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Working Party on Urban Policy

**ENHANCING THE CONTRIBUTION OF DIGITALISATION TO THE SMART
CITIES OF THE FUTURE**

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Table of contents

Executive Summary	3
Introduction.....	4
Digital innovation in cities and the “smart city” concept	4
What are “smart cities”?.....	4
Policy implications of smart cities for the future	9
How to measure a smart city?	10
Opportunities and challenges of “smart cities” for governments and citizens.....	12
Opportunities.....	13
Improve the integration and delivery of public services.....	13
Enhance environmental sustainability and resilience	15
Reduce barriers to entry for entrepreneurs and small firms.....	15
Improve city governance and innovation capacity	16
Engage better with citizens.....	17
Improve tourism information and management.....	17
Challenges.....	18
Data.....	19
Governance.....	20
Capacity and skills.....	21
Regulatory frameworks	21
Financing	22
Ways forward.....	22
References	25
Annex A: Select examples of smart cities initiatives	27

Tables

Table 1. Smart applications and emerging technologies poised to have effect on cities through 2025 ..	8
---	---

Figures

Figure 1. The CITYkeys indicator framework.....	11
Figure 2. Six dimensions of the smart city by the European Smart Cities project.....	11
Figure 3. The policy implications of digital innovation in cities.....	12

Boxes

Box 1. What is a smart city? Selected definitions	6
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Executive Summary

1. Digitalisation is one of several megatrends, including globalisation, demographic change, and climate change, that are reshaping policies from the ground up. For two decades, digital innovation has been at the heart of discourse around “smart cities” to build more efficient and liveable urban environments.

- In a first instance the concept of “smart cities” was largely supply-side and sector-driven, with the private sector taking the leading role in defining both the problem and the solution for digital innovation to generate new economic opportunities, improve service delivery and facilitate citizen engagement.
- To name a few: smart grids help manage energy consumption; smart meters and pipes help track water quality and detect leaks; smart sensors improve traffic flow, transport efficiency and solid waste collection routes; mobile applications enable citizens to report problems in real-time and engage directly with city services; platform companies like Airbnb and Uber are now a mainstay in cities worldwide; low-cost mobile-messaging, telemedicine and video-consultations improve health outcomes and lower healthcare costs; and self-driving cars and car-sharing platforms alleviate pressure on land use.
- Going forward, more emerging technologies are poised to have strong implications for urban development such as additive manufacturing (3D printing), the Internet of Things (IoT), big data analytics, artificial intelligence (AI), advanced energy storage technologies, civic technology, unmanned aerial vehicles (drones) and Blockchain.

2. While digital innovation remains central to the smart city concept, a key policy question for local and national decision-makers is how to make the most for citizens’ well-being of the costly investment in smart technologies, applications and digital innovations.

- This paper (re)defines smart cities as “initiatives or approaches that effectively leverage digitalisation to boost citizen well-being and deliver more efficient, sustainable and inclusive urban services and environments as part of a collaborative, multi-stakeholder process”
- The paper argues that harnessing the benefits of digitalisation in cities is critical to deliver growth and well-being across our economies and societies. It seeks to take stock of a decade of experimentation, uptake and proliferation of smart cities’ initiatives across the globe, in order to help understand what has worked, what has not worked, and what can be improved to leverage fully their potential to drive inclusive and sustainable growth.
- The first part of the paper explores the range of definitions and measurement frameworks that have been proposed around the smart city concept. The second part assesses some of the main opportunities, challenges, risks and trade-offs stemming from digitalisation in cities, to outline the main policy implications for governments in OECD countries. The third part sketches ways forward for the OECD to address the proposed policy questions.

Introduction

1. In an increasingly urbanised world, where cities concentrate more than half of people, jobs and GDP in OECD Member countries, harnessing the benefits of **digitalisation** in cities is critical to deliver growth and well-being across our economies and societies. Around the world, governments are making cities “smarter” by using data and digital technology to build more efficient and liveable urban environments and manage the impact of rapid urbanisation, demographic and climate change.

2. Since its foundation in 1999, the OECD **Regional Development Policy Committee** (RDPC) has made the case for place-based policies to help all regions and cities use their full economic potential. At the fourth OECD Regional Development Ministerial Meeting (Athens, 19-20 March 2019), Ministers concurred that digitalisation is first and foremost a tool to bring greater quality of life to people, which offers significant opportunities. They called for increasing the positive impact of digitalisation on people, business, and governments in all types of places through the creation of quality jobs and better service provision. In particular, Ministers:

- acknowledged the importance of high-speed internet, industry 4.0 and 3D printing, autonomous mobility, artificial intelligence, virtual reality, and blockchain as factors changing industries and jobs and bringing about **opportunities** for “smart cities”, “smart villages” and “smart territories”;
- called for leveraging digital tools that can help subnational governments achieve more effective taxation systems, public procurement, simplified regulations and procedures, open government, and enhance accessibility of services, among other benefits;
- called for investing in digital infrastructure throughout their **territories** to ensure a more balanced growth, while ensuring good planning, accessibility and timely, smart regulation to stay ahead of the curve with respect to technological change; and
- invited the RDPC to provide **data and tools** to address the regional implications of the impacts of digitalisation and other technological change in regions and cities,

3. This background paper seeks to take stock of a decade of experimentation, uptake and proliferation of smart cities’ initiatives across the globe, in order to help understand **what has worked, what has not worked, and what can be improved** to leverage fully their potential to drive inclusive and sustainable growth. The first part of the paper explores the range of definitions and measurement frameworks that have been proposed around the *smart city* concept. The second part assesses some of the main opportunities, challenges, risks and trade-offs stemming from digitalisation in cities, to outline the main policy implications for governments in OECD Member countries. The third and final part sketches some ways forward within the RDPC’s 2019-2020 Programme of Work and Budget.

Digital innovation in cities and the “smart city” concept

What are “smart cities”?

4. Over the past two decades, the “smart city” concept has been largely **supply-side driven**, with the **private sector** having “taken the leading role so far in defining both the problem and the solution” (Kleinman, 2016) on how digital innovation can help generate

new **economic opportunities**, improve public **service delivery** and facilitate **citizen engagement** in cities. This trend accelerated in a backdrop of rising demand for services, shrinking public budgets, and lowering trust in government.

5. Smart cities are at the interface between **social and technological** dimensions. The concept encompasses “cities of all size”, including smaller communities or regional municipalities where various inspiring examples can also be found. However, much of the discussion around smart cities has revolved around the technological dimension mainly due to the initial lead role by corporate organisations such as IBM, CISCO, Intel, and more recently by GE, Microsoft, Oracle, and Amazon. These initiatives tend to focus on the development of cloud based platforms and solutions for smart city projects. The role of technology has therefore been key for the enablement of new production, distribution and governance processes; the transformation of organisational and institutional arrangements; and the information of individual choices and behaviours. However, information and communication technologies are not the only components in providing smart solutions. Social innovation, which creates new social forms and forms of cooperation in society, is also essential. In this context, the capacity of municipalities to involve the various stakeholders (entrepreneurs, academics, non-governmental organisations and citizens) in planning and implementation processes should be emphasised, as well as their ability to agree on the best solutions for development, responsibilities and investments as a result of common efforts.

6. The smart city concept is evolving and is still subject to debates. There is a range of definition for “smart cities” across OECD countries and institutions (Box 1). In most cases, smart cities have been defined as initiatives or approaches that use **digital innovation** (including digital-enabled innovation) to improve competitiveness in a community and **efficiency of urban services**. A search on Google Trends suggests that worldwide interest in smart cities significantly increased since 2013 making “smart” the most popular adjective of cities in comparison with others such as sustainable, healthy, liveable, green and resilient.

7. Several **emerging technologies** are poised to have effect in cities through 2025 (Table 1). They are predicted to have particularly strong implications for urban development and management such as additive manufacturing (3D printing), the Internet of Things (IoT), big data analytics, artificial intelligence (AI), advanced energy storage technologies, civic technology, unmanned aerial vehicles (drones) and Blockchain. In the intermediate future, autonomous vehicles (AV) are also primed to have a strong impact on cities.

8. In addition, many **smart applications** are already being used in infrastructure-based service services in the areas of security, healthcare, mobility, energy, water, waste, economic development, housing, engagement and community (Table 1). To name a few: smart grids help manage **energy** consumption; smart meters and pipes help track **water** quality and detect leaks; smart sensors improve **traffic** flow, **transport** efficiency and **solid waste** collection routes; **mobile** applications enable citizens to report problems in real-time and engage directly with city services; platform companies like **Airbnb** and **Uber** are now a mainstay in cities worldwide; low-cost mobile-messaging, telemedicine and video-consultations improve health outcomes and lower healthcare costs; self-driving **cars** and car-sharing platforms alleviate pressure on land use; **e-career platforms** boost local **jobs** and cross-generational bonds; lastly, smart cities also provide opportunity for start-ups, service providers and consultancies related to digital innovation and attract skilled workers.

9. The concept of smart cities has changed significantly since the original (and narrow) usage combining ICT, digital usages and citizen participation and navigating a complex system of governance involving local administrations, public agencies, firms, citizens and communities. While digital innovation remains central to the smart city concept, a key question is whether investment in smart technologies and digital innovations ultimately contribute to improve the **well-being of citizens**. This is why the OECD defines smart cities as “initiatives or *approaches that effectively leverage digitalisation to boost citizen well-being and deliver more efficient, sustainable and inclusive urban services and environments as part of a collaborative, multi-stakeholder process*” (OECD, 2018a). This definition stresses:

- the need to document better the contribution of smart cities’ to improving the **life of people** while continuing to deliver solutions to some of the most common urban challenges in a sectoral or multi-sectoral fashion;
- the importance of **citizen engagement** and collaborative partnerships to boost civic engagement (citizen participation and feedback; co-creation and co-production models; citizen-centred services and engagement platforms);
- the value of experimentation with public access to **open data** and collaboration within/between cities; private-public-people; national-regional-local scale; and
- the need for **integrated, holistic approach** to addressing urban challenges through digital innovation in a city’s governance, planning, and infrastructure investment.

Box 1. What is a smart city? Selected definitions

National governments

Denmark: the Ministry of Transport, Building, and Housing and the Danish Business Authority consider “Smart City” as an evolving concept: “Initially, the concept was only used in a narrow and governmental context especially in relation to environmental, energy and infrastructure issues in terms of how information and communication technologies can improve urban functionality. Subsequently, virtually all other areas of welfare started working with Smart City, for example in business development, innovation, citizen involvement, culture, healthcare and social services, where the use of data and digital platforms helps smart new solutions.”

Korea: the Ministry of Land, Infrastructure and Transportation defines a smart city approach as one that “makes use of opportunities from digitalisation, clean energy and technologies, as well as innovative transport technologies, thus providing options for inhabitants to make more environmentally friendly choices and boost sustainable economic growth and enabling cities to improve their service delivery”. It also states: “smart cities are a tool for solving urban problems and improving the quality of life by applying ICTs and new technologies to cities.”

Latvia: The Ministry of Environmental Protection and Regional Development defines smart city as a city which implements a strategic package of measures to address the most pressing challenges and boost the competitiveness of the area, providing solutions for citizens and entrepreneurs, inter alia such measures which i) do not require substantial maintenance in the long term (save resources); ii) provide more efficient public services (faster, more comfortable, cheaper, e-services, one stop shop principle); iii) improve overall well-being of society, security and public order; iv) allow timely anticipation and prevention of potential challenges (flood hazards, energy shortages, heat losses, sewer leaks, etc.); iv) do not affect, reduce or eliminate impact on environment; and v) are based on smart development planning, which responds flexibly to the most pressing challenges and

development opportunities in the area, identifying existing and potential competitive sectors and promoting their development, as well as providing cooperation between different stakeholders (public administration, entrepreneurs, academics, NGOs, citizens).

Spain: the Spanish government works with the concept defined by the Spanish Association for Standardisation and Certification: “the Smart City concept is a holistic approach to cities that uses ICT to improve inhabitants’ quality of life and accessibility and ensures consistently improving sustainable economic, social and environmental development. It enables cross-cutting interaction between citizens and cities, and real-time, quality-efficient and cost-effective adaptation to their needs, providing open data and solutions and services geared towards citizens as people.”

United Kingdom: UK Department of Business, Energy and Industrial Strategy says “The concept [of smart city] is not static: there is no absolute definition of a smart city, no end point, but rather a process, or series of steps, by which cities become more “liveable” and resilient and, hence, able to respond quicker to new challenges.”

International organisations

European Union: “A smart city is a place where the traditional networks and services are made more efficient with the use of digital and telecommunication technologies, for the benefit of its inhabitants and businesses” (European Commission, 2014).

OECD: Smart cities are defined as “initiatives or approaches that effectively leverage digitalisation to boost citizen well-being and deliver more efficient, sustainable and inclusive urban services and environments as part of a collaborative, multi-stakeholder process” (OECD, 2018a).

United Nations: a smart city approach “makes use of opportunities from digitalisation, clean energy and technologies, as well as innovative transport technologies, thus providing options for inhabitants to make more environmentally friendly choices and boost sustainable economic growth and enabling cities to improve their service delivery.” (United Nations, 2016)

Inter-American Development Bank: a smart and sustainable city is defined as “an innovative city that uses ICT and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, and environmental aspects” (Bouskela et al., 2016).

The private sector

Smart Cities Council – a collective of several major large corporate firms active in smart city technology (including Cisco, IBM, Intel, and Qualcomm) – proposes the following definition: “a smart city gathers data from devices and sensors embedded in its roadways, power grids, buildings and other assets. It shares that data via a smart communications system that is typically a combination of wired and wireless. It then uses smart software to create valuable information and digitally enhanced services” (Smart Cities Council, n.d.).

IBM defines a smart city as “one that makes optimal use of all the interconnected information available today to better understand and control its operations and optimise the use of limited resources”.

Cisco defines smart cities as those that adopt “scalable solutions that take advantage of ICT to increase efficiencies, reduce costs, and enhance quality of life”.

Source: European Commission (2014); OECD (2018a); United Nations (2016); Bouskela et al. (2016) ; Smart Cities Council (n.d.)

Table 1. Smart applications and emerging technologies poised to have effect on cities through 2025

Security	Healthcare	Mobility	Energy	Water	Waste	Economic development and housing	Engagement and community
Predictive policing	Telemedicine	Real-time public transit information	Building automation systems	Water consumption tracking	Digital tracking and payment for waste disposal	Digital business licensing and permitting	Local civic engagement applications
Real-time crime mapping	Remote patient monitoring	Digital public transit payment	Home energy automation systems	Leakage detection and control	Optimisation of waste collection routes	Digital business tax	Local connection platforms
Gunshot detection	Lifestyle wearables	Autonomous vehicles	Home energy consumption tracking	Smart irrigation		Online retraining programs	Digital citizen services
Smart surveillance	First aid alerts	Predictive maintenance of transportation infrastructure	Smart streetlights	Water quality monitoring		Personalised education	
Emergency response optimization	Real-time air quality information	Intelligent traffic signals	Dynamic electricity pricing			Local e-career centres	
Body-worn cameras	Infectious disease surveillance	Congestion pricing	Distribution automation systems			Digital land-use and building permitting	
Disaster early-warning systems	Data-based public health interventions:	Demand-based micro-transit				Open cadastral database	
Personal alert applications	Maternal and child health	Smart parking				Peer-to-peer accommodation platforms	
Home security systems	Data-based public health interventions:	E-hailing (private and pooled) Car sharing					
Data-driven building inspections	Sanitation and hygiene	Bike sharing					
Crowd management	Online care search and scheduling	Integrated multimodal information					
	Integrated patient flow management systems	Real-time road navigation					
		Parcel load pooling					
		Smart parcel lockers					

Source: McKinsey Global Institute (2018), Smart Cities: Digital Solutions For A More Livable Future, Executive Summary

Policy implications of smart cities for the future

10. Over the past two decades, different stakeholders have been at the forefront of smart city initiatives worldwide with different expectations and needs:

- The **private sector**, in particular large companies, has been an advocate, investor and game-changer in the use of technologies to define and address a range of problems in selected sectors; it is now confronted with the challenge of considering new forms of public-private collaborations to facilitate the uptake of these initiatives in the face of megatrends, regulatory change and infrastructure needs;
- While **urban planners** have seen data and technology as mere tools to improve administration and services, they are well positioned to anticipate their high impact on policy making and planning and foster complementarities across sectoral initiatives and strategies;
- The **city leaders** spearheading smart city initiatives have gained agility and efficiency in their administration, but are struggling to demonstrate tangibly the positive effects on residents' outcomes and the implications on decision-making and local governance;
- Finally, the potential of **entrepreneurs, innovators and start-ups**, who are also working closely with local governments to build smart solutions to improve life in cities, remains largely untapped.

11. While digital innovation can yield many opportunities, policy makers often lack a clear understanding of the **policy implications**, including the challenges, risks and trade-offs of digital innovation in cities, and evidence of how such innovation can be leveraged for more inclusive and sustainable outcomes.

12. On the one hand, there can be important **efficiency and sustainability gains** from digital innovation, which provides new ways to deliver public services and optimises the use of idle or surplus resources. For instance, the tourism sector in cities can benefit from improved dissemination management (e.g. seamless transport and timely provision of tourism information). Digital innovation can also enable **new forms of engagement** with a broader range of citizens, and **co-production** throughout the policy design and implementation process. Moreover, it can create strong impacts on the **local job market** – for example, new ways of delivering public services may provide an opportunity for start-ups, service providers and consultancies related to digital innovation, and attract skilled workers.

13. On the other hand, however, policy makers must also balance these opportunities with significant **challenges** to implementation of smart cities initiatives. For instance, there are legal ambiguities and breaches in regulatory frameworks, but also human and technological capacity gaps within city administrations. Digital innovation also comes with **risks** (e.g. privacy and consumer protection, fair competition, the potential to exacerbate exclusion in the case of a strong digital divide). Finally, digital innovation also requires managing **trade-offs** among policy objectives (e.g. “smart” initiatives may not necessarily result in more environmentally sustainable or inclusive outcomes).

14. Assessing and managing those policy implications requires understanding how well smart efforts ultimately deliver in terms of **improving the functions of the city** and helping city leaders reach their broader policy targets and goals, notably **better lives** for their

residents. Key policy questions for decision-makers, which are targeted within the RDPC’s 2019-2020 Smart Cities Programme include:

- How can smart city initiatives support a whole-of-government effort to deliver better urban services and improve the well-being of citizens, through more agile institutions and more transparent **decision-making**?
- Which tools and strategies can support **multi-sectoral initiatives** from local governments, building on policy complementarities that are at the core of the multi-dimensional, outcome-based and people-centred well-being concept?
- Which business models and incentives are needed to reap the full potential of the contribution of the **private sector** in its diversity– from large companies to entrepreneurs, social innovators and SMEs - to smart cities strategies, in a shared responsibility with local governments and stakeholders at large?
- How to **measure** how smart a city is vis-à-vis intended well-being?

How to measure a smart city?

15. A “smart city” is a place where traditional infrastructure, networks, and services are made more efficient. A very important question is therefore how to **measure the “smartness” of the city** and what indicators to use. These indicators should be used to assess how efficiently and wisely the city uses its available resources, the effectiveness and rationality of planning, the availability of services, etc. These dimensions are the basis for improving the daily life of the inhabitants in the city, their well-being, mobility, security, and environmental sustainability.

16. Cities need to assess the outcomes of their smart cities initiatives, but in most cases they do not. A recent OECD-Bloomberg Philanthropies Survey on “Innovation Capacity” across 80+ cities (OECD, 2018g) shows that just under **17% conduct a systematic and comprehensive assessment** of their innovation outcomes, while half report that they evaluate some elements of their innovation strategy or outcomes.

17. There are, indeed, **important limitations to measuring** the extent to which a city is “smart.” Some relate to government’s structure and operations, which generates differences in how departments collect and produce data with data being incompatible, or difficult to incorporate into a broader urban system framework. Furthermore, some data are outside the capabilities of municipal administrations. For example, a city may be able to measure ridership and access to its public transit system using data it collects from ticket sales and swipes, and even through manually counting; however, there still remains a lack of knowledge about whether each rider’s needs are actually being met, and if the transit offer take them where they need to go.

18. This is why, although the literature about measuring smart cities’ performance is both vast and varied, there has been **no comprehensive assessment framework** to measure the extent to which the use of digital innovation in cities is delivering better well-being outcomes for residents. Most impact measurement attempts have been **project-focused rather than policy-oriented**. They have also been largely **place-specific** in the sense that what was measured often depended on the impact the city was trying to achieve, which varies from one city or country to another. Another need moving forward is to ensure that

measurement and evaluation of smart cities include data and indicators which are available over several years to compare the "smartness" of the city over time.

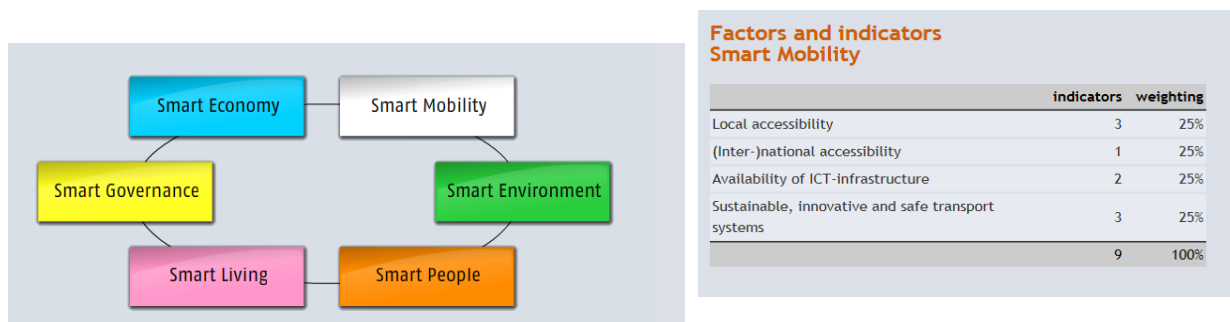
19. There are some cases where smart cities initiatives have been evaluated along their contribution to **societal, environmental, economical, and institutional** improvements. As an example, the *CITYkeys indicators* co-funded by the European Commission, breaks down the measurement indicators of a smart city into People, Planet, Prosperity, Governance, and Propagation (Figure 1). Under these categories, corresponding indicators have been identified; for example, a smart city approach related to environmental protection (Planet) would be evaluated along indicators addressing energy efficiency or climate change mitigation performance. Many scorecards and rankings break down the smart categories further, using terminology such as “smart living”, and “smart mobility”: offering indicators on transit systems and ICT-infrastructure, as well as cultural facilities and tourism appeal (Figure 2).

Figure 1. The CITYkeys indicator framework

People	Planet	Prosperity	Governance	Propagation
<ul style="list-style-type: none"> • Health • Safety • Access to (other) services • Education • Diversity & social cohesion • Quality of housing and the built environment 	<ul style="list-style-type: none"> • Energy & mitigation • Materials, water and land • Climate resilience • Pollution & waste • Ecosystem 	<ul style="list-style-type: none"> • Employment • Equity • Green economy • Economic performance • Innovation • Attractiveness & competitiveness 	<ul style="list-style-type: none"> • Organisation • Community involvement • Multi-level governance 	<ul style="list-style-type: none"> • Scalability • Replicability

Source: Bosch et al. (2017), “CITYkeys indicator for smart city projects and smart cities,” <http://nws.euocities.eu/MediaShell/media/CITYkeystheindicators.pdf>

Figure 2. Six dimensions of the smart city by the European Smart Cities project



Source: www.smart-cities.eu/model.html

20. To bridge the gap related to the absence of a comparable, harmonised and comprehensive measurement framework, the *OECD Smart Cities Programme* is currently developing a **smart cities indicator framework** that will provide local and national

governments with metrics, data and measurement on the extent to which digitalisation delivers better results and impact for citizens. The framework will cover select policy sectors and will also measure smart cities contribution to policy complementarities against well-being outcomes and sustainable development goals at a functional scale (defined through where people work and live rather than administrative boundaries). It will focus both on the *effectiveness* (how well the intervention is performing against its goals) and *efficiency* (whether the intervention is the right course of action to achieve the desired impact at the least cost), notably key areas of public service delivery, water, energy and circular economy, mobility, housing and the built environment.

21. The rationale for developing such an indicator framework is that smart city efforts related to the impact of technological interventions span a range of urban dimensions. They may offer solutions to enhancing the **internal operations** of a city, or to handling the external- and **service-focused provisions** of a city. Some internal functions could be related to **city governance** – how inclusive decision-making is or how open and accessible data is; or management of its **cybersecurity** – how well the city is able to protect its digital network and systems and respond to attacks, or **IoT architecture** – how networked and integrated are the city’s large-scale systems. Whereas more externally focused impacts could rely on the sophistication of the city’s **big data analytics capacity** – that is, how much meaning and information a city is able to extract from large data sources and turn it to policy intervention; or **network innovation** – measuring if a city’s systems are coordinated and harmonised in a way that cuts down inefficiencies for the operator (civic servant) and user (resident).

22. Above all the criteria for a smart city, is that it “mobilises and uses” the city’s resources in an efficient and effective way and draws on local engagement to i) address the needs and improve the lives of its residents, ii) enhance and optimise the city’s economic output, iii) responsibly and sustainably use natural resources and protect the environment, and iv) help the management of its systems and governance.

Opportunities and challenges of “smart cities” for governments and citizens

Figure 3. The policy implications of digital innovation in cities



Opportunities

23. The digital revolution provides a unique opportunity for policy makers to **recalibrate local policies from the ground up**. In 2016, 83% of all adults and 95% of all businesses in OECD Member countries had access to high-speed broadband. New technologies are transforming how policy makers engage with the labour market, with society and with public services. Around one-half of all people across the OECD have accessed public services or health information online. Digitalisation is enabling one-fourth of all workers in the OECD to work remotely, and e-health technologies have the potential to transform patients' experiences and health outcomes.

24. Emerging technologies are already becoming indispensable to citizens' daily lives, whether they live in cities, towns or rural areas. One often thinks first of smartphones, but there is also artificial intelligence (AI), big data analysis, 3D printing, and industrial robots which produce goods, to name just a few. Other emerging technologies look to be on the verge of making a transformative contribution, like blockchain and self-driving cars. These technological innovations will affect all of society but cities, in particular, stand to be transformed by the digital revolution.

25. Digital revolution brings opportunities for ground-breaking innovations in **urban design, policymaking and infrastructure**. Many cities are already tapping this potential, often with the close involvement of the private sector. Around the world, governments are making cities "smarter". They are using data and digital technology to help tackle climate change and to improve administrative processes by searching for efficiencies, cutting red tape, delivering better value for money and engaging citizens. Many sector-driven technologies have also contributed to new social initiatives, climate change actions and green growth in cities across a range of areas, through energy, water, clean air and other environmental benefits.

26. Much has been made of the opportunities generated by digital innovation in cities, in terms of **efficiency gains**, improved **public service delivery**, opportunities for more integrated urban services, lower barriers to entry for **entrepreneurs and SMEs**; greater **citizen participation**, as well as more **transparency and accountability** in the public sector. Key take-away messages and examples from select cities are provided in the following sections against some of the objectives of "smart cities".

Improve the integration and delivery of public services

27. Digital innovation is a means to fundamentally render urban services more efficient. Data-driven innovation in particular can increase efficiency and promote **integration of urban systems** ("system of systems"). For example, big data availability on transport flows, energy, water and waste systems allows unprecedented depth of analysis and facilitates targeted real-time interventions for a better management of urban systems. **Smart grids** can also be connected to transport system (mainly with electric vehicles) and home devices to manage energy supply and demand more efficiently.

28. The **electricity grid** is a good example of an increasingly integrated system through ICTs and real-time data. A key aspect of such "smart grids" is demand- and supply-side management, enabled by smart metres that contribute to energy savings. A wider potential of smart grids, however, lies in integrating fluctuating renewable energy supply as well as electric vehicles. Electricity grids can also be used to connect communicating devices, known as the Internet of Things (IoT). This includes all machines, devices and services connected via electricity grids and information systems, such as solar panels, weather

stations, heating and air conditioning, washing machines, dishwashers light bulbs, or electric vehicles.

29. The **IoT technologies** – which could have a total economic impact of USD 3.9 trillion to USD 11 trillion per year (Manyika and Chui, 2015) - can also support the efficiency of public service delivery in a number of ways. For instance, by enabling street objects (street lamps, parking metres) to communicate, which allows a continuous monitoring of their performance and scheduling maintenance only when it is needed – or predict when there is danger of a breakdown. Another example is to be found in the city of **Rotterdam, Netherlands**, where the Internet of Things (IoT) is used to better plan and manage shipping and reduce the ecological footprint of the port.

30. In addition, innovations in public service delivery may contribute to broader objectives for environmental sustainability: **car-sharing** and **home-sharing** applications and platforms help to optimise the use of idle or surplus resources in the economy. **Autonomous vehicles** can reduce the space dedicated to parking (parking lots, parking garages) in cities, thereby freeing up prime urban real estate for other (potentially more productive or sustainable) activities.

31. **Transport** provides an example of the promising effects of ICTs and data use in cities. Mobile applications, such as *moovel* and *Citymapper*, update commuters on the fastest transfer points, considering all available transport routes and traffic conditions. Matching demand and supply in real time cuts travel times. This in turn can save people time and money and reduce pollution and emissions in cities. Transport systems can be further optimised by dynamic road pricing and other types of traffic management based on **real-time data analytics**. For example:

- The Intelligent Traffic Management System of **London, United Kingdom** not only uses near-time traffic information to constantly adapt traffic light circuits, but also learns from continuing statistical observations to increasingly predict traffic and traffic volumes. The system is estimated to have reduced congestion in London by around 8% annually between 2014 - 2018 (TfL, 2011);
- **Hamburg, Germany** is working on various policies to reduce the use of cars (e.g. building cycling ways), and adopting Intelligent Transport Systems projects to improve users' mobility experience, including a long term tract for automated and networked driving, investments to move towards green trucks in the harbour area, and a pilot project on urban air mobility;
- **Saint Paul, United States** also invested in data visualisation capabilities that provide powerful insights into critical service areas such as transport. One example is visualisation dashboards that provide in depth analysis for traffic stops within the city. Information includes demographics of motorists stopped, demographics for officers making the stop, reason for stops, vehicle searches, people searches.

32. Through a co-creation process with citizens, the city of **Umea, Sweden** is developing **new sustainable housing areas** to counteract urban sprawl and allow for a lifestyle without car ownership. The new developments in the city are in line with “the city of 5 km”, a dense mixed city reducing cars and promoting walking and cycling. Households are provided with positive feedback for sustainable behaviour, based on sensor driven demand-side management. Energy systems are also based on 100 percent renewable energy in the whole district.

Enhance environmental sustainability and resilience

33. Digital innovation can also bring opportunities for **sustainability and resilience** in cities. Unmanned aerial vehicles, for instance, could allow geospatial surveying, and more accurate and cost-efficient air and water pollution monitoring, where information can be shared with citizens in real time. Smart meters and dynamic pricing on electricity have the potential to drastically change the energy consumption patterns of firms and households. They can provide incentives to adapt energy consumption to energy demand. Moreover, electrically powered cars, bicycles and scooters could considerably reduce air and noise pollution. The circular economy, a concept that aims to improve economic and resource efficiency, can also be enhanced by digital innovation, which allows more accurate management of consumption and production processes. Early warning systems for floods and other types of natural disasters could improve preparedness, response and recovery.

34. Several cities have implemented ambitious smart cities programmes that seek to achieve better sustainability and resilience:

- An example can be found in integrated energy solutions such as district energy or heat pumps. For instance, the city of **Yokohama, Japan**, introduced a Community Energy Management System to achieve efficient energy management, including the installation of emergency management systems in 4,200 homes, the introduction of 2,300 electric vehicles and of 37 MW of photovoltaic generation, and the reduction of 39,000 tonnes of CO₂ emissions (IEA, 2016).
- The city of **Bristol, United Kingdom** is another example of energy efficiency through smart equipment. Bristol is taking part in an EU-funded smart city project (REPLICATE), looking at how smart city solutions can directly benefit local residents and be scaled up and replicated. The project aims to promote new ways of reducing energy use, rethinking transport choices and using infrastructure. As a part of this initiative, Bristol is developing an Energy Demand Management System and creating smart streets with 24 street charging sites.
- In the city of **Groningen, the Netherlands**, smart bins automatically send text message to the city government when they are full. It allows reducing labour and petrol costs – and thus environmental impacts – by sending garbage trucks only to bins that need emptying.
- The Flood Early Warning System of the city of **Austin, United States**, combines flood maps, real-time data and predictive modelling to improve the efficiency of evacuation decisions and plans. The system predicts which streets will become flooded up to six hours beforehand and maps flooded areas and road closure. Before this system, evacuation mostly took place after the disaster had occurred.

Reduce barriers to entry for entrepreneurs and small firms

35. After an initial development of software, digital products can be produced with a very low (or even sometimes zero) marginal cost, resulting in extreme returns to scale. Successful innovators in ICT businesses can benefit from a temporary exclusivity based on first-mover advantage, intellectual property rights protection, brand reputation, and network effects. This exclusivity fosters concentrated market structures, so-called “winner-take-all” where only a few companies dominate the entire market. This market structure can generate growing income inequalities since most of profits of innovative firms are

redistributed to shareholders, senior managers and key staffs who belong to the top income groups.

36. But at local scale, digital innovation for smart cities often requires much lower costs than other industries that call for large capital expenditures, and therefore provides avenues to engage with firms of all size. Digital innovation enables “creative destruction” which allows newcomers in the market to supersede leading incumbents such as large companies and firms, as well as reduces barriers to entry on many markets.

37. Cities have an important role to play for new innovators with a brilliant idea and for disruptive technologies to be able to compete with dominant incumbents. For example, **Umea, Sweden** has been providing a level playing field for co-operation with universities, hospitals, rural areas in the surroundings, and industrial incubators (Uminova) to develop digital solutions. It provides an interesting related to biomedicine, thus increasing collaboration between start-ups, scientists and corporations.

38. New ways to deliver public services can also create needs for new **local business and jobs** in cities such as service providers, consultancies, system engineers and IT related programmers, which can affect the job market in cities.

Improve city governance and innovation capacity

39. Digitalisation also provides cities with an opportunity to enhance their organisational and administrative **capacity** to overcome common challenges such as red tape, risk averse human resource management practices, a silo approach to policy development, hierarchical structures, and the lack of a talented and motivated workforce. In an era of intersecting, persistent policy challenges, coupled with a need to deliver more tailored public services in an increasingly constrained fiscal context, many local governments are rethinking how to best leverage capacity in terms of human, financial, institutional, physical and community resources to better serve residents.

40. Over the past few years, cities have started a process of transitioning from “importing” to “producing” and ultimately “utilising” innovation as a strategic asset. The smart cities movement to increase efficiency levels of local public administrations is an example of this trend. Adopting a formal, clear and inspiring ‘**innovation strategy**’ can create an environment that fosters **risk-taking** and **organisational change**. Cities without a formal strategy seem to be more inclined to experience with data driven analytics and rethinking their approaches to financing and partnership.

41. **Leadership** is an essential ingredient for detonating cities’ innovation capacity according to 70% of cities that answered the OECD-Bloomberg Philanthropies survey on innovation capacity (OECD, 2018g). This suggests that in local governments, the role of politicians is likely to be extremely influential in the adoption of innovations. Political leaders at the head of local public administrations can determine and influence workplace culture in ways that human resources practices may not always be able to do. This may not just be the case of political leaders, since senior managers have a critical role in translating that vision into practice.

42. Dedicated **innovation units**, often located within Mayors’ office, may have a major impact on cities’ capacity to innovate and are an increasingly popular tool to support innovation work in the public sector. These units may perform a variety of functions to foster a culture of innovation in the local public administration. Their organisation and structure vary significantly from city to city.

Engage better with citizens

43. Digital technologies can improve citizen engagement through e-government services and **civic technology** to facilitate access to information, take better and informed decisions, and express opinions through online platforms, petitions and voting. Across OECD Member countries, the use of digital government services has tripled since 2006, with around 36% of OECD citizens submitting forms via public authorities' websites in 2016 (OECD, 2017). Across the European Union, the digitalisation of services has somewhat or even substantially reduced operating costs for 85% of cities (ESPON, 2017).

44. A greater use of digital technology may also enable innovative and experimental governance in cities and metropolitan areas. For instance, in 2018, **Freetown, Sierra Leone** launched a phone-based tax collection system through which citizens can pay their local taxes in five simple steps, which is expected to help the city council collect more taxes. As a result, the city has collected over 300% more taxes than the previous year. Another example is the use of **behavioural insights** for policy design, which is becoming more common in OECD Member countries (OECD, 2019a). Governments also facilitate data-driven innovation by opening up public data and rewarding programmers and entrepreneurs, for example through **hackathon** events.

45. In addition, governments increasingly use **crowdsourced data** to gain real-time detailed information on public service delivery and infrastructure needs, and facilitate appropriate real-time responses. For instance, in many cities, citizens can report and inform city employees through smartphone applications about the location of potholes, broken traffic lights, stray garbage, manage disasters or any other urban challenges they face on a daily basis. Key examples in this area include:

- **Louisville, United States**, where the *Air Louisville project* measures air quality through crowdsourced data - when residents are having asthma attacks (measured by a GPS-enabled device on inhaler medication). It led to greater transparency about hyper local air quality issues, which are then addressed through new policies dealing with traffic congestion and tree planting. Residents who participated learned about their asthma triggers and were coached by respiratory therapists leading to a 80+ drop in rescue asthma inhaler usage over the period of 18 months;
- **Detroit, United States**, where the Innovation and Emerging Technology team developed an application, Improve Detroit, which allows residents to See, Click, Fix right from their phones. Geo-tagged photos of potholes, downed trees, and other issues are automatically routed to the appropriate departments for resolution;

46. Going forward, there is room for governments to better identify and determine **target groups** for policy instruments through the completion of online surveys, primary data collections and IoT technologies. For example, wearable devices, telemedicine or e-health could send early warnings of citizens' health conditions, which would improve the responsiveness of the healthcare system and reduce medical expenses by avoiding emergency care and unplanned hospitalisation.

Improve tourism information and management

47. Technology and the emergence of digital distribution platforms have played a central role in the expansion of the **tourism** sector, along with cultural shifts by which consumers are increasingly willing to share resources. The rapid growth of the sharing economy - expected to reach USD 335 billion by 2025 - has provided policy makers with

an opportunity to “re-think how tourists experience their country and how citizens can benefit from participating in this new form of economic activity” (OECD, 2016c). **Accommodation** and **transport** are two of the most important sectors that seized opportunities from the platform economy. In both cases, a small number of platforms dominate the marketplace: *AirBnB* had nearly 2 million properties in over 190 countries in 2015, while car-sharing options were largely provided by *Uber* and *Blablacar*.

48. There are several opportunities created by the sharing economy, including i) expanding and enhancing consumer options; ii) contributing to growth in the market for tourism services; iii) taking advantage of under-utilised or idle assets, and enabling product growth without significant investment; iv) stimulating new entrepreneurs; v) spreading tourism to less visited areas where new investment is limited; and vi) delivering the benefits of tourism to more people, as suppliers and users (OECD, 2016c). Yet there are also important challenges relating to consumer protection, unfair competition (vis-à-vis traditional companies that are more regulated), lower tax requirements or non-compliance (thus loss of tax revenue); limited employment and social protection for hosts and drivers (impacts on well-being), and impacts on local communities in areas of high provision.

Challenges

49. Although digital innovations can contribute to making urban environments more liveable, they can be disruptive, and come with a range of **challenges, trade-offs and hidden costs**. Indeed, digitalisation can serve as a “double-edged sword”, which may either improve the public policy response to other transformative megatrends, such as globalisation, demographic shifts and climate change – or, on the contrary, may reinforce their destabilising effects (OECD, 2016b).

50. Without an integrated, multi-sectoral, and whole of government perspective, digital innovations can upend legal and **regulatory frameworks** safeguarding **affordability** objectives, **consumer protection**, taxation, labour contracts and fair competition. They can also jeopardise citizen **data, privacy and safety** thus generating trade-offs between disclosing data and perceived impact of smart city services. They can shake the **decision-making** powers and modalities in the era of real-time – and often asymmetric – information. And, equally important, they can deepen **inequality** among digitally marginalised groups unless local governments recognise that tech-driven solutions are as important to the poor as they are to the affluent.

51. To ensure that digitalisation does not widen the gap or contribute to further citizen discontent and a backlash against public institutions, the **human element** should not be forgotten, as not all technology trends are beneficial for societal health or personal happiness. In the case of smart cities, public and private action have to be viewed through the lens of their value to society since **social costs** may arise through digitalisation, in particular during the transition period. Smarter **investment in human resources**, such as in life-long learning and more generally ensuring that people have the skills for the future work, including digital literacy, will need to be available in all cities and regions, and should be viewed as an investment and not a cost.

52. Responses to both opportunities and challenges of digitalisation need to be provided largely at **regional and local level**. Regional innovation strategies can help local economies to seize the business opportunities from emerging disruptive technologies in order to boost productivity and growth while supporting diversification. This requires strategy development, innovation in firms, access to finance, effective stakeholder

engagement, leadership and foresight at all levels of government. It also requires extra efforts to ensure firms, particularly SMEs, fully benefit from these digital.

Data

53. A key characteristic of smart cities is the **wealth of data** generated through digital tools, which can also raise challenges. First, although smart cities would increasingly rely on data for policy design and implementation, more “data” do not necessarily translate into better policy making if not processed into valuable “information”. Indeed, fostering cities’ technological and data management capabilities has a positive impact on innovation capacity. According to the OECD-Bloomberg Philanthropies Survey, over 60% of respondents consider that data availability is an essential factor to foster innovation capacity in cities. Overall, cities produce an enormous amount of data and therefore relatively few cities feel that their innovation capacity is limited by a lack of data. Rather, cities consider that what limits their digital innovation is their weak capacity to **use data** to improve municipal policy-making and implementation; the **data incompatibility** between different policy areas; the **lack of staff** to collect data; and the lack of **data sharing** across agencies and institutions.

54. Reliance on big data may still only provide a piece of the bigger puzzle. Examples of **data-driven policy inefficiencies** can be found, for instance, in smartphone applications inviting citizens to report problems on city streets: one study found that the map of potholes reported by citizens systemically corresponded to areas with younger, wealthy residents who owned smartphones rather than an accurate portrayal of the broader street network’s problem. Another study found that social media alerts generated in the aftermath of Hurricane Sandy overrepresented the challenges experienced in Manhattan (given the high density of smartphone users who reported storm-related problems), compared to the challenges in coastal communities that were in reality harder hit (Kleinman, 2016).

55. There are also important risks associated with **citizen privacy**. In an era of open data, big data analytics and the Internet of Things, personal information could be shared with undesirable persons or for unwanted purposes. The recent data breach affecting 87 million Facebook users (by which a third-party improperly harvested personal data) has made international headlines for its scale and scope, but this case is not unique. Such privacy concerns are particularly relevant for health and medical data. In addition, there are risks that open data and big data analytics, which enable information to be tailored to specific groups according to their personal characteristics, could be manipulated by third parties. Hence, from a public policy perspective, crucial challenges need to be addressed as to the type of data cities should collect and publish as well as for how long it will be stored. In this respect, political considerations, regulatory frameworks, interests and values will be useful to influence, guide and implement citizen privacy-related policies.

56. Given the value of public sector data for citizens, innovators and entrepreneurs, many cities have started to make their data “open”. Opening access to data can be complicated. There are **transaction costs** stemming from agreements between different agencies; contractual and legal issues can arise from data collection; and existing rules are not adapted to data-driven service delivery or decision making in cities. For example, in the Netherlands, data from Twitter and a more formal police mobile application used in Rotterdam cannot be included in police reports for courts.

57. Finally many local governments lack the requisite capacity and skills for collecting, storing and **analysing data given the depth and scale** required, nor the infrastructure and computing power needed to store and process the data. Building in-house capacity with

data scientists is not easy for many cities, given that similar skills are of great value in the private sector as well. Regarding infrastructure and computing power, many cities do not have the financial means or know-how to build and maintain local servers either.

Governance

58. The governance challenges of smart cities are many and include issues of digital **inclusion**, inclusive service delivery, new forms of **participation** in the decision-making or **transparent governance**, among others. In addition, **size matters** both in terms of the nature of the challenge, but also in terms of the scale of smartness envisaged. A mega-city will likely not transform itself into a smart city overnight. The challenge is whether to do some for all (meaning deliver an aspect of smart city for the whole metropolitan area) or all for some (meaning deliver all dimensions of smart city for a small area within the metropolis). The first approach means resources are spread too thinly and also that it can take be a long time horizon, with possible disenchantment due to the slow progress. The second approach can be good as a demonstration project but the demonstration effect may not necessarily attract similar investment to the rest of the city.

59. Boosting the digital innovation capacity of cities requires a **collaborative interaction** between the city, its citizens, stakeholder and upper levels of government. The most crucial aspect of a smart city is probably the interaction with the **citizenship** and the centrality of the citizen in the definition and implementation of any action in the smart city context. A city “smartness” is meaningless unless it is rooted on citizens' participation. Cities have the perception that residents represent valuable partners capable of contributing to innovative policy work.

60. To overcome governance challenges and accelerate the uptake of new processes, practices and approaches, smart cities of all size need to promote an **agile and flexible model of city governance** through innovative collaborative tools, partnerships or forms of contracts that put the interest of local residents at the centre, including through inter-municipal collaboration and public-private partnership. The OECD-Bloomberg Philanthropies Survey results show that almost 90% of respondents have established partnerships with non-profit organisations, NGOs, and academia (Bloomberg Philanthropies and OECD, 2018). This could be due to either to their capacity to represent targeted subsections of the public, or their capacity to mediate external knowledge into the public sector.

61. Revisiting city governance implies a culture of innovation that incentivises experimentation and risk taking but also dedicated goals, strategies, staff, and budget. It is also important to reinforce strategic management and innovation capabilities of **local public officials** to design and implement integrated urban strategies that match the complexity of current and future challenges. New and broader forms of **citizen engagement** that put local residents at the centre of policy planning, design, implementation and decision-making regarding public spaces and infrastructure choice are also spreading out through citizen councils, use of technology, citizen monitoring and public innovation labs. **Open government** initiatives also contribute to expanding and facilitating access to public information, increased transparency and accountability of decision-makers, as well as instances of co-creation of public policies. Finally, innovative **participatory budgeting** can enable citizens to have a say on how public funds are spent, in particular for programmes and infrastructure projects pursuing inclusive objectives.

Capacity and skills

62. Digital innovation will pose challenges to skills and employment policies, since not all cities have the human, technological and governance capacity (within local governments) to adapt to new business models in technologically driven environments. In many cases, municipal governments lack the necessary **human and infrastructure capacity** to develop and adopt comprehensive smart city initiatives, in particular when attempting to incorporate integrated, systems-approaches to urban services within municipal administrations that are often strongly organised in siloed policy areas.

63. While the effects of digitisation will be far-reaching across sectors, particular attention has been paid to the ways in which digital innovation will affect the labour market and the future of work. In the digital age, opportunities abound for those comfortable with technology and innovation, as new jobs require new skills and new entrepreneurial opportunities emerge. On the other hand, prospects for many others may worsen: routine middle-skilled tasks are increasingly being automated, while jobs at the lower end of the skills distribution are seeing increased demand but are associated with low wages and less job security. This growing polarisation risks further exacerbating inequality. Given these trends, measures to enhance the innovation capacities of **disadvantaged groups** and facilitate their access to innovation opportunities are crucial to foster inclusive growth (OECD, 2017b).

64. Policies to ensure that automation is beneficial for regions and cities need to be **place-based**. More specifically, policies have to be tailored to the specific strengths and weaknesses of a city or a region, for example taking into account its sectoral composition; skill levels in the workforce; relations between public actors, businesses and research institutions; as well as its geographical location. Local and regional governments have an important role to play in supporting workforce development training and better matching of skills and employers in the regional job market. The labour market will require training (including re-training and upskilling workers), as well as preparing a new generation of young people for jobs of the future. Across European countries in the OECD, workers in Finland, Denmark, Netherlands, Norway and Sweden are receiving the most training (most of which consists of on-the-job training), while those in France, Turkey, Italy and Greece are receiving the least (OECD, 2017c).

Regulatory frameworks

65. Cities face challenges in creating policy and regulatory frameworks for platforms that – due to network effects – may be seen as **natural monopolies** and may have great influence over audiences and consumers. With the amount of data stored on sharing platforms increasing daily, protecting consumers, avoiding unfair competition, modernising laws and assuring social equality are key challenges.

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

67. Cities must address two goals when regulating sharing platforms: encouraging innovation and competition, whilst protecting the interests of citizens. With uncertainty over how laws and regulations pertain to the digital economy, some municipalities have either restricted or barred them from operating, such as limits on Uber services or the number of days residents can rent out their properties on accommodation sharing sites. With innovation, new challenges emerge: for instance, when an autonomous vehicle strikes and kills a pedestrian, who is to blame?

Financing

68. Enhancing innovation capacity within cities administration also requires **reliable sources of funding**. Funding allows not just experimentation and conducting research but also access to skills and competences outside the local public sector workforce, which could be essential for innovation work. According to the OECD-Bloomberg Philanthropies Survey, a large majority of cities (80%) have dedicated funding from public and private sources to support innovation work. An even larger majority of cities (87%) claim that dedicated funding is critical in determining innovation capacity, which indicates that some cities without an **innovation budget** may feel limited in their ability to innovate. There is an opportunity for cities to **diversify** their sources for innovation as the vast majority of respondents (94%) receive at least some of their funding from the municipal budget.

69. Going forward, cities need to promote the uptake of **innovative financial mechanisms** based on sound valuation practices, which includes considering a range of land based finance tools, infrastructure funds and sustainability bonds to finance public spaces, urban infrastructure, neighbourhood development and affordable housing creation.

Ways forward

70. Digital innovation will have far-reaching effects across the economy and throughout society. Smart cities should not be just a “buzzword”. It is crucial for cities of all sizes to make the most of digitalisation to tackle today’s most urgent policy agendas

71. On 18 March 2019, in the “Athens Road Map on Innovation for Inclusive Growth in Cities” (OECD, 2019b), 60+ Mayors for Inclusive Growth who have made the fight against inequality a priority in their policy agendas called for “**leveraging the full potential of technological and digital innovation to build the smart cities of the future and ensure their contribution to better well-being outcomes** for all our residents as part of a collaborative, multi-stakeholder process across sectors”. Amongst others, Champion Mayors will endeavour to:

- explore how to effectively embrace and plan for sustainable smart urban solutions across different sectors such as energy, water, transport, solid waste, health, land use, but also to expand service delivery to underserved communities without over-depleting resources;
- leverage digitalisation to deliver more efficient, sustainable, affordable and inclusive local public services and urban environments for instance real-time data, electronic congestion tolls, smart parking systems, IoT sensors, smart contracts, amongst others;
- ensure that new technology in public transport (e.g. app-based ride services and shared mobility) is both inclusive and sustainable including to those with reduced mobility and those in underserved communities;

- anticipate the future arrival of automatic and driverless vehicles and potential impacts when integrating them into the mobility profile of cities with safety as the highest priority. This would include anticipating and capitalising upon changes in land use, housing and transportation patterns triggered by smart urban solutions;
- take advantage of technologies that help better manage and visualise city investments, housing development, and predict potential areas at risk of limited access to services and opportunity, and plan accordingly;
- enhance efforts to collect and use data to improve accessibility of job opportunities, public services, green, cultural and leisure spaces in our cities and metropolitan areas;
- encourage new approaches to re-training and upskilling workers and to prepare young people for jobs of the future, and mitigate the impact of automation and digitalisation on the local labour market;
- leverage the potential of data innovation, including smart, big, open and geospatial data, to ground urban policy decisions in up-to-date and quality information and evidence, while safeguarding the privacy of individuals;
- recognise that tech-driven solutions are as important to the poor as they are to the affluent, by exploring not only the potential benefits but also the challenges, linked with artificial intelligence, automation and disruptive technologies on marginalised and disadvantaged groups, and address them;
- adopt appropriate local regulation for the sharing and gig economy to further employment security, protect the public interest and workers' social safety nets; and
- strengthen the monitoring and evaluation of local policies to demonstrate how smart cities can improve administrative and fiscal processes, engage citizens better, build trust in city leaders and shape better lives and outcomes for residents.”

72. On 20 March 2019, in the “Declaration on Policies for Building Better Futures for Regions, Cities and Rural Areas” [[OECD/LEGAL/0448](#)] (OECD, 2019c), Ministers of regional development called, amongst others, for “**connecting all places – regions and cities - to the global economy, by promoting the digitalisation of the economy and building regional ecosystems that:**

- address both the divides in access to **digital infrastructure**, and the **skills gaps** for workers, entrepreneurs and firms, in particular SMEs;
- link cities and rural areas to support sharing of **knowledge**, innovation, resources and amenities, and enhance **well-being** for all residents, leveraging complementarities and valorising regional diversity; and
- encourage an expanded scope for innovation policy to **enhance economic performance, social conditions, and sustainability** in all types of regions, and
- leverage the opportunities that digitalisation can bring to both urban and rural areas.”

73. One thing is clear: **cities, like countries, cannot work alone** to build the smart cities of the future. National and local governments must come together to enable the rapid diffusion of new technologies and deliver positive benefits for millions of citizens.

74. In this spirit, the *OECD Smart Cities Programme* seeks to assess and measure the performance of smart cities and how they contribute to inclusive growth and well-being. Going forward, the Programme will i) develop an **indicator framework** that will strengthen internationally-comparable statistics and data across 600 metropolitan areas above 250,000 inhabitants; ii) collect and analyse world-class **solutions and best practices**; and iii) propose a **typology of cities** with similar characteristics (challenges, capacity to respond, etc.) to foster peer-to-peer dialogue for finding common solutions to common problems and iv) conclude with a **checklist** with key principles and framework conditions for local and national governments to put in place as enablers to smart city initiatives, strategies and investment.

75. Within the Programme, a “start-up” or “**human city accelerator**” will also help city leaders and managers better define and build relevant products and services that solve real problems addressing real needs; identify clients and market segments; find funding opportunities and contract to develop smart city solutions. It will also help entrepreneurs learn in a few months what they would have learned in years, through mentorship, networking, education and visibility. This could plant the seeds of a **global smart city innovators network** that could facilitate the collaboration of national, regional, and local governments with innovators and entrepreneurs to match demand and supply, and advise local governments on how to enhance the enabling environment for innovators to deliver.

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Annex A: Select examples of smart cities initiatives

Annex A. Smart cities initiatives

	Smart city programme or initiative	Details
Australia	<i>Smart Cities Plan</i> launched by the Department of the Prime Minister and Cabinet	The Australian Government has six Smart Cities policy priorities (Jobs/Skills, Infrastructure/Investment, Liveability/Sustainability, Innovation /Digital Opportunities, Governance/Planning/Regulation, and Housing) that articulate the Smart Cities Plan's ambitions for smart policy, investment and technology.
Austria	Research and Technology (RTD) programme called "City of Tomorrow" launched by the Austrian Federal Ministry of Transport, Innovation and Technology (BMVIT).	"City of Tomorrow" is based on the previous RTD programmes including "Building of Tomorrow" and "Energy Systems of Tomorrow" It is focusing on the research and development of new technologies, technological systems as well as urban services for future cities.
Belgium	Belfius (bank) – European Investment Bank (EIB) co-financing programme: "Smart Cities and Sustainable Development" (2014) & "Smart Cities, Climate Action & Circular Economy" (2016)	The first programme supported 62 projects with EUR 400m, and the second programme is providing another EUR 400m. Belfius has a Smart Cities partnership with Agoria, the Belgian federation of the technological industry.
Canada	Smart Cities Challenge, launched by Infrastructure Canada	A competition open to municipalities, regional governments and Indigenous communities, which encourages communities to adopt a smart cities approach to improve the lives of their residents through innovation, data and connected technology. Four initiatives will be selected to receive federal funding, with the requirement that projects are scalable and replicable
Chile	Fundacion Pais Digital, a non-profit foundation co-established by government leaders, entrepreneurs, and universities in 2001 has been leading smart city projects. Public-private initiative, for the implementation of a digital platform called: "DOM en Línea" (Department of Municipal Works Online), to manage the documentation and grant permits, approvals, authorisations and certificates, through the internet.	The foundation brings together different Ministries, Universities, NGOs, the Chilean Association of Municipalities, and ECLAC to develop partnerships and pilot projects. The Ministry of Transport and Telecommunications (MTT) of Chile launched the "Smart City Gran Concepcion" with World Bank in 2014. The Ministry of Housing and Urban Planning leads the DOM initiative, with the participation of private organisations such as the Chilean Chamber of Construction (CCHC), the Construction Institute (IC), unions such as the Association of Directors of Municipal Works (ADom), the Association of Architects' Offices (AOA) and the College of Architects of Chile. Ongoing developments include setting up a national digital platform, which to carry out via internet the procedures within the Municipal Works Department' responsibility.
Czech Republic	1/ Prumysl 4.0 initiative to identify the vision and technological pre-requirements for the 4 th industrial revolution (2015, Ministry of Industry and Trade) 2/ Czech Smart City Cluster, a partnership between companies, governments, self-governments, knowledge institutions and citizens.	Prumysl 4.0 initiative has an action plan to create Smart Cities. The Cluster provides technological and methodological support for Municipalities' Smart City projects.

	Smart city programme or initiative	Details
Denmark	A number of different sector-based initiatives such as the energy Smart Grid Strategy (the Danish Ministry of Energy, Utilities, and Climate), digitisation in the public digitisation strategy (the Danish Agency for Digitisation) and data in the Basic Data Program (a number of ministries).	Invest in Denmark under the Ministry of Foreign Affairs conducted a research with Arup and CEDI on smart cities linking to national prosperity. It highlighted five requirements (municipal capability, investment certainty, skills and research, public acceptance and digital literacy, and sharing of data).
Estonia	Estonian Smart City Cluster – Smart City Lab co-financed from 2015-2018 by the European Regional Development Fund (ERDF) via the Enterprise Estonia	The Cluster is designed to create an innovative environment in cities which will boost the competitive ability of companies by bringing together businesses, citizens, public authorities, R&D institutes and structures that support innovation. The cluster will focus on the creation, development (including product development) and exporting of innovative solutions taking in different spheres of urban life.
Finland	The Six City Strategy (6Aika) launched in 2014 is an open innovation platform of the six largest cities in Finland (Helsinki, Espoo, Vantaa, Tampere, Oulu and Turku) where stakeholders can share smart solutions and implementation of experimental projects intending to tackle challenges related to urban environment.	The Platform is managed by the Ministry of Economic Affairs and Employment, and companies can freely experiment their innovative solutions in the six cities. All data, experiences and standards are shared between stakeholders. It is funded by European Regional Development Fund, European Social Fund, the Finnish Government and the participating cities. As of 2017, 26 projects with a total budget of 45 million EUR have been executed ever since.
France	1/ France's research tax credit 2/ Smart grids and connected cities are fully integrated into the "Sustainable City" plan as part of the "New Industrial France (<i>Nouvelle France Industrielle</i> ; NFI)" project launched in May 2015. 3/ "La French Tech" initiative Created in November 2013	Smart grid and connected city companies conducting research and development in France are eligible for France's research tax credit Within the framework of NFI, Bpifrance, France's public investment bank is providing financial support. (e.g. EUR 50 million of "City of tomorrow" fund for start-ups in the smart city sector) Innovative companies working with smart grids and smart cities receive business development support through "La French Tech" initiative.
Germany	1/ "City of the Future", a funding programme of EUR 150 million operated by the German Ministry of Education and Research (BMBF) 2/ Smart City Charter (June, 2017), developed by the Smart Cities Dialogue Platform 3/ Smart Cities research cluster, established by German Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR)	The "City of the Future" funding is given out for a range of projects that bring local residents, researchers, local government, and municipal utilities together to work out ideas and solutions for cities. The Smart City Charter was developed by the Smart Cities Dialogue Platform established in 2016 by the BMUB. As part of the Platform, representatives from cities, towns, districts and municipalities, local government associations, various ministries, Land-level urban development authorities, the scientific community, professional, economic and social organisations and civil society all came together to discuss smart cities in the context of integrated and sustainable urban development. The Cluster is to understand the impact that societal adoption of digital technologies has on urban development, to repurpose digital and big data methods and instruments for urban development, to rethink action areas in urban policy with digital know-how and to work with professionals from cities, municipalities and businesses.
Greece	City Challenge Crowdhackathon co-organised by the Union of Municipalities and Communities of Greece [KEDE] and Crowdpolicy [company]	The first event was held in 2017 with more than 200 contestants in 50 teams. 40 experienced mentors and 17 members of the evaluation committee from Municipalities, the market and the academic community supported the event.
Hungary	The Lechner Center assigned to coordinate and support upcoming smart city initiatives and to link public and private players by the government.	The Centre is aiming to facilitate a more centralised and coordinated management in smart city projects.

	Smart city programme or initiative	Details
Iceland	Reykjavik city is actively working on Smart City Projects including Reykjavik Fibre Network (Open Access); Strateó (transportation app); Better Reykjavik (citizen engagement platform); LUKR - The Land Information System of the Reykjavik Area (joint GIS system)	Population living in the Capital Region accounts for 60% of total population of Iceland. Reykjavik Fibre Network is offering 100 percent Fibre to the Home (FTTH) connectivity in the city and plans to connect neighbouring towns this year.
Ireland	Dublin and Cork respectively adopted smart city strategies called "Smart Dublin" and "Cork Smart Gateway".	The Prime Minister (Taoiseach)'s Department launched "Getting smarter about smart cities: Improving data privacy and data security" to call for the cities' smart city strategies to consider data privacy and security.
Italy	Investment budget to support public-private projects for smart electricity grids, broadband computer network infrastructure and the development of smart city services from the Ministry for Economic Development.	Initial budget of EUR 65m was announced in 2016.
Japan	1/ Ministry of Economy, Trade and Industry [METI] subsidised projects – Projects for Next Generation Energy and Social Systems (2010), Projects for Promoting Introduction of Smart Communities (2012). 2/ Future City Initiative [FCI], one of the 21 national projects in the New Growth Strategy (2010) 3/ Ministry of Land, Infrastructure, Transport and Tourism [MLIT], Model Projects (2019-)	While the projects subsidised by METI received massive financial support, the FCI provided cities with special measures, such as deregulation in the legal and tax system in order to foster the project development. In the summer of 2019, MLIT is expected to launch "Model Projects" (pilot projects) in several cities, to be carried out by consortiums consisting both of local governments and private companies.
Korea	1/ U-Korea Master Plan (2006); U-City Act (2008) & U-City Comprehensive Plan (2009); Smart City Act (2017) – amendment to the U-City Act 2/ Urban Regeneration New Deal Project (2017) 3/ Special committee on Smart Cities under the Presidential Committee on the Fourth Industrial Revolution (2017)	U-Korea Master Plan is a strategy for ubiquitous development to solve the problems caused by the high urban density. U-City Act is a top down planning from central government to local government and IT business to coordinate multiple industry sector convergence. The U-City Act became a base of newly enacted Smart City Act. The Urban Regeneration New Deal Project announced 68 pilot projects in 2017, and 5 projects are going to harness "smart" technologies (smart city projects). The Presidential Committee announced in January, 2018 that the national smart city pilot projects will be expanded from Sejong and Busan to Naju and Gimcheon for the next few years.
Latvia	1/ The Smart Specialisation Strategy 2/ EU Cohesion Fund 2014-2020 3/ Planning document alignment between the stakeholder ministries. 4/ Local Smart city Task Force.	Development of a Research and Innovation strategy for Smart Specialisation (RIS3) is currently a prerequisite in order to receive funding from the European Regional Development Fund (ERDF). Latvian Strategy includes advanced ICT, Smart energy, and Smart materials/technology/engineering. EUR 10 billion from EU Cohesion funds are being used for digitalisation and smart development. Smart city's definition, necessity and possible solution integration in the relevant planning documents of the next EU Cohesion planning period expected to align the activities between ministries and to allocate funding for smart city solution creation and implementation through Smart city collaboration platform. Creation of a local Smart city Task Force (collaboration platform) with stakeholders from academia, public and private sector to identify problems, solutions and opportunities of Smart city environment in Latvia.

	Smart city programme or initiative	Details
Luxembourg	City infrastructure projects launched by the Ministry of the Economy and Digital Luxembourg	Luxembourg's Smart City model – an urban development concept designed to optimise daily management of city infrastructure through IT and Internet of Things technologies. Six main fields are economy, mobility, environment, people, living and governance. Projects underway: construction of tram system for Luxembourg City, a progressive shift to all-electric public transport in the capital, large-scale development of zero-energy district, and the "Data Public.lu" open data portal.
Mexico	Mexico's Urban Operating Systems Roadmap (2014, Pro Mexico & Secretariat of Economy)	The Roadmap provides National and International key enablers for smart cities, as well as the urban operating systems strategies currently implemented by the Government, the leading players actively involved and the possible scenarios for the development of smart cities public policies and their enforcement.
Netherlands	National Smart City Strategy (Prime Minister)	At the request of the Prime Minister, the Strategy was jointly created by over 40 representatives from municipal authorities, 60 employees from 40 different companies of all sizes, and 30 scientists.
New Zealand	Smart Cities Programme (LINZ – Land Information New Zealand)	LINZ is a public service agency in charge of geographical information and managing government property. LINZ worked with Auckland, Wellington and Christchurch in the Smart Cities Programme and provided financial support for a variety of smart city initiatives with Better Public Services funds.
Norway	Cities of the Future [Framtidens byer] (2008-2014)	Cities of the Future is a partnership between the state government, the industry and the 13 largest cities in order to reduce greenhouse gas emissions, manage climate change and make cities better places to live in. Cities of the program will cooperate in five major areas: land use and transportation, consumption and waste, energy in buildings, climate adaptation and improving the quality of urban environment.
Poland	National Smart Specialisation	Polish Strategy includes several areas relevant to technologies for smart cities including Smart grids and geo-information technologies, smart sensor networks, modern waste management and sustainable energy system.
Portugal	Sustainable Cities 2020 Strategy [CS2020] (2015, Directorate-General for Territorial Development)	The Strategy identifies 10 key challenges for smarter urban development and provides vision, principles, and 52 strategic guidelines. The guidelines are categorised into four axes – Smartness & Competitiveness; Sustainability & Efficiency; Inclusion & Human Capital; Place-based & Governance.
Slovak Republic	The pilot scheme of aid aimed to support experimental development and innovations in the build-up of smart cities (2017, Deputy Prime Minister's Office for Investments and Informatisation)	The scheme includes EUR 1 million from the state budget. Subsidies were designed to focus on 1/ Digitalisation of city management, services to inhabitants and public security and 2/ Transport management.
Slovenia	Strategic Research and Innovation Partnership [SRIP] – Smart cities and communities set up by the Jožef Stefan Institute, Ministry of Economic Development and Technology, Government Office for Development and European Cohesion Policy.	SRIP is part of Smart Specialisation Strategy. The vision of partnership is to establish a globally recognised ecosystem of partners, permanently synergistically enhancing and linking their competence, as well as offering adequate capacities for R&D, production and marketing of globally competitive innovative high-tech solutions in all aspects of Smart cities and communities. The partnership is focusing on six industrial vertical (Health, Energy and utilities, Mobility, transport and logistics, Security, Smart city ecosystem and Urban life quality) and on six different technology areas (Cybersecurity, Digital transformation, GIS-T, HPC and big data, Internet Service and IoT).
Spain	National Smart Cities Plan (2015, Ministry of Energy, Tourism and Digital Agenda)	The Plan has a purpose to promote technological industries, within the Smart Cities in Spanish local territory, and to help local authorities in the process of developing Smart City.

	Smart city programme or initiative	Details
Sweden	Smart City Sweden, the national export and investment platform for smart and sustainable city solutions.	The Smart City Sweden is funded partly by the Swedish Government through the Ministry of Enterprise and Innovation and the Swedish Energy Agency, and partly by the industry and businesses. It is managed by IVL Swedish Environmental Research Institute, in close collaboration with actors at the regional and local levels.
Switzerland	Smart City Switzerland (The Swiss Federal Office of Energy & SwissEnergy for Municipalities)	The programme aims to identify the opportunities of using new ICT technologies in the planning and realisation of urban project. The programme sets up a national network and promotes smart initiatives by providing support and services for stakeholders.
Turkey	1/ Information Society Strategy and Action Plan for 2015-2018 (2015, Ministry of Development) 2/2019-2022 National Smart Cities Strategy and Action Plan (Ministry of Environment and Urbanisation) 3/ Geographical Information Strategy and Action Plan (Ministry of Environment and Urbanisation)	The Information Society Strategy and Action Plan underlines the primary need for determining strategies and targets in order to implement and expand the smart city solutions. Based on this, "National Smart Cities Strategy and Action Plan" and "Geographical Information Strategy and Action Plan" were drafted, and these documents are at the approval phase.
United Kingdom	1/ Innovation investments from the Innovate UK (innovation agency) 2/ Future Cities Demonstrator Competition (2012, Innovate UK)	As of 2017, GBP 32 million has been spent on the UK's IoT programme from the Innovate UK. Through the Future Cities Demonstrator Programme, Glasgow was awarded GBP 24m to implement its proposal, and Bristol, London and Peterborough were each awarded GBP 3m to implement part of their proposed plan.
United States	1/ Smart Cities Initiative (2015, White House) 2/ Smart City Challenge (2015, Department of Transport) 3/ Smart Cities and Communities Task Force, a body under the Networking and Information Technology Research and Development (NITRD) Program	Smart Cities Initiative promised USD 165 million investment in smart-city solutions, and announced to expand the initiative with additional USD 80 million investments in September, 2016. Seven finalists (cities) worked with DOT to realise their ideas to develop smart transportation system. Coordination with the Department of Transport Smart City Challenge, Green Bonds and loan guarantees by the Department of Housing and Urban Development