 864 M euros in financial support to help finance the restoration of key infrastructure in the fields of energy, water and wastewater, telecommunications, transport, health and education.

One big challenge for Zagreb itself is the legacy of 20 years underinvestment in its basic infrastructure, including the absence of needed extensions to its tram system and a sewer system unable to cope with flash floods. There was no construction of new tram lines for 20 years despite many announcements of tram network expansions.

Zagreb initiated its own Smart City process in 2016 in a difficult context of widespread distrust of a large portion of the public opinion towards the city mayor for perceived – and later documented – cases of corruption. Planning decisions by the mayor, in particular, triggered a wave of demonstrations in 2016-2017. Milan Bandić was first elected in 2000 and remained mayor almost continuously until his death. He died unexpectedly in February 2021 while in office.

The present mayor, Tomislav Tomašević was a delegate at the Zagreb assembly before being elected to the Croatian parliament as part of the Left-Green coalition in 2020. He was elected mayor of Zagreb in 2021.

Governance and main actors

Development of the Smart City Strategy

In 2016 the city of Zagreb initiated the process to develop its own Smart City Framework strategy. Setting aside weaker aspects of its governance detailed below, the process itself followed a path broadly regarded as an example⁶⁰. This included the active involvement of a large number of local stakeholders in the development of the strategy itself via a Working Group tasked with producing

⁶⁰ The process itself was closely aligned to the recommended practice of the European Innovation Partnership on Smart Cities and Communities (EIP-SCC).

the framework strategy. The Office for strategic planning and development of the City of Zagreb commissioned the Institute for Economics of Zagreb to assist it in the design of this process⁶¹.

In parallel, Zagreb took part in the URBACT III project 'SmartImpact' - Local Impact from Smart City Planning – led by the city of Manchester, with Zagreb, Dublin, Stockholm, Eindhoven, Porto, Guadalajara, Miskolc, Smolyan and Suceava as participants. The network of cities with its experts was supported by the Fraunhofer Institute⁶².

As documented in a presentation made in 2019⁶³, the Framework Strategy Working Group elaborated the strategy based on Smart city theory, strategic frameworks and relevant documents on international and national level. The existing situation, development possibilities and the application of information and communication technologies and smart solutions for the most prominent sectors (quality of life, economy, city administration, environmental protection and fight against climate change) had been analysed.

The Working Group proceeded from a clear brief which enabled the production of detailed action plans by priority area without losing sight of the strategic objective. Zagreb's ultimate goal and the *raison d'être* of the Strategy is the achievement of substantial improvements in the quality of life for its citizens by the set target date of 2030. While the framework strategy addresses digitalisation, it remains a means to an end. As emphasised in the abovementioned presentation, *'Citizens are among the most significant users of smart solutions and technologies, thus such solutions should be developed for their benefit and for comprehensive improvement of quality of life in the City of Zagreb.'*

Policy-making process and context



The resulting document is the [Zagreb Smart City Framework Strategy Vision Up to 2030](#).

The strategy foresees the City, through its Office for strategic planning and development, as the lead implementing body. Zagreb Holding, the legal structure which controls most of the utilities and infrastructures owned by the city, is expected to assist in the implementation - including through procurement - for the bulk of the measures. Smart Energy projects will be implemented by the North-West

Croatia Regional Energy Agency while part of the actions under the 'Economy' priority would rely on ad hoc partnerships with private sector partners.

The framework strategy was adopted by the City council on the 26 February 2019. It follows and complements the adoption by the Council of other planning documents: the *City of Zagreb Development Strategy for the Period up to 2020*, the *Development Strategy of the Zagreb Urban Agglomeration*, the *City of Zagreb Sustainable Energy and Climate Action Plan (SECAP)* and the *Master Plan for the City of Zagreb* and the *Zagreb and Krapina Zagorje Counties Transport System*. The production of these planning documents is partly driven by the fact that they fulfill planning documentation required to access funding made available under the EU cohesion policy.

⁶¹ <https://www.eizg.hr/projects/past-projects/basic-premise-for-elaboration-of-development-strategy-of-zagreb-urban-agglomeration-economic-aspects-suaz/1727>.

⁶² Link: <https://urbact.eu/smartimpact>.

⁶³ Petrović Krajnik, Lea, Damir Krajnik, and Ivan Mlinar. 'Zagreb Smart City Strategy'. 3rd International Conference on Smart and Sustainable Planning for Cities and Regions 2019 - <https://www.bib.irb.hr/index.php/1041043>.

The Covid pandemic and the 2020 earthquake added to the challenges created by fraught city politics. The new mayor is now in charge of the transition from the planning to the implementation phase.

Smart City Components

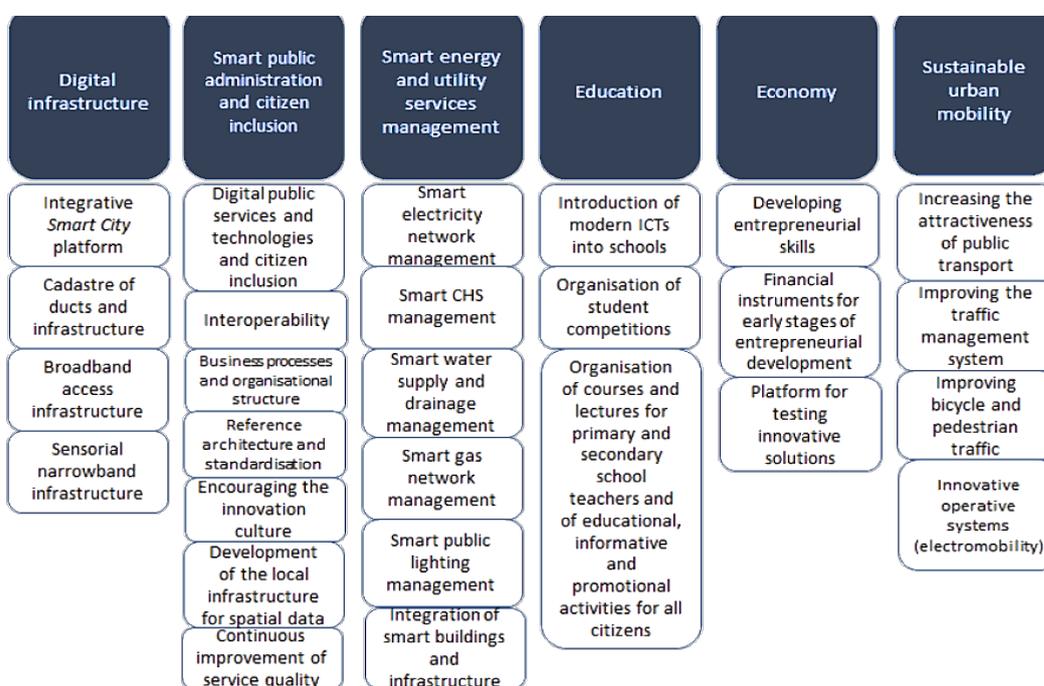
The strategy document defines the overarching purpose of digitalisation as follows:

The main purpose of smart cities is to provide optimal quality of life for every citizen, while, at the same time, operating at the highest level of resource preservation, which is something the City of Zagreb strives for. The above-mentioned can only be attained by innovative urban management, that is, development of useful solutions based on real data and information on the city life, with the help of communication technologies in a way that they:

- Connect different sources of information, resulting therefore in synergy;
- Achieve a significant level of efficiency and resource preservation through integrated approaches; and
- Include both citizens and investors in the city's development in order to make it more attractive, sustainable, resistant to many challenges and dedicated to increasing the quality of life.

The action plans per strategic area

Figure A.5 - Action plans per strategic area



Translation into projects

Below is a sample of the projects through which the city chose to translate the strategy. These reflect the priorities for the *Smart Public Administration & Citizen Inclusion* area.

<p style="text-align: center;">e-Public hearing</p> <p>Description: A project developed to enable citizens to participate more easily in public debates on proposed spatial plans through online services. Within the application, there are proposals for spatial plans on which it is possible to give an opinion, proposal or remark. Holder: City Office for Strategic Planning and Development of the City</p>	<p style="text-align: center;">E-employee</p> <p>Description: E - employee is a free mobile application a kind of communication channel between employer and employee. The application will provide all employees with access to information and documents arising from the employment relationship, as well as submitting inquiries / requests to the employer. Implementing authority: Zagrebački holding doo - directorate</p>	<p style="text-align: center;">Digitization of Zagreb Holding - Development of a single platform</p> <p>Description: Development of a unique Zagreb Holding Group platform that will represent a new central IT system for managing services and service users and enable new digital communication channels of ZGH Group for data presentation and interactive communication to all users of utility, energy and other services of ZGH Group, Implementing authority: Zagrebački holding doo - directorate</p>
<p style="text-align: center;">Establishment of information security system</p> <p>Establishment of a standardised, more secure and reliable network and information system in order to enable the uninterrupted operation of Zagreb Holding. Implementing authority: Zagrebački holding doo - directorate</p>	<p style="text-align: center;">Establishment of an integrated technical protection system</p> <p>Description: integration of a single monitoring center through which it will be possible to respond more quickly to services and security of citizens and ensure faster resolution of incidents to increase security. The project integrates the Group's technical protection system (services such as video surveillance, access control, alarms, mechanical protection, smart locks, fire alarms, etc.) and upgrades it to a security monitoring and operational center that is a modern scalable solution. Implementing authority: Zagrebački holding doo - directorate</p>	<p style="text-align: center;">Development of the ZIPP Geoportal</p> <p>Objective: Development of the ZIPP Geoportal as a central place for finding, reviewing and using spatial data of the City of Zagreb. ZG3D: 3D model of the City of Zagreb Spatial and statistical analyses for the needs of planning and management of the City Implementing authority: -City Office for Strategic Planning and City Development https://geoportal.zagreb.hr/</p>

Source: city of Zagreb website (translated)

Main risks and challenges observed

Mayor Milan Bandić who initiated the Smart City Strategy process in 2016, was the longest-serving mayor of Zagreb. He held the post almost continuously from 2000 to 2021 until his unexpected death by heart attack in February 2021. However, by that point, Mayor Bandić's continuous hold on the mayoralty represented a hurdle rather than an asset for the city. His personal exercise of power put him in direct conflict with the elected municipal assembly. Furthermore, at the time of his death, Mayor Bandić was still fighting charges of embezzlement and abuse of power following a procedure initiated in 2014, during which he was briefly arrested and temporarily removed from his mayoral duties.

The newly elected mayor launched the Smart City hub in January 2022 and announced a first application intended to provide budget process transparency to residents: Open Budget of the City of Zagreb. Detailed information on budget revenues and expenditures will be available to the public through the Smart City Hub Zagreb.

The stakes are exceptionally high since in addition to a fraught history of mismanagement in the city itself, the country's policymakers are currently developing legislation addressing conflicts of interest in public life, anticorruption and transparency measures. As a consequence, the current developments in Zagreb itself and the decisions of the new mayor are under special scrutiny from the national press.

Lessons learned

'Efficient Transparent and Smart Administration' is the key area. The critical portion of the work revolves around the Smart City Hub platform, on which a number of applications will be built which will serve the other parts of the strategy.

More information on the Zagreb Smart City Hub platform can be found [here](#). The main goal of the Zagreb Smart City Hub platform is to combine data from various databases available to the City of Zagreb and institutions and companies founded by the City of Zagreb and ensure their integration and configurability of applications to ensure visibility and availability in one place. The basic goal of the Smart City Hub of the City of Zagreb is to bridge the gap between different platforms, data formats and communication channels within city offices and institutes and enable better connectivity to branches, institutions and companies founded by the City of Zagreb, providing tools for internal and e-initiatives. Among the tools for transparency to be delivered, one centrepiece is the [Geoportal](#).

The Smart City Hub has the potential to be of great support to the restoration of trust between the city authorities and the residents of the city. This key element is both the most promising and the biggest challenge since the success of the strategy overall greatly depends on it.

Vienna

Vienna, capital of Austria, is one of the largest Metropolitan Areas of the EU by population. Once a city of 2 million, it experienced substantial population decline in the early 20th and took almost a century to reach that number again. In 2021, Vienna's metropolitan area population is estimated at 3 022 500 persons.

Vienna is a 'global' metropole through the multiple origins of its resident population as well as its oversized role in global politics. It is host to numerous international institutions including several agencies of United Nations.

1.420 congresses were held in Vienna in 2019 according to its statistical office. As the location of many international events and one of the major tourist destinations, Vienna has a very deliberate approach to building its 'brand'. Vienna has consistently ranked at or close to the top in 'quality of life' rankings assessing global metropolises issued by various organisations since 2000.

Vienna's Smart City approach includes making this a part of its 'branding' strategy, promoted on its [visitors site](#). In 2019, the city authorities issued a comprehensive thematic report called [Vienna Visitor Economy Strategy 2025](#) as one of 12 thematic plans included in its Smart City framework



Smart City as part of the brand, screenshot of the [wien.info](#) site

The academic and private research sectors are strongly represented in Vienna. This is true in particular in the life sciences with 260 companies active in Vienna, employing more than 15 100 people and generating around 9.5 billion euros in revenue per year.

Governance and main actors

The [Smart City Wien](#) Framework Strategy is one of the earliest such strategy to be adopted in Europe. The first complete strategy was adopted by the city authorities in 2014 and has been continually revised and expanded since then. Through this strategy, Vienna sets itself the goal to 'reach the highest possible resource preservation together with optimum quality of life for all citizens, achieved through comprehensive innovations.' In its latest iteration, adopted in 2019, the strategy lists [65 individual objectives in 12 thematic fields](#).

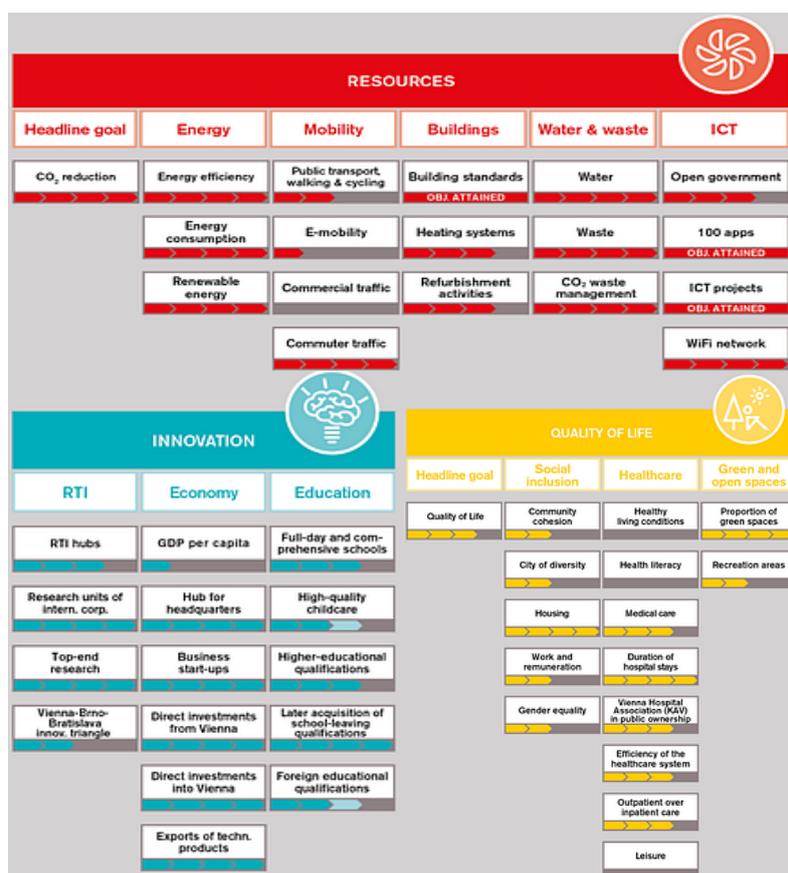
The approach to smart city chosen by Vienna is very comprehensive and includes almost all dimensions of the city's own responsibility. The many structures, agencies, services and external partners involved make up something akin to a vast 'change management network' and an ecosystem spanning across the city's economy and beyond. Through multiple participations in European projects, the main actors also contribute to exporting know how as well as the particular understanding of smart cities developed in Vienna.

A specific legal structure, [Urban Innovation Vienna GmbH](#) (UIV) is responsible for the management of the process overall, from running the consultations leading to a strategy document to its implementation. The structure is a subsidiary of Wien Holding, itself owned by the City of Vienna. UIV operates in permanent partnership with a number of other local public agencies, the Austrian federal ministry for Climate, Environment, Energy, Mobility and Innovation as well as other research and innovation bodies. Among the latter are TU Wien and AIT. UIV also engages in specific co-operations in energy and mobility projects.

For input, in addition to very structured consultation processes with stakeholders, the UIV and the local authorities rely on two permanent councils made up of local stakeholders: the Vienna Economy Council and the Vienna Climate Council.

Smart City Components

Through its three main dimensions - resource preservation, quality of life and innovations - it spans the entirety of urban development over the period ending in 2050 and treats digitalisation primarily as a mean to achieve sustainability. Through this strategy, Vienna sets itself the goal to 'reach the highest possible resource preservation together with optimum quality of life for all citizens, achieved through comprehensive innovations.' In its latest iteration, adopted in 2019, the strategy lists [65 individual objectives in 12 thematic fields](#).



Source: Smart City Wien Indicators (2017 report)

of the original 2014 version and retains the central tenet of Smart City Wien'.

The current guidance, which serves to frame specific projects, include the following:

- Digital Agenda Vienna 2025
- Energy Framework Strategy 2030
- Health Goals Vienna 2025
- KliP II – Climate Protection Programme
- Masterplan Participation
- SEP 2030 – Urban Energy Efficiency Programme
- Sustainable Logistics 2030+ Action Plan
- Urban Heat Islands Strategy
- Vienna Children and Youth Strategy
- Vienna 2030 – Economy and Innovation

One notable feature of Vienna's approach is the comprehensive collection indicators as part of the monitoring of progress. Smart City Wien publishes the results of this collection. It has now also produced separate sectoral strategies. The scope and range of this reporting is illustrated in the indicators table published in 2017 where arrows below items indicate the degree of completion.

According to UIV, 'Vienna has updated its Smart City Wien Framework Strategy (based on the results of the first Smart City monitoring process) in order to maintain its leading position and continue setting new standards. The Smart City Wien Framework Strategy 2019–2050 was adopted by Vienna City Council on 26 June 2019. The revised strategy builds upon the goals and objectives

- Vienna Visitor Economy Strategy 2025

Main risks and challenges observed

The main risk observed with regards to the specificity of the approach selected by Vienna, comes from the emphasis on indicators and rankings. A well-known pitfall of this extensive formal monitoring is the tendency of projects implementers to focus on achieving set quantitative targets sometime at the expense of sound decisions favouring the overall success of the project.

A comparative study including Vienna conducted on four cities among the most advanced and influential on Smart Cities in Europe in 2018⁶⁴ found that of all four, Vienna had the lowest participation of civil society.

Lessons learned

The sheer variety of actions undertaken as part of the Smart City strategy is vast.

Several initiatives in the building and construction sectors are notable for the likely lasting and substantial positive impact they will have, especially on the energy and climate objectives.

Among them, the work led by ASPERN around energy efficiency solutions in buildings and residential areas:

Aspern Smart City Research (ASCR), Europe's biggest energy research project, has been conducting applied research at the aspern Seestadt urban development area since 2013. The research association – a joint venture by Siemens Österreich, Wien Energie, Wiener Netze and the City of Vienna (Vienna Business Agency and Wien 3420) – pursues an integrated approach, with over 100 researchers from a range of different fields using vast quantities of real-time data from aspern Seestadt to analyse interactions and correlations between user behaviour and building technology in energy-efficient buildings. The buildings analysed simultaneously produce and consume energy and are integrated into a smart power grid.

Source: <https://smartcity.wien.gv.at/en/aspern-smart-city-research/>

⁶⁴ Mora, Luca, Mark Deakin, and Alasdair Reid. 'Strategic Principles for Smart City Development: A Multiple Case Study Analysis of European Best Practices'. *Technological Forecasting and Social Change* 142 (1 July 2018). <https://doi.org/10.1016/j.techfore.2018.07.035>.

Annex IV – Insights on best practices from our literature review

This annex provides key insights from the literature review that we have conducted before starting our mapping exercise. In their study '*Strategic Principles for Smart City Development: A Multiple Case Study Analysis of European Best Practices*',⁶⁵ Luca Mora et al take a look at several studies from European cities, especially based on activities conducted in EU funded projects, such as Open Cities, CitySDK, Commons4EU and Smarter Together. The insights of the study have been very relevant not only to help the identification of best practices but also to inform the formulation of our policy recommendations. The study looks at Barcelona, Helsinki, Vienna and Amsterdam. The authors identify **four different aspects** that need to be considered, in order **to define a reasonable smart city strategy**, namely: 1) technology-led or holistic strategy, 2) model of collaboration, e.g. involving industry, academia, civil society and government, 3) top-down or bottom-up approach, and 4) mono-dimensional or integrated intervention logic, i.e. whether to focus on one domain or to develop multiple domains in an integrated parallel approach.

Indeed, the developments in Barcelona, Helsinki, Vienna and Amsterdam show that depending on the concrete project, the above decisions can be taken in a different way as to enable a successful implementation. The **general best practice principles for enabling smart city development in Europe** - as identified by the authors – are the following:

- Do not focus on technology only but look beyond at its broader implication on society;
- Move towards a model of collaboration that enables the integrated execution of project involving multiple domains simultaneously;
- Pursue integrated top-down (government-led) and bottom-up (community-driven) approaches;
- Define, build and follow a strategic smart city framework for the planned developments; and
- Establish a special accelerator entity that should boost the digital transformation of the community.

The discussion in the paper further determines that more knowledge and knowledge exchange are needed and, in that sense, they recommend to:

- Provide knowledge sharing platforms that enable cities to connect and exchange specific know-how and experiences (such as the Smart Cities Marketplace of the European Commission);
- Develop and deliver educational events and seminars and define corresponding long-term strategies; and
- Enable the implementation and utilisation of decision support tools for systematically achieving sustainable smart city design and development strategies.

The authors of '*A Review of Technical Standards for Smart Cities*' provide a more technical discussion on the aspects of strategic smart city development.⁶⁶ Thereby, they add to the above that the ICT

⁶⁵ Mora, Luca, Deakin, Mark, and Reid, Alasdair; *Strategic Principles for Smart City Development: A Multiple Case Study Analysis of European Best Practices*; Technological Forecasting and Social Change; 2018.

⁶⁶ Lai, C.S.; Jia, Y.; Dong, Z.; Wang, D.; Tao, Y.; Lai, Q.H.; Wong, R.T.K.; Zobia, A.F.; Wu, R.; Lai, L.L.; *A Review of Technical Standards for Smart Cities*; Clean Technol; 2020; <https://doi.org/10.3390/cleantechnol2030019>.

eco-system of a smart city should be based on established open standards, such that a vibrant and sustainable open eco-system can be established on the technical level.

Going into more detail, Paolo Neirotti et al. present an empirical study that investigates the domain coverage of best practices in relation to different constraints and variables, such as economic, demographic and geographical aspects.⁶⁷ This paper has identified a large **number of best practices typologies** which were considered in the course of the study. Some relevant examples are provided by:

- Dynamic and adaptable electricity networks taking into account end user behaviour patterns;
- Self-healing smart grids having the capability to react to unexpected anomalies;
- public lighting with smart lampposts offering different functions, such as sensors, sound cameras and Wi-Fi access;
- Monitoring systems for lampposts allowing to reduce CAPEX and OPEX based on data acquisition and smart data analysis;
- Integrating regenerative energy resources like heat, water, and wind power;
- Increasing the efficiency of city logistics based on integrated data platforms including the needs of consumers, municipalities, producers and businesses in general;
- Enabling social learning and participation with focus on disadvantaged citizens such as minorities, elderly and disabled citizens;
- Increased transparency relating to the processes in a municipality based on ICT technology.

Finally, Robin Effing et al. identify in their study further interesting experiences across European cities and notably:⁶⁸

- Berlin has implemented an Open Data portal that increased the transparency of the public administration and provided useful data for various apps and for data enthusiast and journalists;
- Reykjavik has implemented a citizens' participation platform called Better Reykjavik, where citizens can propose new policy options for the future city/municipality development;
- A similar approach – but focussing on the budget planning – has been trailed in Krakow with the goal to increase the transparency of public spending.

These are just some highlights from the papers and studies we have reviewed. But our review has not just be based on academic studies but has also covered projects and initiatives that aim at gathering corresponding best practices and capitalise on them through engaging cities across Europe. **ESPON** certainly has several resources to offer, for example, the policy handbook on *'Supporting the WHO's decade of healthy and inclusive urban ageing'* contains a large number of good practices for policy design with respect to the ageing population in city.⁶⁹ These good practices cover different domains such as *'Outdoor spaces and built environment'*, *'Transport and mobility'*,

⁶⁷ Neirotti, Paolo, De Marco, Alberto, Cagliano, Anna Corinna, Mangano, Giulio, and Scorrano, Francesco; Current trends in Smart City initiatives: Some stylised facts; Cities; 2014.

⁶⁸ Effing, R., Groot, B.P.; Social Smart City: Introducing Digital and Social Strategies for Participatory Governance in Smart Cities; Electronic Government; 2016; https://doi.org/10.1007/978-3-319-44421-5_19.

⁶⁹ Erik van Ossenbruggen, Atze Verkennis, Thijs Fikken, Agnese Macaluso, Anita Peeters, Inés Arevalo, Cristina Muñoz, James Whitley – Ecorys, Mats Stjernberg, Mari Wøien Meijer; Supporting the WHO's decade of healthy and inclusive urban ageing; ESPON; 2019; [Supporting the WHO's decade of healthy and inclusive urban ageing](#).

'Housing', 'Social participation', 'Social inclusion and non-discrimination', 'Civic engagement and employment', 'Communication and information' as well as 'Community support and health services'.

In addition, the **URBACT Programme**, which is a European Territorial Cooperation programme for sustainable integrated urban development, hosts a good practices repository with various interesting cases.⁷⁰ As of March 2022, the catalogue contains 97 good practices from 25 European Cities. Thereby, the practices are very concrete, and based on cities experience with real projects that were based on city-to-city cooperation (e.g. Spring Clean Campaign or Public Utility Park). In addition, the **Urban Agenda for the EU** should be mentioned in this context.⁷¹ Several of the actions developed in particular by Partnerships such as Digital Transition, Urban Mobility, or Energy Transition among others are of particular relevance as they are grounded on multi-governance collaboration and joint efforts toward tackling common challenges.

⁷⁰ [URBACT - Good practices overview](#) as of 14.03.2022.

⁷¹ [Urban Agenda initiative](#) as of 14.03.2022.

Annex V – Matrix of best practices

The matrix of best practices was used to identify successful solutions for preventing or mitigating the associated risks of the transition towards smart cities and to capture their relevant aspects. The complete matrix provides an overview of 27 best practices hereby covering all identified macro challenges.

The overview presents the 27 cases examined. For each, the columns present the addressed macro challenge, a general description, the stakeholder groups impacted, the territorial dimension of the best practice, implementation details such as estimated budget and implementation time of the best practices as well as prerequisites, things to adapt and identified KPIs.

The full matrix is available as a [separate Excel file](#) (tab 'best practices') to allow for easier consultation, accessible alongside the study online.

As an example, the **best practice 'Empowerment of digital skills for youth (Germany, Spain, Czech Republic)'** (row 5) describes a project that aims to help young people, especially from socially or educationally disadvantaged backgrounds, to develop digital literacy as a key competency for their personal development and active participation in society as well as for their professional development. The targeted age group is children and young adolescents mainly coming from low income/education households. Identified KPIs are:

- Number of youth workers participating;
- Number of local youth members participating;
- Dissemination of information materials;
- Number of training programmes.

Annex VI – Overview of the main EU legislative frameworks and initiatives in the domain of smart transition and the risks tackled by them

Policy document	Short description	Privacy, surveillance, cybersecurity and safety aspects	Data loss, inaccuracy, lack of reliability and interoperability issues	Digital inequality /exclusion	Financial burden for authorities and service providers	Economic damage and inequalities	Lack of trust or approval in the service and/or service provider	Loss of human contact and isolation through remote care, working, training and shopping	Potential dependency on private technology providers and vendor lock-in
Overarching legislation for the digital sphere									
COM/2020/842 Digital Markets Act Published on 15/12/2020	The two proposals – released as a package – address the legal uncertainty and administrative burden which originates in the fragmentation of national and EU legislation regulating digital services, including recent case law. A coherent and harmonised legal approach, as a baseline requirement, facilitates the understanding and application by local and regional authorities of the horizontal rules that define the responsibilities and obligations of providers of digital services.						X		X
COM/2020/825 Digital Services Act Published on 15/12/2020							X		X

Policy document	Short description	Privacy, surveillance, cybersecurity and safety aspects	Data loss, inaccuracy, lack of reliability and interoperability issues	Digital inequality /exclusion	Financial burden for authorities and service providers	Economic damage and inequalities	Lack of trust or approval in the service and/or service provider	Loss of human contact and isolation through remote care, working, training and shopping	Potential dependency on private technology providers and vendor lock-in
COM/2020/767 The EU Data Governance Act Published on 25/11/2020	The EU Data Governance Act that aims to create a framework that will facilitate data-sharing. Its main aims are to safely enable the sharing of sensitive data held by public bodies, to regulate data sharing by private actors. It is of particular relevance given the role played by local government in ensuring access to data and its availability.		X						
COM/2022/68 Data Act Published on 23/02/2022	The Data Act aims to maximise the value of data in the economy by ensuring that a wider range of stakeholders gain control over their data and that more data is available for innovative use, while preserving incentives to invest in data generation.		X						
Directive 2002/58/EC on Privacy of Electronic Communication Published on 12/07/2002	The e-Privacy Directive builds on EU telecoms and data protection frameworks to ensure that all communications over public networks maintain respect for fundamental rights. There should be a high level of data protection and of privacy regardless of the technology used.	X					X		
COM(2017) 10 Proposal for a	The Commission has started a major modernisation process of the data protection framework over the past few years, which culminated in the adoption of	X					X		

Policy document	Short description	Privacy, surveillance, cybersecurity and safety aspects	Data loss, inaccuracy, lack of reliability and interoperability issues	Digital inequality/exclusion	Financial burden for authorities and service providers	Economic damage and inequalities	Lack of trust or approval in the service and/or service provider	Loss of human contact and isolation through remote care, working, training and shopping	Potential dependency on private technology providers and vendor lock-in
Regulation on e-Privacy Published on 10/01/2017	the General Data Protection Regulation (GDPR). The ePrivacy legislation needs to be adapted to align with these new rules.								
Legislation on data									
Regulation (EU) 2016/679 General Data Protection Regulation Published on 27/04/2016	GDPR ensures our personal data can only be gathered under strict conditions and for legitimate purposes.	X					X		
Regulation (EU) 2018/1807 On the free flow of non-personal data	The regulation aims at removing obstacles to the free movement of non-personal data between different EU countries and IT systems in Europe. It ensures: - Free movement of non-personal data across borders: every organisation should be able to store and process data anywhere in the EU. - The availability of data for regulatory control: public authorities will retain access to data, even when it is	X	X						X

Policy document	Short description	Privacy, surveillance, cybersecurity and safety aspects	Data loss, inaccuracy, lack of reliability and interoperability issues	Digital inequality /exclusion	Financial burden for authorities and service providers	Economic damage and inequalities	Lack of trust or approval in the service and/or service provider	Loss of human contact and isolation through remote care, working, training and shopping	Potential dependency on private technology providers and vendor lock-in
Published on 14/11/2018	located in another EU country or when it is stored or processed in the cloud. - Easier switching between cloud service providers for professional users. - Full consistency and synergies with the cybersecurity package, and clarification that any security requirements that already apply to businesses storing and processing data will continue to do so when they store or process data across borders in the EU or in the cloud.								
Directive (EU) 2019/1024 on open data and the re-use of public sector information Published on 20/06/2019	The PSI Directive focuses on the economic aspects of the re-use of information rather than on access to information by citizens. It encourages EU countries to make as much information available for reuse as possible. It addresses material held by public sector bodies in EU countries, at national, regional and local levels. This includes material held by ministries, state agencies, municipalities, and organisations funded mostly by or under the control of public authorities such as meteorological institutes.		X	X	X		X		X
COM(2021) 281 European Digital Identity Regulation	Member States will offer citizens and businesses digital wallets that will be able to link various aspects of their national digital identities. These may be provided by	X	X	X				X	

Policy document	Short description	Privacy, surveillance, cybersecurity and safety aspects	Data loss, inaccuracy, lack of reliability and interoperability issues	Digital inequality/exclusion	Financial burden for authorities and service providers	Economic damage and inequalities	Lack of trust or approval in the service and/or service provider	Loss of human contact and isolation through remote care, working, training and shopping	Potential dependency on private technology providers and vendor lock-in
Published on 28/05/2021	public authorities or the private sector, if they are recognised by the Member States.								
Policy documents on standards and certification									
COM(2022) 31 Communication on EU Strategy on Standardisation Published on 02/02/2022	The strategy sets out four main priorities: removing fragmentation in the Digital Single Market, adapting the EU regulatory framework to facilitate digital innovation, promoting a data-driven finance and addressing the challenges and risks with digital transformation, including enhancing the digital operational resilience of the financial system.		X						X
COM(2021) 206 Artificial Intelligence Act Published on 21/04/2021	This proposal aims to develop an ecosystem of trust by proposing a legal framework for trustworthy AI. The proposal aims to give people and other users the confidence to embrace AI-based solutions, while encouraging businesses to develop them. Rules for AI available in the Union market or otherwise affecting people in the Union should therefore be human centric, so that people can trust that the technology is used in a way that is safe and compliant with the law, including the respect of fundamental rights.		X				X		

Policy document	Short description	Privacy, surveillance, cybersecurity and safety aspects	Data loss, inaccuracy, lack of reliability and interoperability issues	Digital inequality /exclusion	Financial burden for authorities and service providers	Economic damage and inequalities	Lack of trust or approval in the service and/or service provider	Loss of human contact and isolation through remote care, working, training and shopping	Potential dependency on private technology providers and vendor lock-in
Regulation (EU) 2019/881 Cybersecurity Act Published on 17/04/2019	The EU Cybersecurity Act introduces an EU-wide cybersecurity certification framework for ICT products, services and processes. Companies doing business in the EU will benefit from having to certify their ICT products, processes and services only once and see their certificates recognised across the European Union.	X		X		X			
Policy documents on other digital topics of relevance for smart cities									
COM(2021) 118 Communication on 2030 Digital Compass: the European way for the Digital Decade Published on 09/03/2021	The Communication 'Digital Compass: The European Way for the Digital Decade' set out digital ambitions for the next decade in the form of clear, concrete targets. The digital compass uses the 4 points of the compass to identify the main goals to reach over the next decade: - a digitally skilled population and highly skilled digital professionals; - secure and sustainable digital infrastructures; - digital transformation of businesses; - digitalisation of public services.			X		X	X		
COM(2020) 591 on a Digital Finance	The strategy sets out four main priorities: removing fragmentation in the Digital Single Market, adapting the EU regulatory framework to facilitate digital innovation, promoting a data-driven finance and addressing the challenges and risks with digital	X		X		X	X		

Policy document	Short description	Privacy, surveillance, cybersecurity and safety aspects	Data loss, inaccuracy, lack of reliability and interoperability issues	Digital inequality /exclusion	Financial burden for authorities and service providers	Economic damage and inequalities	Lack of trust or approval in the service and/or service provider	Loss of human contact and isolation through remote care, working, training and shopping	Potential dependency on private technology providers and vendor lock-in
Strategy for the EU Published on 24/09/2020	transformation, including enhancing the digital operational resilience of the financial system.								
COM(2021) 609 on European Missions Published on 29/09/2021	the European Parliament and Council of the EU have mandated the Commission to introduce a new way of working across policy areas, fields of expertise and science, directly engaging with companies, local communities and the innovation community: EU Missions. Rooted in research and innovation, they aim to address societal challenges and reconnect citizens with the European Union by inspiring and empowering them to improve their lives and those of others.			X	X	X	X		X
Digital Europe Programme (DIGITAL)	The Digital Europe Programme (DIGITAL) is a new EU funding programme focused on bringing digital technology to businesses, citizens and public administrations. It will provide strategic funding to answer these challenges, supporting projects in five key capacity areas: in supercomputing, artificial intelligence, cybersecurity, advanced digital skills, and ensuring a wide use of digital technologies across the	X	X	X	X	X	X		X

Policy document	Short description	Privacy, surveillance, cybersecurity and safety aspects	Data loss, inaccuracy, lack of reliability and interoperability issues	Digital inequality /exclusion	Financial burden for authorities and service providers	Economic damage and inequalities	Lack of trust or approval in the service and/or service provider	Loss of human contact and isolation through remote care, working, training and shopping	Potential dependency on private technology providers and vendor lock-in
	economy and society, including through Digital Innovation Hubs.								
Relevant programmes and initiatives for smart cities									
European Urban Initiative	The European Urban Initiative will be an umbrella initiative bringing together several EU funded programmes dealing with sustainable urban development. In particular it will have a strand on innovative actions. The European Urban Initiative aims at supporting cities within this new Cohesion policy frame, encouraging them to be bold on innovation and to spread the benefits of tested solutions across Europe while supporting capacity building and evidence-based policy making, and knowledge sharing, on sustainable urban development.	X	X	X	X	X		X	
Urban Innovative Actions (UIA)	Urban Innovative Actions (UIA) is an Initiative of the European Union that provides urban areas throughout Europe with resources to test new and unproven solutions to address urban challenges. UIA will soon be embedded and become a key stream of the European Urban Initiative, therefore the European Commission confirms its will and intention to continue funding and supporting urban innovation			X	X	X	X		

Policy document	Short description	Privacy, surveillance, cybersecurity and safety aspects	Data loss, inaccuracy, lack of reliability and interoperability issues	Digital inequality /exclusion	Financial burden for authorities and service providers	Economic damage and inequalities	Lack of trust or approval in the service and/or service provider	Loss of human contact and isolation through remote care, working, training and shopping	Potential dependency on private technology providers and vendor lock-in
	and testing, now with a stronger focus on capitalisation and scale up.								
Urban Agenda for the EU	The Urban Agenda for the EU represents a new multi-level working method promoting cooperation between Member States, cities, the European Commission and other stakeholders in order to stimulate growth, liveability and innovation in the cities of Europe and to identify and successfully tackle social challenges. In particular partnerships of relevance are the one on Digital Transition, Urban Mobility, Energy Transition.			X	X	X	X		
EU Mission: Climate-Neutral and Smart Cities	EU Missions are a new way to bring concrete solutions to some of our greatest challenges. They have ambitious goals and will deliver concrete results by 2030. They will deliver impact by putting research and innovation into a new role, combined with new forms of governance and collaboration, as well as by engaging citizens. EU Missions are a novelty of the Horizon Europe research and innovation programme for the years 2021-2027. The Cities Mission will involve local authorities, citizens, businesses, investors as well as regional and national authorities to: - Deliver 100 climate-neutral and smart cities by 2030			X	X	X	X		X

Policy document	Short description	Privacy, surveillance, cybersecurity and safety aspects	Data loss, inaccuracy, lack of reliability and interoperability issues	Digital inequality /exclusion	Financial burden for authorities and service providers	Economic damage and inequalities	Lack of trust or approval in the service and/or service provider	Loss of human contact and isolation through remote care, working, training and shopping	Potential dependency on private technology providers and vendor lock-in
	- Ensure that these cities act as experimentation and innovation hubs to enable all European cities to follow suit by 2050								
URBACT	URBACT is a European exchange and learning programme promoting sustainable urban development and the exchange of knowledge among cities. The programme finances the set up of networks across a variety of themes, some of which of relevance to the digital transition. Focus is also on the development and dissemination of best practices, and knowledge capitalisation promotion for urban practitioners. They also have national contact points across EU Member States that bring in local knowledge and disseminate at local level - thus also overcoming language barriers.			X	X	X	X		
New Leipzig Charter- The transformative power of cities for the common good	The New Leipzig Charter provides a key policy framework document for sustainable urban development in Europe. The Charter highlights that cities need to establish integrated and sustainable urban development strategies and ensure their implementation for the city as a whole, from its functional areas to its neighbourhoods. The document is strongly aligned with the Cohesion Policy and its framework for sustainable urban development.			X		X	X		

Policy document	Short description	Privacy, surveillance, cybersecurity and safety aspects	Data loss, inaccuracy, lack of reliability and interoperability issues	Digital inequality /exclusion	Financial burden for authorities and service providers	Economic damage and inequalities	Lack of trust or approval in the service and/or service provider	Loss of human contact and isolation through remote care, working, training and shopping	Potential dependency on private technology providers and vendor lock-in
	Member States agreed to implement the Charter in their national or regional urban policies.								
Living-in.eu	EU cities, regions and Member States are in the process of signing a political declaration 'Living-in.eu', subscribing to a set of principles and commitments, aiming to deploy standards based interoperable local data platforms and other urban solution (currently there are more than 100 signatories).	X	X	X	X	X	X		X
Smart Cities Marketplace	The Smart Cities Marketplace was created by merging two former platforms, the 'Marketplace of the European Innovation Partnership on Smart Cities and Communities (EIP-SCC Marketplace)' and the 'Smart Cities Information System (SCIS)'. It aims to bring cities, industries, SMEs, investors, banks, researchers and many other smart city actors together.	X	X	X	X	X	X	X	X
100 Intelligent Cities Challenge	The Intelligent Cities Challenge (ICC) is a European Commission initiative that supports 136 cities in using cutting-edge technologies to lead the intelligent, green and socially responsible recovery. The ICC cities and their local ecosystems will be engines for the recovery of their local economy, create new jobs, and strengthen citizen participation and wellbeing.			X	X	X	X		X

Policy document	Short description	Privacy, surveillance, cybersecurity and safety aspects	Data loss, inaccuracy, lack of reliability and interoperability issues	Digital inequality /exclusion	Financial burden for authorities and service providers	Economic damage and inequalities	Lack of trust or approval in the service and/or service provider	Loss of human contact and isolation through remote care, working, training and shopping	Potential dependency on private technology providers and vendor lock-in
JoinUp	Joinup is a collaborative platform to help e-Government professionals. The European Commission created Joinup to provide a common venue that enables public administrations, businesses and citizens to share and reuse IT solutions and good practices, and facilitate communication and collaboration on IT projects across Europe. Joinup offers several services that aim to help e-Government professionals share their experience with each other. Joinup supports them to find, choose, re-use, develop and implement interoperability solutions.				X		X		X
WiFi4EU	The WiFi4EU initiative provides municipalities with the opportunity to apply for vouchers to the value EUR 15 000. The vouchers are to be used to install Wi-Fi equipment in public spaces that are not already equipped with a free Wi-Fi hotspot.			X	X				
SmartCare	SmartCare is an EU-funded cross-regional project that is developing a coordinated and integrated approach to the provision of health and social care for older people through an open IT platform to tackle a range of common threats which weigh on the autonomy of life.			X	X		X		

Annex VII – Initial list of possible policy options identified throughout the study

Set up a supervisory body for certification and quality assurance of the digital infrastructure in cities: (see policy option in Chapter 4)

Support the establishment of local networks, coalitions, and joint ventures among cities and regions: (see final discussion in Chapter 4)

Strengthen the role of national contact points to further link EU and local realities and support capitalisation and upscale (see policy option in Chapter 4)

Set up helpdesks and pools of experts for less-digitalised cities (pilot project for technical support – see policy option in Chapter 4)

Reinforce capacity building of public administrations to strengthen digital skills and promote capitalisation through peer-to-peer learning (staff training and staff exchange) (see policy option in Chapter 4)

Capitalise activities across EU-funded programmes working on different aspects of the smart transition: (see final discussion in Chapter 4)

Integrate citizens in design approaches to transition and promote bottom-up solutions: (see final discussion in Chapter 4)

Research and provide further evidence on the benefits and costs associated with remote working and service provision in cities: (see Chapter 4)

Create a knowledge platform for best practices to support replicability and scale up of inclusive smart city solutions (see Chapter 4)

Develop an [urban data community](#) at the European level: support the sharing of knowledge and experience, other than identifying new transformation potential in the field of data management for city governments. Reliance on third parties for provision of data management services can lead to legal issues, e.g. if data leave the EU. Sharing experience can help keep data management skills within city administrations. The policy option fits the new framework for data governance and attention to data sovereignty.

Assess existing legislation on energy efficiency in the built environment against the impact of remote working: While multiple pieces of legislation exist, e.g. the [Energy Performance of Buildings Directive](#), there could be a comprehensive assessment of the environmental impact of ICT in general, and smart city solutions in particular. From the impact of remote working to the energy implication of new solutions for the smart urban ecosystem, future legislation on energy efficiency for building and urban planning could concentrate on the relevant aspects of the smart transition.

Increase efforts to provide fixed and mobile broadband connectivity to all cities and communities across the EU: From overarching actions such as the Recovery and Resilience Facility, NextGenerationEU, and the new Cohesion Funds, to specific programmes such as WIFI4EU, the EU is pushing strongly for the deployment of broadband across the EU. This should remain a priority to reduce disparities across EU regions and foster digital inclusion.

Support the constitution of networks for local stakeholders involved in digital inclusion: Since the start of the COVID-19 pandemic, digital exclusion has become a politically challenging topic. To foster digital inclusion, several cities across the EU are in the process of elaborating digital inclusion

strategies. In France, regional digital inclusion hubs have been inaugurated. Building on EU actions such as the European skills agenda and the objectives of the digital compass, the EU could support the creation of networks to share expertise and best practices on measures aimed at fostering digital inclusion in cities.

Support communities and local and traditional product or service providers to survive competition from online platforms: Possibilities for funding, sharing experiences, or support in line with the Just Transition Fund could be devised to support local traditional activities in surviving rising competition from e-commerce alternatives. Funds could be mobilised in the framework of protection and valorisation of local heritage, and in line with sustainable tourism objectives.

Declare connectivity a right and regulate the provision of essential services: The issues of digital exclusion and vendor lock-in are particularly strong in peripheral areas of the EU. While various measures are being taken to reduce this digital divide, one action could be recognising connectivity as a right. Recognising the right of EU citizens in rural areas to have the same right to connectivity as citizens from metropolitan areas could force action on regulating market dynamics in the provision of services such as access to broadband connections.

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This study explores the main impacts of the smart city transition on our cities and, in particular, on citizens and territories. In our research, we start from an analysis of smart city use cases to identify a set of key challenges, and elaborate on the main accelerating factors that may amplify or contain their impact on particular groups and territories. We then present an account of best practices that can help mitigate or prevent such challenges, and make some general observations on their scalability and replicability. Finally, based on an analysis of EU regulatory frameworks and a mapping of current or upcoming initiatives in the domain of smart city innovation, capacity-building and knowledge capitalisation, we propose six policy options to inform future policy-making at EU level to support a more inclusive smart city transition.

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