Smart Cities and Inclusive Growth

Building on the outcomes of the 1st OECD Roundtable on Smart Cities and Inclusive Growth

OECD

With the support of:

Ministry of Land, Infrastructure and Transport, Korea

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This paper was authorised for publication by Lamia Kamal-Chaoui, Director, Centre for Entrepreneurship, SMEs, Regions and Cities, OECD.

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Foreword

This paper has been prepared in the framework of the OECD Programme on Smart Cities and Inclusive Growth. It offers a synthesis of the lively discussions held during the 1st OECD Roundtable on Smart Cities and Inclusive Growth (9 July 2019, OECD Headquarters, Paris, France), enriched with analytical research. Next steps in the Programme will further advance knowledge on the drivers and pitfalls of smart cities, help better measure smart city performance, and provide targeted support to interested cities and countries to improve the effectiveness of their smart city initiatives.

While the COVID-19 pandemic had not hit yet at the time of the 1st OECD Roundtable, leveraging the benefits of smart cities will be particularly critical to help cities and countries manage and rebound from this unprecedented global crisis. At a time of physical distancing and lockdown, digital technologies are playing a major role in relaying real-time life-saving information, ensure the continuity of key public services (for example through remote education) and bridge social isolation. If well connected with inclusive growth objectives, smart city tools and applications can offer a powerful tool to support the shift from in-person to remote service delivery, mitigate the fallout of the crisis on urban residents and businesses, including the most vulnerable ones, and empower new forms of local governance. The OECD Programme on Smart Cities and Inclusive Growth will continue to assist local and national policy makers with data, best practices and policy recommendations to shape a healthier and brighter future for all.

Acknowledgements

This paper was prepared by the OECD Centre for Entrepreneurship, SMEs, Regions and Cities (CFE) led by Lamia Kamal-Chaoui, Director, as part of the Programme of Work and Budget of the Regional Development Policy Committee (RDPC). It contains the proceedings from the **1st OECD Roundtable on Smart Cities and Inclusive Growth**, which was held on 9 July 2019 at the OECD Headquarters in Paris, France.

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The OECD Secretariat is grateful to the Ministry of Land, Infrastructure and Transport of Korea (MOLIT) for supporting the organisation of the Roundtable and the preparation of this report. Special thanks are conveyed to Seong-yo Mun (Director General), Hyuck Jin Kwon (Director General), Seongkyun Cho (Director), Jiyoung Shim (Director), Jaewon Jung (Senior Deputy Director), Seung-Hee Yi (Deputy Director), Eun Jung So (Deputy Director), Byung-Chul Hwang (Assistant Director), Hyun-young Lee (Assistant Director), Hyeong Bin Park (Assistant Director), Cheol Soon Baik (Assistant Director) and Seong-yoon Moon (Interpreter) from MOLIT for their continuous and valuable support throughout the project. The OECD Secretariat would also like to thank H.E. Hyoung-Kwon Ko (Ambassador) and Ikjin Lee (Counsellor) from the Permanent Delegation of Korea to the OECD for their co-operation throughout the preparation of the Roundtable and the paper.

The project benefitted from the insights of all speakers, moderators and stakeholders who joined the 1st OECD Roundtable on Smart Cities and Inclusive Growth (see list of participants in Annex A).

Thanks are due to Pilar Philip who prepared this paper for publication.

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Key points

Five key takeaways from the 1st OECD Roundtable on Smart Cities and Inclusive Growth

- While the digital revolution is offering an unprecedented window of opportunity to improve the lives of millions of urban residents, there is no guarantee that the rapid diffusion of new technologies will automatically benefit citizens across the board. Smart city policies need to be designed, implemented and monitored as a tool to improve well-being for all people.
- Building smart cities is not only the business of cities or the private sector. National governments can and should play an enabling role to support innovative solution delivery, capacity building and upscaling.
- Measuring smart city performance is a complex task but is critically required. Advancing the measurement agenda calls for a comprehensive, multi-sectoral and flexible framework that is aligned with local and national strategic priorities and embraces efficiency, effectiveness and sustainability dimensions.
- Smart cities need smart governance. Business and contractual models need to adapt to rapidly changing urban environments and encompass a more holistic approach, sometimes re-regulate rather than simply de-regulate, and leverage public procurement, including at the pre-procurement stage.
- Citizens are not only recipients but also actors of smart city policies. Putting people at the centre of smart cities means co-constructing policies with citizens throughout the policy cycle.

1 Setting the scene on smart cities and inclusive growth

What does a "smart city" mean?

The "smart city" concept initially referred to initiatives that use digital and ICT-based innovation to improve the efficiency of urban services and generate new economic opportunities in cities. With the proliferation of smart city initiatives around the world (Box 1.1), greater attention needs to be paid to whether the benefits and costs of smart cities are spread across all segments of society, i.e. assessing the distributional effects of smart cities on people, planet and places. Based on the discussions that took place during the first session of the 1st OECD Roundtable on Smart Cities and Inclusive Growth, this section will: (i) review existing definitions of smart cities and propose a possible typology of smart cities; (ii) present a SWOT analysis of smart city initiatives in OECD countries; and (iii) discuss the role that national and sub-national governments play in smart cities and inclusive growth.

Definitions of smart cities

The smart city concept is still in flux and subject to debate. Definitions of smart cities vary across OECD countries and institutions according to the geopolitical context and to the specific issues at hand (Box 1.1). However, in most cases, smart cities revolve around initiatives that use digital innovation to make urban service delivery more efficient and thereby increase the overall competitiveness of a community.

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. A human-centric approach is considered key to make a city smarter. 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 four main issues:

- 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 stakeholder engagement in local governance and collaborative partnerships to boost civic engagement and leverage the role of the private sector in decision-making at the local level (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 an integrated and holistic approach to address urban challenges through digital innovation in a city's governance, planning, and infrastructure investment.

The first session of the Roundtable shed further light on specific examples of smart city initiatives propelled by the national governments of Korea, Japan, Canada and Italy, all of which put residents' well-being at the centre:

- **Korea** has championed smart cities by leading large-scale projects in this sector. The Korean smart city initiative includes four main pillars: i) research and development; ii) the Smart Solution Challenge (private companies can receive up to 20 million USD for three years to develop smart city projects); iii) deregulation; and iv) a national pilot programme for smart cities. The Korean smart city initiative has been very successful notably thanks to the high level of uptake of smartphones (95% of Koreans use a mobile phone), compact urban development and the development of the IT industrial ecosystem. In addition, the rise of local governments' initiatives, the creation of dedicated smart city teams within local administrations, citizen engagement and rapid corporate growth have been instrumental to the success of the smart city initiative. The national government is now rethinking how to "live smart" in a digital era. Korea faces three main concerns: privacy; the smart divide; and cost. Korea is addressing the smart divide through public CCTV networks and integrated social services. For example, SK Telecom and the Korea Land and Housing Corporation (LH) work together to equip the elderly with a speaker that recognises their voice and provides them with information, entertainment and company.
- **Japan** defines smart cities as "a sustainable city or region incorporating ICT and other new technologies to solve various challenges it faces and manages itself (planning, development, management and operation) for its overall optimisation". Moreover, smart cities need to be cross-sectoral and encompass sectors such as energy, transport, health and medical care. Shifting from a government-led approach to public-private collaboration is an important priority. Smart city projects can only be successful if they engage a variety of stakeholders, such as technology developers and service providers (who *make* technology); city developers (who *add* technology); city administrators (who *use* technology); residents and local companies (who *purchase* technology). In 2019, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in Japan supported 15 'Leading Model Projects' and 23 'Prioritised Projects for Implementation', which are based on consortia with the private sector and local governments to solve urban and regional challenges through new technologies and data. MLIT and other ministries designated 71 consortia as "Partners for Smart Cities Promotion," which have sufficient capability and earnestness, and will support them through a public-private council. The idea underlying these projects is to encourage cities to take their own initiatives and to respond to the challenges of the places that have been left behind.
- The Smart Cities Challenge programme in **Canada** is a competition open to local and regional governments and indigenous communities, which aims to empower communities to adopt a smart city approach to improve the lives of their residents through innovation, data and connected technology. This competition was designed to engage all communities, including rural and remote communities that have little to no access to the internet. The Challenge offers four prizes up to CAD 50 million, which are open to all communities regardless of their population size. To ensure that all communities would be able to participate, the government put in place a series of incentives to help small cities build up capacity and develop their proposals. In total, the government received 130 applications covering a wide range of solutions in areas such as food security, reducing isolation of the senior population, integration of migrants, and accessibility for people with disabilities. One of the main aspects of the competition is that all ideas have to be shared and be applicable to other communities. An independent jury selected the four winners: i) the town of Bridgewater and its proposal addressing energy poverty, ii) Nunavut Communities and its project on suicide prevention, iii) the City of Guelph and its project on circular food economy to reduce waste and increase local food production, and iv) the City of Montreal and its plan to improve mobility for all residents

and manage food insecurity. The federal government is continuing to learn from municipalities and communities to foster positive technological change.

- In **Italy**, Metropolitan Cities 2014–2020 is a programme funded by the European Union that promotes the renewal of urban services and fosters urban inclusion by empowering disadvantaged groups. Fourteen metropolitan cities and areas (Milan, Turin, Venice, Bari, Naples, Palermo and Rome among others) currently participate in this programme. The programme follows a new approach where cities and citizens are considered key drivers of innovation, and technology and digital services are leveraged to improve quality of life. Today, 119 projects are being implemented on topics such as smart urban mobility, building permits and waste management systems. The aim is to improve programming and provision of social services through digital platforms and service delivery platforms, and to create an ecosystem of cross-cutting projects that focus on users, supply-demand driven innovation and data availability.

Beyond the national experiences shared during the Roundtable, there is a range of definitions for "smart cities" across OECD countries and institutions (Box 1.1).

Box 1.1. Selected definitions of "smart cities"

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."

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: The 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: According to the European Commission, “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[1]).

United Nations: A smart city approach, as defined by the United Nations, “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[2])

Inter-American Development Bank: A smart and sustainable city is defined by the Inter-American Development Bank 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[3]).

The private sector

Smart Cities Council: This 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, 2012[4]).

IBM: A smart city is defined by IBM 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: According to Cisco, smart cities are those that adopt “scalable solutions that take advantage of ICT to increase efficiencies, reduce costs, and enhance quality of life”.

Source: OECD (2019[5]), Enhancing the Contribution of Digitalisation to the Smart Cities of the Future.

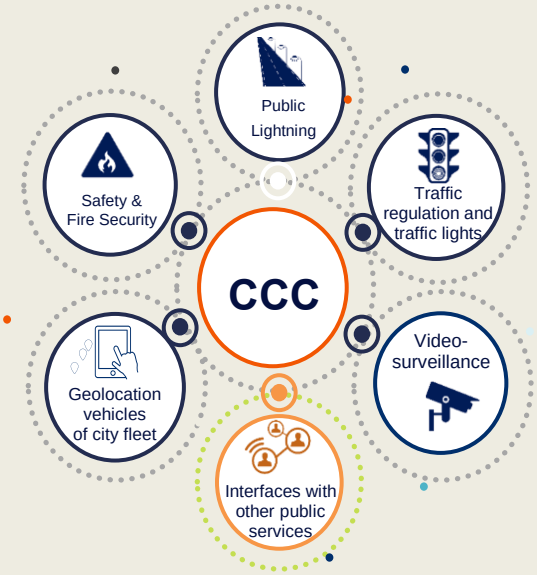
Smart solutions put forward by cities increasingly require strong collaboration with the private sector and citizens (Box).

Box 1.2. Spotlight on smart cities: Curitiba (Brazil) and Dijon (France)

The **city of Curitiba** was selected as the most connected and intelligent city in Brazil. Curitiba is the capital of the state of Parana, with a strategic location in Mercosur, close to São Paulo and the Port of Paranagua (the second largest in Brazil). In 1974, Curitiba developed the first Bus Rapid Transport (BRT) system, a system of bus corridors that revolutionised the way citizens moved across the city. The city also provided its residents with free access to internet in public spaces. Curitiba is developing projects such as Fab Labs, urban farms, apps to help citizens navigate the city and innovation hubs including the Vale do Pinhao (Pinhao Valley) or Bom negócio (Good Business). Curitiba is promoting a 'smart city movement' to build an innovation ecosystem to promote smart solutions that are aligned with the implementation of the SDGs.

An example of this effort is the restoration of an entire community in a location named Caximba, which may become the largest socio-environmental project in the city to recover an area with 30,000 people living under difficult circumstances. Another project involves the launch of the first public co-working space in Brazil, freely accessible to all citizens and with 430 solar panels installed at the City Hall. The city uses 70 indicators divided into 11 axes (mobility, environment, energy, technology, innovation, economy, education, health, safety and governance) to ensure that technology benefits all citizens and that the impact of its policies can be measured.

The city of Dijon (France) is often presented as the first smart city in France because of its street lighting management, smart traffic management and quality of Wi-Fi services. A consortium is providing what is known as the first centralised and connected solution for city management of its kind in Europe. This example also shows how digitalised services are not automatically synonymous with smart and suggests that public services need to be re-engineered. The project aims to reduce costs significantly (e.g. by 65% on the energy bill related to street lighting), upgrade and better manage urban equipment (e.g. street lighting upgrade, planning repair and renewal), better co-ordinate services (road network maintenance and waste collection) and improve public safety (via centralised solutions for crisis management). It also represents an opportunity to innovate by offering new digital public services to citizens (In/Out signalling) and promoting the incubation of digital economy (open data lake).



Some of the technologies that have been developed in Dijon involve the implementation of Power Line Communication on the street lighting network and the installation of a CITYBOX® router and other services on each lamp post. Such technologies provide citizens with a smarter system of street lighting, Wi-Fi, CCTV, audio animation and smart traffic management.

Source: Presentations of Curitiba (Brazil) and Suez Group during the 1st OECD Roundtable on Smart Cities and Inclusive Growth

Private companies, academia and civil society also have a major role to play to bridge technological innovation and inclusiveness. For example, it is essential to balance the goal of a company (which is to provide customers with the best products and services) and the goal of smart cities (which is to improve living standards of all citizens through the digitalisation of public services). Also, at a time where disparities across and within cities continue to rise, creating smart cities without considering their distributional effects could exacerbate inequalities. The world stands at a crossroad where technology can generate either opportunities or risks – it is high time to engage all actors and some experimentation needs to be promoted in action-oriented research.

Typology of smart cities

A key factor in defining and understanding smart cities is related to the different types of cities. Each city has specific characteristics in terms of size, built environment, fiscal resources and many other features. Such differences affect the capacity of cities to manage smart technologies and attract smart city investment. Different physical characteristics may also affect the degree of applicability of specific digital technologies. Many studies on smart cities tend to focus on large cities, which makes it difficult to transfer their experience to smaller cities. Another issue relates to the digital divide within the same city. For instance, in Detroit (US), 29.71% of the population does not have access to any kind of broadband (National Digital Inclusion Alliance, 2019[6]). In this context, there is no digital panacea that fits all cities; smart city initiatives need to match local circumstances to generate benefits. Typologies of smart cities can therefore help understand where each city stands, foster peer-to-peer dialogue for finding common solutions to common problems, and function as a compass to indicate which direction a city should move forward.

Among the various approaches that have been used to classify smart cities into groups, the OECD has identified five main approaches based respectively on: i) the level of economic growth and status of a city; ii) urban growth lifecycle; iii) smart urban innovations dimensions; iv) goals; and v) spatial cluster analysis. Each typology has its own merits, which are reviewed in more detail below.

By level of economic growth

Macomber (2016[7]) suggested four types of smart cities across two dimensions, legacy vs. new cities, and developed vs. emerging economies (Table 1.1):

- *"Developed economy + legacy city".* In this type, smart city technologies will need to deploy across (and sometimes dismantle) existing physical infrastructure, such as roads and buildings, or embedded service businesses. Low population growth is a common phenomenon in developed countries, and in many cases, it may create a zero-sum situation.
- *"Emerging economy + legacy city".* Like the first type, most physical structures are already established in these cities, but the main difference is fast-growing population and often severe congestion, which enhances opportunities to add value by improving efficiency and liveability. Private finance may be invested in improving existing infrastructure and better using it.
- *"Emerging economy + new city".* This type usually experiences high economic growth in addition to high population growth, which can generate high returns on investment. These cities do not have many obstacles to be dismantled such as existing physical or social structures. Investors have opportunities to capture revenues from growing population as new users. There is an important chance to provide infrastructure that will determine both economic competitiveness and quality of life in the future.
- *"Developed economy + new city".* Most of cities in this category are satellite cities around existing mega-cities. They compete with neighbouring cities for job opportunities and economic

growth. Such cities need to focus both on hard infrastructure (to reduce costs for companies) and on soft infrastructure (to provide high quality of life to residents).

Table 1.1. Characteristics and examples of smart cities by level of economic growth

Type	Characteristics	Examples
1	Developed +Legacy	London (UK), Detroit (US), Tokyo (Japan), Singapore
2	Emerging +Legacy	Mumbai (India), São Paolo (Brazil), Jakarta (Indonesia)
3	Emerging + New City	Suzhou (China), Astana (Kazakhstan)
4	Developed + New City	Songdo (Korea), Masdar (UAE), Hafen (Germany)

Source: Macomber, J. (2016[7]), "The 4 Types of Cities and How to Prepare Them for the Future", Harvard Business Review, January, retrieved from https://hbr.org/2016/01/the-4-types-of-cities-and-how-to-prepare-them-for-the-future

By stage of urban growth

The Ministry of Land, Infrastructure and Transport of Korea **(MOLIT)** (2019) classifies smart cities by stage of urban growth; i) new cities, ii) existing cities, and iii) shrinking cities. First, smart cities in *new cities* are mainly large-scale smart city projects that are developed from scratch. This type of smart cities aims to solve urban problems and to provide smart city testbeds for cutting-edge smart city solutions, as well as to establish an innovative industry ecosystem for smart cities. Second, smart cities in *existing cities* need a different approach, since existing physical and social infrastructure may hinder from deploying smart city facilities and solutions. In order to develop smart cities on an existing layout, it is important to select target areas and to set up a customised development plan to make the areas lively and competitive. Third, *shrinking cities* tend to have many urban problems but generally cannot afford expensive cutting-edge technology. It is therefore important for shrinking cities to identify their areas of vulnerability and tools to prevent them (for example through alarm sensors to prevent fire).

By type of smart urban innovation

Nilssen (2019[8]) proposes four types of smart cities by dimension of smart urban innovation (Table). The four dimensions are: i) technological innovation, with new practices and services; ii) organisational innovation, which happens internally in public organisations; iii) collaborative innovation, which combines efforts and resources based on the triple helix model (creating synergies among governments, universities and companies); and iv) experimental innovation, through a citizen-centric approach.

- First, *technological smart cities* focus on the critical role of new technologies in developing new practices and services (e.g. applications that encourage the use of public transport).
- Second, unlike technological smart cities, *organisational smart cities* do not necessarily provide an immediately tangible result for end-users. Rather, they focus on positive changes in daily-based operations in municipal governments to increase efficiency and productivity. One caveat is that organisational smart cities tend to have a project-based approach and the scope of their smart city initiatives is rather incremental, as projects often have a limited timeframe.
- Third, *collaborative smart cities* focus on co-operation among diverse actors in urban areas, mainly governments, universities and private companies. An open and interactive governance process is a prerequisite as the entrepreneurial role of diverse actors and interactions among them are critical conditions for success. Smart cities based on this approach tend to have a

more radical scope than the two types previously mentioned, since this type encourages actors to play a more entrepreneurial role.

- Fourth, *experimental smart cities* provide living labs as an essential tool to facilitate urban innovation. This type puts more weight on story-telling aspects of innovation through an experimental and citizen-centric approach. Their goal is to achieve holistic sustainability through the combination of the former three types of smart city initiatives.

Table 1.2. Types of smart cities by dimension of urban innovation

	Characteristics	Incremental vs Radical innovation
Technological	New technological practice and services	Incremental
Organisational	Internally in the government; project-based	Incremental
Collaborative	Public-private networks and partnerships	Radical
Experimental	Innovative urbanism; citizen centric	Radical

Source: Nilssen, M. (2019[8]), "To the smart city and beyond? Developing a typology of smart urban innovation", Technological Forecasting & Social Change 142, p.98–104.

By goal

The Korean Research Institute for Human Settlements **(KRIHS)** emphasises that new types of smart cities have emerged as a way to pursue various goals, ranging from responding to climate change to establishing innovative industrial ecosystems (KRIHS, 2018[9]). After analysing 60 smart cities in Korea, KRIHS classified them in three types: i) a smart city equipped with advanced infrastructure; ii) a platform-centred smart city; and iii) a smart city for innovation space (Table 1.3). First, smart cities equipped with *advanced infrastructure* focus on efficient city management. They invest in combining ICT with infrastructure, for example in terms of transport, safety, and built environment. Second, *platform-centred smart cities* focus on connecting and integrating information systems that used to operate independently from each other. Smart city control centres and smart city platforms are therefore built to reap synergies among existing data and services. Finally, smart cities for *innovation space* focus on cutting-edge technologies and commercialise them to foster related industries. Public-private partnerships are particularly essential since these cities do not only focus on solving urban problems but also on spearheading new industries. Governments provide financial support to develop new solutions and reform regulatory frameworks for the private sector to test new technologies and ideas.

Table 1.3. Number of types of smart cities in Korea as classified by KRIHS

Type	No. of Cities
Smart city equipped with advanced infrastructure	26
Platform-centred smart city	31
Smart city for innovation space	3
Total	60

Source: KRIHS (2018[9]) A Study on Strategic Response to Smart City Types, Korean Research Institute for Human Settlements, Sejong.

In line with KRIHS (2018[9]), **Lee and Chang** (2019[10]) also proposes two different types of smart cities, depending on the goal the cities are striving for, as well as their key elements and methods: i) problem-solving smart cities; and ii) opportunity creating smart city. *Problem-solving smart cities* aim to implement cost-efficient solutions for urban problems. Main methods include implementing individual solutions for urban issues, operating "living labs" and sharing solutions through city networks. This type of smart cities may often be found in city centres and shrinking cities. *Opportunity creating smart cities* aim to create innovative ecosystems for industries. In this regard, a key element is to create and support innovative industries. Main methods include, for example, deregulation and establishing digital infrastructure based on open data platforms for industries. In Korea, *Opportunity creating smart cities* can be found both in greenfields and brownfields. In particular, smart cities can help create opportunities from existing resources in physical space. Sharing economy can offer more efficient opportunities in brownfields. However, it is more efficient to create new economic opportunities such as autonomous vehicles in greenfields because new infrastructure is necessary to allow for the adoption of new technology.

By spatial cluster

Giffinger et al. (2014[11]) develops a smart city typology for European small and medium sized cities to help benchmark cities that have similar characteristics. Based on 81 city components and 28 domains, the typology constructs six key fields for smart cities: smart economy, smart environment, smart governance, smart living, smart mobility, and smart people. A cluster analysis has been conducted to identify relatively homogeneous cities according to these six key fields. The analysis has identified six spatial clusters (i.e., groups of cities with similar key field features) (Table 1.4).

Table 1.4. Clusters values according to the 6 smart city key fields

Cluster	Smart Economy	Smart Environment	Smart Governance	Smart Living	Smart Mobility	Smart People
1	-0.73	-0.84	-0.44	-0.57	-0.92	-1.08
2	-0.44	-0.17	-0.71	-0.67	-0.51	-0.55
3	-0.39	-0.10	-0.29	-0.13	-0.28	-0.45
4	0.68	0.22	0.01	0.88	0.60	0.45
5	0.27	0.02	0.10	0.19	0.26	0.24
6	0.13	0.46	0.65	0.21	0.15	0.62

Note: 0 = mean of all cities. Negative values refer to a cluster performance below average in the respective key field; positive values indicate that this cluster performs higher than the European average city.
Source: Giffinger, R., Haindlmaier, G., and Strohmayer, F. (2014[11]). Typology of cities, Planning for Energy Efficient Cities, retrieved from http://pleecproject.eu/downloads/Reports/Work%20Package%202/pleec_d2_2_final.pdf

By comparing itself to the values of the cluster (i.e., average value of cities with similar characteristics), each city can assess its position and areas for improvement.

- Cluster 1 (Craiova, Sibiu, and Timisoara). In general, the values of this cluster are low across the six key fields, particularly in terms of smart people. However, smart governance shows higher values than the other fields.
- Cluster 2 (Liepaja, Kaunas, Kosice, Pleven, Ruse, Larisa, and Patrai). This cluster registers particularly low values in smart governance, smart living, and smart people, whereas it performs well on smart environment.
- Cluster 3 (many cities including Ancona, Banska Bystrica, Bialystok, Bydgoszcz, Coimbra, Gyor, Kielce, Miskolc, Nitra, Oviedo, Padova, Pecs, Perugia, Rzeszow, Suwalki, Szczecin, Tartu, Trento, Trieste, Usti nad labem, Valladolid, and Venezia). Although all key fields register negative values, smart mobility and smart governance almost reach the European average.

  - Cluster 4 (Graz, Linz, Luxembourg, Salzburg). Smart living, smart economy and smart mobility have a much higher value then European average. In contrast, smart governance and smart environment are disproportionately less efficient.
  - Cluster 5 (many cities including Aalborg, Aarhus, Aberdeen, Brugge, Cardiff, Cork, Eindhoven, Enschede, Erfurt, Gent, Innsbruck, Kiel, Leicester, Ljubljana, Madgeburg, Maribor, Pamplona, Plzen, Portsmouth, Regensburg, Rostock, Santiago de Compostela, Stoke-on-Trent, Trier, and Verona). This cluster is close to European average values across the six key fields.
- Cluster 6 (Clermont-Ferrand, Dijon, Ekilstuna, Goettingen, Groningen, Joenkoeping, Jyväskylä, Montpellier, Nancy, Nijmegen, Odense, Oulu, Pointiers, Tampere, Turku, Umea). Both smart governance and smart people have outstanding values. Smart environment is also above the European average. Other fields show potential for further improvement.

SWOT analysis of smart cities initiatives in OECD countries

While smart cities have the potential to change cities for the better, they also come with potential hidden costs. Defining scalable, efficient and realistically achievable smart city policies requires a clear understanding of the strengths, weaknesses, opportunities and threats facing smart cities in OECD countries (Figure 1.1). A given aspect of smart cities can play multiple roles in this analysis, depending on which perspective it is seen from. One example is data, which can constitute both a weakness, an opportunity and a threat. Data is often cited as one of the most valuable assets in the world today. Data offers a fundamental opportunity for smart cities to exploit in the future; but it can also constitute a weakness in cities that are less capable to use data, and a threat when considering privacy concerns that stem from the wealth of data generated through smart cities. The following section recalls the main strengths, weaknesses, opportunities and threats of smart cities as discussed in (OECD, 2019[5])

Figure 1.1. SWOT analysis of smart city initiatives in OECD countries

Source: Author's elaboration

Strengths

OECD countries are well positioned to put in place smart city policies due to their high rate of digital uptake and a number of successful examples already in place. In 2016, 83% of all adults and 95% of all businesses in OECD Member countries had access to high-speed broadband (OECD, 2019[5]). New technologies are transforming how policy makers engage with the labour market, with society and with public services. Around 50% of the OECD population have already accessed public services or health information online. Digitalisation is enabling a quarter of all workers in the OECD to work remotely, and e-health technologies spreading throughout the OECD have the potential to transform patients' experiences and health outcomes. 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[12]). Across the European Union, the digitalisation of services has somewhat or even substantially reduced operating costs for 85% of cities (ESPON, 2017[13]). Cities across the OECD have taken advantage of these assets to develop a wide range of smart city initiatives, which have been largely documented (OECD, 2019[5]) . 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. Even though this conception of smart cities now needs broadening, the two decades worth of research and experimentation on smart cities by the private sector provide a wealth of experience and data which can be drawn on. To name a few efficiency outcomes related to smart cities: 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; 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 ((OECD, 2019[5]). In addition, 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. (OECD, 2019[5])

Weaknesses

Although smart cities 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” that can guide policy decisions. Overall, cities produce an enormous amount of data and relatively few cities feel that their innovation capacity is limited by a lack of data. Rather, potential obstacles to innovation may include the weak capacity of some cities to *use* data in municipal policy-making; incompatibility of data across different policy areas; the lack of staff dedicated to data collection and processing; and insufficient data sharing across agencies and institutions. Heavily data-driven initiatives also sometimes run the risk of a bias, for example when smartphone applications inviting citizens to report problems on city streets reflect the concentrations of younger, wealthier residents with smartphones rather than depicting the street network’s actual problems. While many cities have started to “open” their data to citizens, innovators and entrepreneurs, transaction costs or contractual and legal issues may arise due to a lack of regulatory frameworks favouring innovation and experimentation. Policies to ensure that automation is beneficial for cities and regions will need to take into account place-specific sectoral compositions and skill levels in the workforce, and train (or re-train) workers for the jobs of the future. The risk of territorial divides related with smart cities is critical for policy makers. While pioneering cities will be well-equipped to leverage digital innovation, other cities might be marginalised due to the lack of adequate policy measures. According to the city in which people live, they may benefit from smart city projects or not.

Opportunities

Smart cities offer many opportunities for more efficient service delivery, digital inclusion, inclusive service delivery, and new forms of participation in the decision-making process. Data-driven innovation can promote the integration of urban systems into a more efficient, sustainable and resilient “system of systems”, for example by linking up real-time data on transport flows, energy, and water and waste systems. Smart meters and dynamic pricing on electricity have the potential to drastically change the energy consumption patterns of firms and households. Electrically powered cars, bicycles and scooters could considerably reduce air and noise pollution. Digital innovation can also enhance the circular economy, a concept that aims to improve economic and resource efficiency, through 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. Digital technologies can promote a more agile and flexible model of city governance through e-government services and civic technology to

facilitate access to information and voicing opinions through online platforms, citizen monitoring and public innovation labs. 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. 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. (OECD, 2019[5]) There is also an opportunity to promote integrated contracts. Smart cities of all sizes 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. (OECD, 2019[5])

Threats

In an era of open data, big data analytics and the Internet of Things, there are important risks associated with citizen privacy, when personal information (including health and medical data) could be unduly shared with undesirable persons or manipulated for unwanted purposes. An important question to address, both in terms of political considerations and regulatory frameworks, pertains therefore to the type of data that cities should collect and publish, and for how long it should be stored. On the labour market, the growing polarisation between those at ease with technology and those at the lower end of the skills distribution with higher risk of automation can further exacerbate inequality. Smart cities may also unintentionally deepen existing divides between already digitally marginalised groups and better connected groups. To curb further citizen discontent and a backlash against public institutions, upskilling and training in digital literacy will be a critical investment for the future of local governance. Furthermore, new business models aided by emerging technologies may threaten affordability objectives, consumer protection, taxation, labour contracts and fair competition – for example by circumventing tax laws, employing independent contractors or promote the vested interests of large companies at the expense of smaller firms. Legal and regulatory frameworks, such as those related to public procurement, will need to adapt quickly in order to provide the necessary safeguard mechanisms. .

2 Evolution of smart city policies over time: spotlight on the case of Korea

Smart city policies are not static; they can change according to the priorities of the city or the country. In this respect, Korea offers an interesting example of how smart city policies have changed over time. Since the early 2000s, the Korean government has viewed smart cities as an engine of future growth. Three periods can be distinguished in Korean smart city policies: (i) the construction stage (2003-2013); (ii) the connecting stage (2014-2016), focusing on connecting smart city services and building governance structure; and (iii) the enhancement stage (2017-2020), during which the government is putting emphasis on innovative smart cities and creating a smart city ecology (Table 2.1).

Table 2.1. Characteristics of smart cities in Korea, by stage

	Construction stage (2003-2013)	Connecting stage (2014-2016)	Enhancement stage (2017-)
Goal	To create new growth engine by combining ICT with construction industry	To provide high quality service by integrating existing infrastructure and service	To solve urban problems and create innovative jobs
Information	Vertical information integration	Horizontal information integration	Cloud based information integration
Platform	Closed platform	Public platform (open to relevant organisations)	Open platform (open to private sectors)
Legal framework	Law of Ubiquitous City Construction	Law of Ubiquitous City Construction	Law for Smart City Creation and Promotion of Industries
Main agents	Ministry of Land, Infrastructure, and Transport	Ministry of Land, Infrastructure, and Transport; Ministry of Science and ICT; Ministry of Trade, Industry and Energy	Smart city governance
Target	New towns	New towns, existing cities	New towns, existing cities, declining cities
Projects	Integrated Operation Control Centre (IOCC), physical infrastructure	Smart city platform, service integration	National smart city pilot projects, Smart city platform, smart city R&D, smart city challenge(for existing cities), smart urban regeneration (for declining cities)
Resource	Profits from Residential district development projects	Government budget	Government budget, resource from private sectors

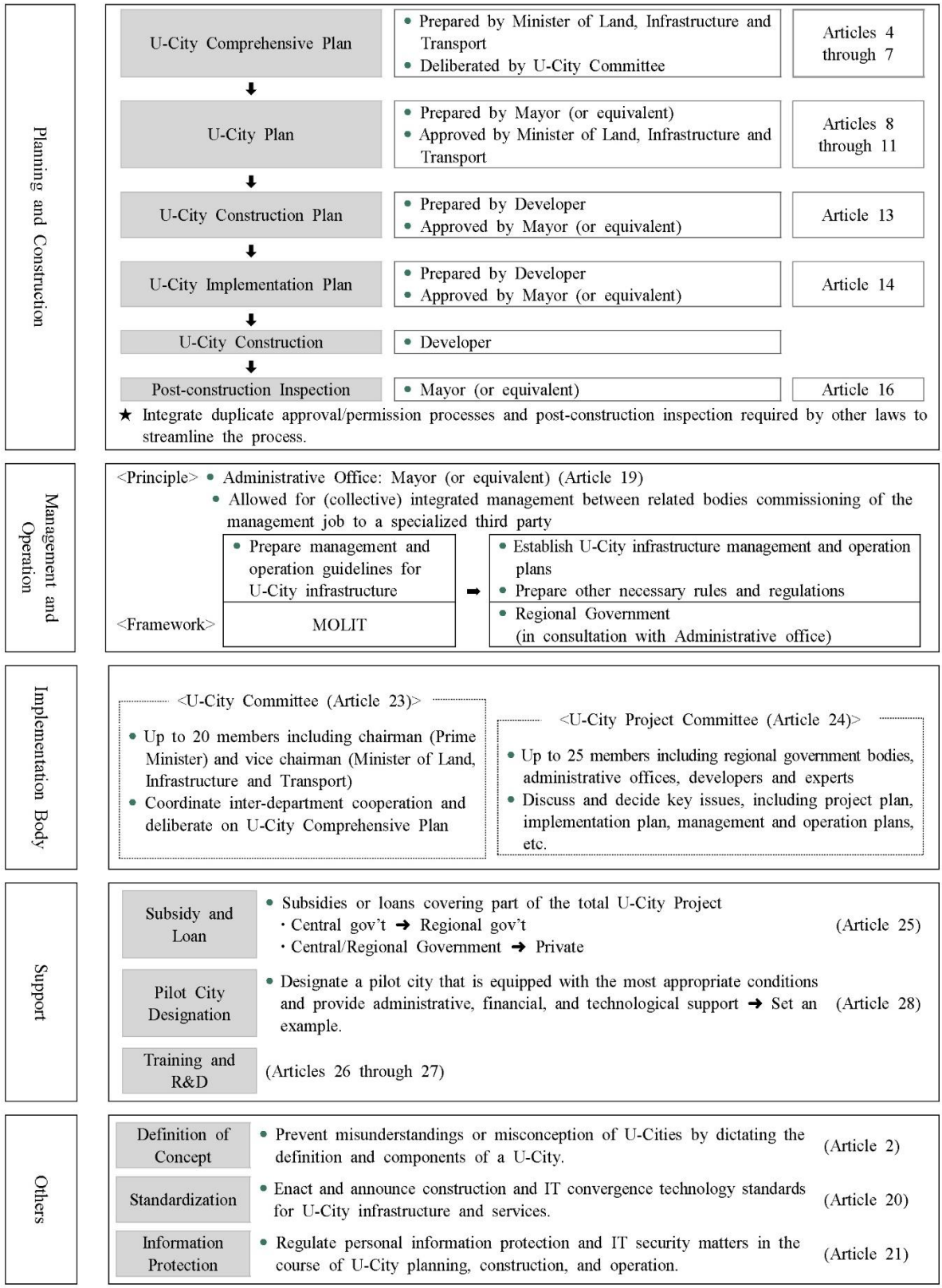
Source: KRIHS (2018[9]), A Study on Strategic Response to Smart City, KRIHS, Sejong.

Construction stage (2003-2013)

Ubiquitous cities were the ancestors of smart cities in Korea. In 2003, some commercial urban services (such as the bus information system and CCTV for crime prevention) were offered through digital technologies in a new town called Dongtan, which served as the initial model of Korean smart cities. During

the construction stage (2003-2013), two features were particularly salient. A first feature was that smart city development was limited to “new towns”, in areas larger than 1.65 million m^2. A second feature was the enactment of the U-City Act, which provided the legal framework for smart city development. The initial concept of the U-City (which stands for “ubiquitous city”) focused on collecting information regarding urban infrastructure. Considering that Korea had built a high-speed communication network across the country in the early 2000s, and it was also constructing many new towns, incorporating ICT in new towns and urban planning was relatively cost-effective. The Korean government set policies encouraging new towns to equip themselves with cutting-edge technology in urban infrastructure, especially in transport and safety sectors to improve traffic management and crime prevention, respectively. While the initial U-City concept mainly concerned underground infrastructure, its scope was progressively broadened to encompass all urban infrastructure through an information platform called an Integrated Operation Control Center (IOCC) ((Lee and Chang, 2019[10])). At the same time, having distinct laws and regulations for ICT and for new town construction respectively made it difficult to expedite the U-City construction. A customised legal framework was required to facilitate more efficient implementation of high tech facilities and systems in new towns. The Korean government therefore decided to enact a comprehensive piece of legislation dedicated to U-City construction in 2008 (Figure 2.1). The U-City Act focused on infrastructure, technology and services, with the aim of improving competitiveness and quality of life. Urban Information Systems (UIS) development strategies and the emerging sector of “ubiquitous computing” gave rise to the U-City (OECD, 2018[14]).

Figure 2.1. Legal framework on U-City construction in Korea

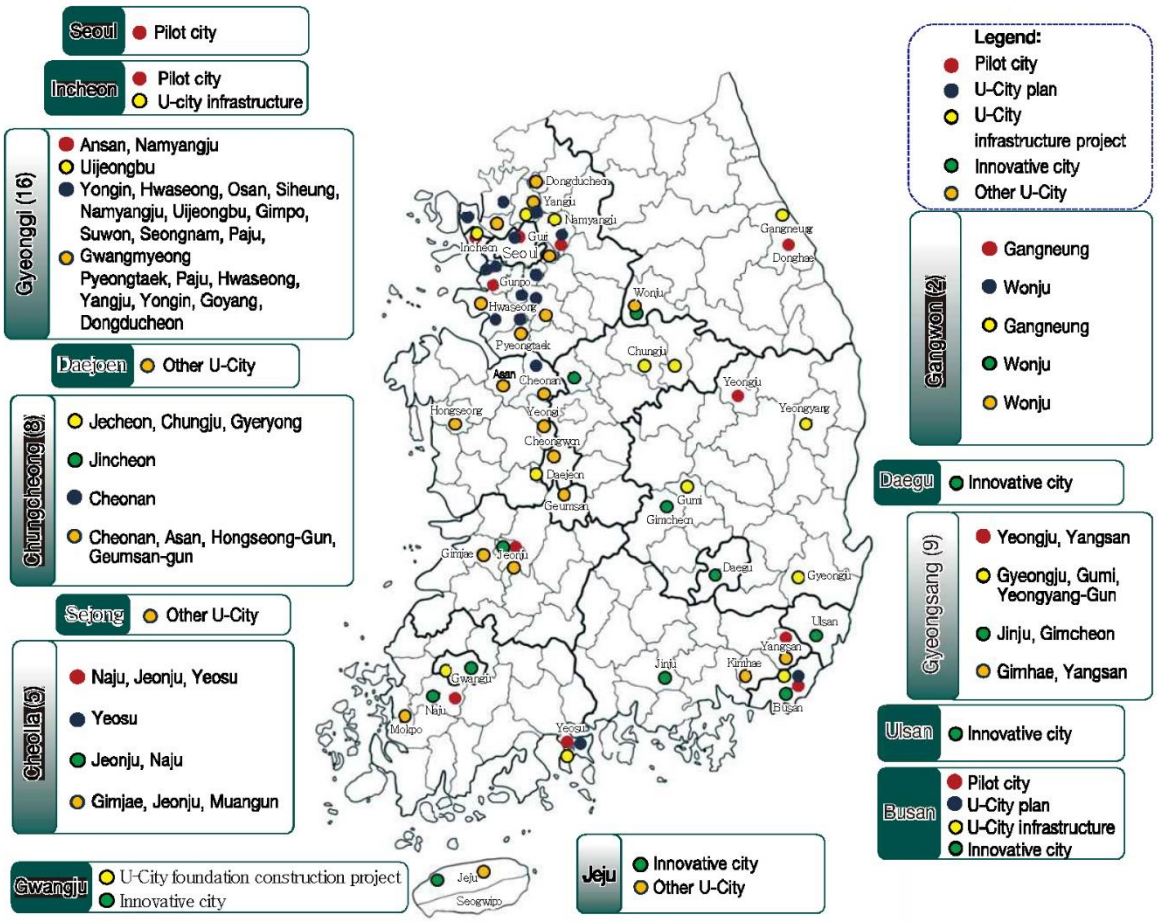


Source: KRIHS (2013[15]), A primer on Korean planning and policy: Smart city. Korea Research Institute for Human Settlements, Gwacheon.

The construction of U-City infrastructure such as ICT infrastructure and integrated operation control centres cost on average KRW 40-60 billion, which accounts for 1-3% of the total cost of new town construction. Profits from new town developments were used to finance the construction of U-City infrastructure. The U-City Act mandated that U-City infrastructure be considered as part of urban infrastructure, thus qualifying it for urban infrastructure financing. This financing model allowed the construction of U-cities without additional support from national and local governments. This is one of the main reasons why Korea was able to build many U-cities over a short period. Within less than four years after the adoption of the U-City Act, 50 cities and counties had implemented some form of U-City project by 2012 (Figure 2.2). One downside of this financing model, however, was that the eligible new towns supported by the U-City Act were limited to areas larger than 1.65 million m² and they should be residential land development projects. Only when a new town is larger than this size, the cost of constructing a U-City can be recovered by selling housing to new residents. In other words, financing for U-City infrastructure was difficult without large-scale residential development projects (Lee and Chang, 2019[10]).

After 2010, the Korean government operated a drastic change in urban policy, as new town developments stagnated and the number of U-City projects was rapidly reduced. Nevertheless, nationwide U-city infrastructure built during this period still functions as a critical asset for designing and implementing current smart city policies in Korea.

Figure 2.2. U-Cities in Korea in 2012



Source: Lee and Chang (2019[10])(2019), the evolution of smart city policy of Korea, Smart City Emergence, pp 173-193.

Connecting stage (2014-2016)

During the connecting stage (2014-2016), there was an evolution from the construction of U-cities towards the integration of information and systems that used to operate independently from each other. While U-city infrastructure such as IOCCs was a key word in the previous period, smart city platforms became a new key word in smart city policies. Smart city governance was also improved and regulations were reformed (KRIHS, 2018[9]).

With the abrogation of the Housing Site Development Promotion Act (2014), which used to be primarily used for new town development, the government was no longer able to rely on stable financial resources for U-city construction stemming from the profits of new town developments. The government pursued the integration of U-city services and systems such as public transport and crime prevention, which were operating independently. Smart city platforms were developed through national R&D programmes and they provided the technical basis to integrate U-city solutions that local governments had been operating (KRIHS, 2018[9]). For example, CCTVs originally installed only for traffic management could be used in multiple ways, for example for crime prevention. The government also provided financial and technical support to encourage local governments to establish smart city platforms. Connecting previously distinct services opened new horizons.

Co-operation among government bodies proved to be essential and some legal issues had to be solved to achieve integrated systems. For instance, information coming from security CCTVs was a matter of personal privacy and it was illegal to share CCTV video footage with other agencies. Solving such issues took a lot of time and effort (Lee and Chang, 2019[10]). Korean government bodies signed a series of memoranda of understanding (MoU) to facilitate sharing information, institutionalise the co-operation and build a smart city governance framework (Table 2.2). The MoUs allowed relevant agencies to start sharing information or to share more information. MOLIT worked on providing support to local governments in building integrated smart city services through IOCCs.

Table 2.2. Examples of MoUs signed for service integration in Korea

Government bodies	MoU
MOLIT-Policy agency (15)	To share CCTV information of IOCC with police stations, especially for urgent crimes
MOLIT- National Emergency Management Agency (15)	To share information on infrastructure (such as side streets, parking spaces and dangerous facilities) with fire stations to support fire-fighting and rescue activities
MOLIT, Sejong, Anyang, Osan, LH, SK telecom (16)	For IOCCs to receive position information from telecom company and to share it with police and fire stations to help women, children, and people with dementia

Source: KRIHS (2018), A Study on Strategic Response to Smart City Types, KRIHS, Sejong

Enhancement stage (2017-present)

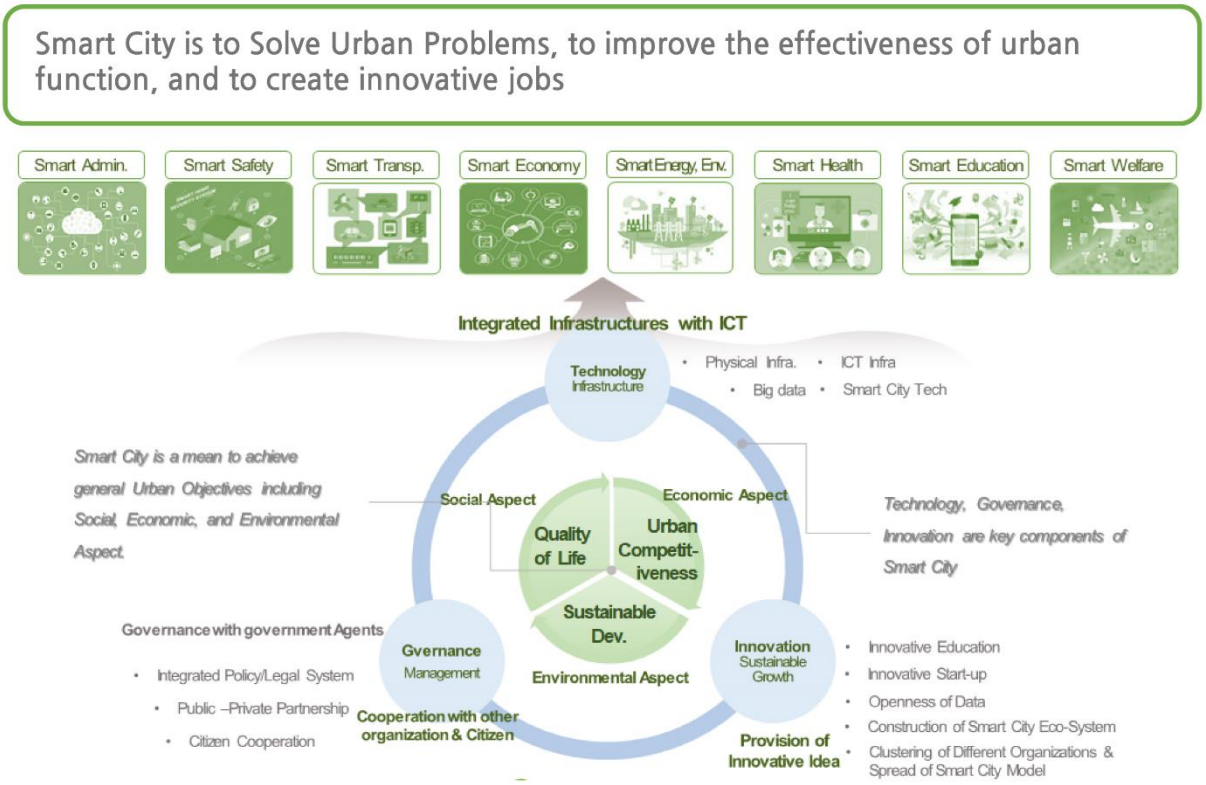
The enhancement stage (2017-present) includes an expansion of the smart city concept, reforms of legal frameworks and regulations, and customised smart city projects.

Expansion of the smart city concept

Just before 2017, two factors led to expanding the smart city concept. First, Korea started to incorporate a variety of aspects of smart city concepts from Europe and the US, such as citizen participation, sustainable development and better governance. Second, the international discourse on the Fourth Industrial Revolution has influenced the potential role of smart cities by shedding new light on the issue of the future of work. According to Lee and Chang (2019[10]), there was a national consensus in Korea around the fact that a smart city also needs to be a place for innovative job creation rather than just focusing on solving

urban problems. Therefore, the smart city concept in Korea expanded to meet the perceived global standards of smart cities (Figure 2.3).

Figure 2.3. The renewed smart city concept in Korea



Source: Lee and Chang (2019[10]), The Evolution of Smart City Policy in Korea, Smart City Emergence, pp 173-193.

Reform of legal frameworks

Following a comprehensive review of existing legal frameworks for smart cities in 2016, the U-City Act was revised into the "Law for Smart City Creation and Promotion of Industries" ("Smart City Act") (Table 2.3). The latter allows for engaging more and diverse stakeholders in smart city projects, and for encompassing various aspects of smart cities going beyond the construction phase, such as management, operations and the promotion of innovative industries. The construction of smart cities was also freed of former limitations to newly built cities. Deteriorating older cities and city centres are now being transformed into smarter environments that enable citizens to participate in finding solutions to urban problems, with closer consideration of local characteristics.

Table 2.3. Changes from the U-City Act (2008) to the Smart City Act (2016) in Korea

	Main revisions
Expansion of smart city scope	Smart city infrastructure expands from information collecting facilities to information processing ones such as cloud, platform, and other software programs Smart city projects include not only construction projects but also technology improvements and operation and management Size of smart cities that are eligible for government support decreases from 1.65 million m2 to 0.3 million m2
Smart city industries promotion	National and regional governments should establish smart city industry promotion plans Providing legal grounds for financial support for smart cities
Smart city certification system	Introducing a certification system for smart cities

Source: KRIHS (2018[9]), A Study on Strategic Response to Smart City Types, KRIHS, Sejong

Customised smart city projects

Two pilot projects: Sejong and Busan

In 2018, two cities – Sejong City and Busan Metropolitan City – won the national call for smart city pilot projects. The purpose of these pilot projects is not only to solve urban problems, but also to provide smart city testbeds for cutting-edge smart city solutions and establish innovative industry ecosystems for smart cities. These pilot projects are large-scale development projects from scratch, located in greenfields districts. The pilot project in Sejong is located in the 5-1 residential district. It covers 2.7 km^2 and a population of 19,000 residents in 8,900 households, with a total cost estimate of KRW 1.4 trillion. The pilot project in Busan is the Eco-Delta City district. It covers 2.8 km^2 and a population of 8,500 residents in 3,300 households, with a total cost estimate of KRW 2.2 trillion.

The two pilot smart cities focus on different themes:

- **Sejong** focuses on smart mobility and health care. First, the master plan of Sejong smart city gives priority to transport based on innovative technologies such as driverless vehicles and cars powered by hydrogen and electricity. Car-sharing is an important part of Sejong's goal to reduce the number of cars used per capita by two-thirds by 2040. Sejong also plans on reducing traffic jams by using AI embedded in a traffic management system. Second, Sejong will use wearable devices and robotics in homes, public spaces and medical facilities to improve the responsiveness and delivery of healthcare. For example, Sejong plans to use AI in homes to detect medical emergencies such as falls, injuries and illness. Drones will collect images and video information to provide relevant information to medical professionals in hospitals.
- **Busan** put emphasis on smart water management and robots. Smart water management includes smart water meters, automated detection and drainage of pollutants, and a water re-use system. The master plan of Busan smart city calls for robots to help parking and returning cars like an automated valet service. Robots can also assist in detecting parking violations ((Intralink, 2019[16])).

After announcing their basic concepts in 2018, Sejong and Busan are developing their space planning and smart city solutions. In 2021, residents will move into the smart city districts where they will have access to cutting-edge smart city infrastructure such as data centres, digital twins, IoT, self-driving cars and drones (Table). In addition, national R&D projects are being carried out. For example, smart grid R&D projects and smart water management R&D projects are being tested in the two pilot projects.

Table 2.4. Key services in the two Korean smart city pilot projects of Sejong and Busan

Mobility	Energy	Education/Healthcare	Infrastructure
Driverless cars	Hydrothermal energy	Drone for first aid	Cloud-based logistics
Last mile solutions	Solar energy	Education platforms	Smart factories
AI-based traffic control	Smart grid	Blockchain for medical records	Smart water meters

Source: Intralink (2019), Market Intelligence Report: Smart Cities, South Korea, Department for International Trade of UK

The designated districts in Sejong and Busan will also be able to benefit from exemptions from previously restrictive regulations (e.g. through more relaxed location requirements). Deregulation plays a critical role in attracting private investment and validating cutting edge smart city solutions. New smart city solutions need to be tested in many ways before being commercialised. In particular, some smart city components, such as safety and healthcare, need to solve regulatory issues such as privacy. For private companies, obtaining the government's authorisation to test smart city solutions can be a lengthy process. In this context, lifting regulations in certain areas for developing smart city solutions is critical. The Special Act on the Promotion and Vitalisation of Convergence of Information and Communications Technology, enacted in 2018, lifts regulations for a certain period in strategic industries, particularly those related to the Fourth Industrial Revolution. In other words, new solutions and business models are deemed legal unless specifically prohibited by laws and regulations. "Regulatory sandboxes" also apply to all designated smart city projects: regardless of regulations that might inhibit the project elsewhere in the country, smart city pilot projects are allowed to take place within a certain area. The regulatory sandbox covers six categories: personal data usage, autonomous vehicles, drones, private networks, software development and land use (Intralink, 2019[16]) (Table 2.5).

Table 2.5. Smart cities "regulatory sandbox" in Korea

Category	Details
Personal information	Removes data privacy protections if identification markers are stripped
Driverless vehicles	Allow video recording equipment in vehicles for R&D purposes
Drones	Simplified reporting on videos/images taken for R&D and safety purposes
LAN	Broaden public telecom providers to connect to private networks
Software development	Allows conglomerates to bid on public tenders for software
Land use	Allows developers to enter private contracts for the land sale to companies

Source: Intralink (2019[16]), Market Intelligence Report: Smart Cities, South Korea, Department for International Trade of UK

Other smart city projects

MOLIT also supports smart city projects through initiatives that target either *existing cities* or *shrinking cities*.

- MOLIT plans to select more than 100 *existing cities* and help make them smarter during the period 2019-2023 through two main initiatives, i.e. thematic smart city development and the smart cities challenge.
    - *Thematic smart city development* started in 2018. Through a bottom-up process, regional and local governments consult with residents to find smart city solutions that make a target district more liveable and competitive, before apply for MOLIT support. MOLIT selects four districts every year where it provides financial support for the elaboration and the implementation of the master plan (Table).
    - The *smart city challenge* in Korea started in 2019. While it is also run through a bottom-up process, it puts more weight than the thematic smart city development programme

on pilot testing smart city solutions proposed by private companies. Regional/local government and private companies can propose particular pilot solutions to a given city, and MOLIT selects some of them and supports their implementation. In 2019, 48 teams applied and 6 teams were selected. The selected solutions in 2019 include relieving parking problems through e-mobility, blockchain-based data platforms, and 5G-based mobile digital twins.

Table 2.6. Cities selected by MOLIT for thematic smart city development in 2018-2019

2018				
Region/City	Daejeon	Bucheon/Gyeonggi	Gimhae/Gyeongnam	Jincheon/Chungbuk
Theme	Science village	Fine dust reduction	Smart tourism	Energy innovation
2019				
Region/City	Tongyoung/ Gyeongnam	Gongju/Chungnam	Sungdong/Seoul	Suyoung/Busan
Theme	Traditional market revitalisation	Smart heritage	Smart transport	Smart tourism

Source: MOLIT (2019), 3rd Smart City Comprehensive Plan.

- *Shrinking cities* can benefit from smart urban regeneration projects. These projects attempt to solve problems in old districts by using data centres and community platforms, rather than large-scale development from scratch. As of June 2019, 12 cities had smart regeneration projects across Korea and MOLIT plans to make it more than double until 2022.

3 Advancing the measurement agenda in smart cities

Solid measurement is critical for smart city policy. It helps ground policy intervention in evidence, enhance accountability, and improve the evaluation of the efficiency and effectiveness of government action. However, tangible evidence of the impact of smart cities remains scarce. Where it exists, it is more place-specific or project-based than policy-oriented.

Mapping existing indicator frameworks: selected examples

Three examples of indicator frameworks deserve attention: the global smart city development index of Yonsei University (Korea); the CITYKeys indicator framework (Eurocities); and the 162 city indicators of 2Thinknow (Australia).

Smart cities Index of Yonsei University

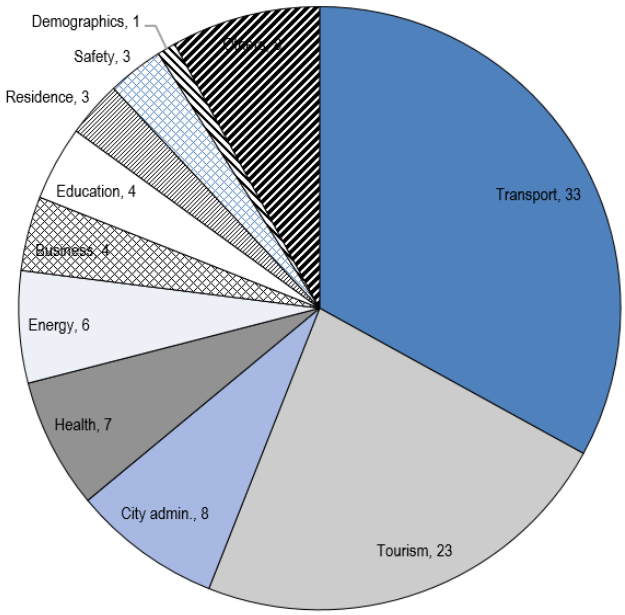
Yonsei University developed a global smart city development index, which analysed 20 cities along 8 dimensions of smart city performance: service innovation, intelligence, sustainability, urban openness, infrastructure integration, governance, urban innovativeness, and partnerships (Table 3.1). The results show that most cities provide app- or web-based smart city services in transportation (33%), followed by culture and tourism (23%), and city administration (8%) (Figure 3.1). However, smart city governance needs to foster innovation and there is a need to better gauge inclusiveness and data quality.

Table 3.1. Smart city performance measurement dimensions

Service innovation	Intelligence	Sustainability	Urban openness
Service integration	Intelligent technology	Smart green service	Open data platform
Service diversity			Service design
Infra. integration	Governance	Urban innovativeness	Partnerships
Multi device platforms	Smart city leadership	Living labs	PPP
Merger of data plan	Smart city strategy	Start-up & eco-system promotion programs	Collaboration
Network infra.	Performance measurement	Start-up & eco-system diversity	
Types of network (cable/wireless/sensor)	Development/ operation process		

Source: Junghoon Lee et al. (2019[171]). 2019 *Smart Cities Index Report*. Yonsei Information Systems Intelligence Lab http://isi-en.yonsei.ac.kr/

Figure 3.1. Ten smart city service categories measured by Yonsei University's global smart city development index (analysis of 993 App-web services of 20 cities)



Source: Junghoon Lee et al. (2019). 2019 Smart Cities Index Report. Yonsei Information Systems Intelligence Lab

CITYKeys

The aim of CITYKeys was to develop and validate a performance measurement framework to promote a common, transparent and comparable monitoring of smart city solutions across European cities. The framework includes two levels of indicators: at city or neighbourhood level, and at project level. The former evaluates the effect of a smart city project by comparing before and after, or by comparing the expected effect with a reference point. The latter monitors the progress of the city as a whole towards smart city goals and assesses how the project has contributed to the objectives at city level (Bosch et al., 2017[18]). The evaluation framework includes the 3Ps (i.e., people for social sustainability, planet for environmental sustainability, and prosperity for economic sustainability), but also governance and scalability/replicability aspects. Under each of these five categories, corresponding indicators have been identified (Figure 3.2). For instance, a smart city approach related to environmental protection is evaluated along indicators related to energy efficiency or climate change mitigation performance. Cities and local governments were involved from an earlier stage of the project and indicators were co-designed with them. The project has 5 main partner cities and 12 participant cities. It calls for an integrated approach contributing to the effort to break siloes in the design and implementation of urban projects.

Figure 3.2. Five evaluation indicators categories of CITYKeys

Source: Bosch, P. et al. (2017[19]), *CITYkeys indicators for smart city projects and smart cities*, http://dx.doi.org/10.13140/RG.2.2.17148.23686. (2017[19])

Innovation city index of 2Thinknow

2Thinknow built an innovation city index, which encompasses 162 indicators based on predominately quantitative analysis of 1,000 data points (2018[20]). The 162 indicators are based on three dimensions: cultural assets, human infrastructure and networked markets (Table). In a 2007 published report, the firm predicted the main challenges of cities in terms of economic growth, environmental sustainability and equity (Hire, 2007[21]). Currently, the index covers 500 cities and has conducted city rankings for the past 12 years.

Table 3.2. 162 city indicators used for the innovation city index of 2Thinknow

Cultural Assets		Human Infrastructure		Networked Markets
Architectural Layering	Noise Limiting	Electricity & Gas	Resources	Multi-Lingual
Decorative Features	Public Green Areas	Food Supply	Textile Industry	Social Media
Green Architecture	Water features	Public Water Supply	Wine, Spirits & Brewing	City Branding
History	Fashion Designers	Waste Management	Clerical Wages	Smart Devices
Neighborhoods	Cafes & Tea Rooms	Business Approach	Labor Force	Embassies
Cinema & Film	Fine Restaurants	Card Acceptance	Working Visa	Neighbors Relationships
Cultural Festivals	Food Diversity	Banking & Finance	Citizen Rights	Domestic Market Health
Dance & Ballet	Meal Affordability	Company Tax	Policing	Domestic Market Size
Handcrafts	Bookstores	Foreign Exchange	Separation of Powers	Exports
Private Art Galleries	Magazine Availability	Multi-National headquarters	Container Freight	Foreign Direct Investment
Public Art Galleries	Media Censorship	Professional Services	Freight	Imports
Public Artworks	News Journalism	Public Meeting Spaces	Postal System	Neighbors Market Size
Public Museums	Public Libraries	Sales Taxes	Railway Track	Reserves
Satire & Comedy	TV & Radio Networks	Airport Connections	Airport Transfers	Trade Diversity
Theatre & Plays	Underground Publications	Languages	Automobiles	Trading Partners Econ.
Youth Activities	Web Censorship	Tourist Entry	City Transport Infra.	Freight Dependencies
Designers	Bicycle Friendly	Travel Advisories	Inter-City Connections	Physical location
Green Business	Streets	GDP Per Capita	International Airport	Trade Routes

Film Production	Walking City	Property Prices	Service Delivery	Relative Military
Hotel Range	Classical Music	Unemployment Rate	Service Frequency	Strategic Power
Inbound Visitors	Music Venues	Arts Education	Taxi Service	
Int'l Conferences	Nightlife	Business Education	Transport Coverage	
International Students	Opera House	Science & Engineering	Crime	
Visitor Entry	Popular Music	Student Population	Violent Crime	
Visitor Information	Alternative Population	University Breadth	Department Stores	
Wealth Distribution	Education Level	Univ Commercialization	Ecommerce Sales	
Air Cleanliness	Equality of Women	Gov't Responsiveness	Local Markets	
Climate & Weather	Population	Government Stability	Local Shopping	
Emissions	Places of Worship	Political Transparency	Retail Establishment	
Natural Disasters	Fitness Facilities	Public Servant Professionalism	Small Retail Clusters	
Nature	Sports Fanaticism	General Medicine	Company Setup	
	Sports Stadiums	Hospitals	Growth Business Funding	
		Infant Mortality Rate	Start-Up Economy	
		Life Expectancy	Start-Up Office Spaces	
		Waiting Lists	Broadband Internet	
		Industry Clusters	Fixed Phone Network	
		Manufacturing Breadth	Government IT Policy	
		Manufacturing Quality	Internet Users	
		Publishing Industry	Mobile Phone Network	
			Wireless Internet	

Source: 2thinknow (n.d.[22]), *City Indicators*, https://2thinknow.com/reference/city-indicators/ (accessed on 11 February 2020).

Key dimensions for smart city performance measurement

Among the different measurement frameworks analysed, the OECD has identified six key dimensions for smart city performance measurement during the 1st OECD roundtable on Smart Cities and Inclusive Growth:

- **Profitability of smart city investment and return on investment**. Measuring profitability is important for the private sector and companies like **Suez**, because private partners will not be convinced to join an initiative if it has no profitable projects. This point was also corroborated by the experience of the **Global Fund for Cities Development**, a global network of cities dedicated to finding solutions to finance and invest in urban development. In collaboration with UN Habitat, it developed a platform on smart cities with more than 300 cities across the world to evaluate the social impact of smart city investments. Its work suggested that the return on investment in smart public lighting systems is usually seven years and such investment can help lower the cost of the service by up to 75%. Another example can be found in Tokyo (Japan), where the installation of sensors on water pipelines allowed for saving more than a hundred million of litres per year by reducing leaks. Such examples show that smart city investment can have a measurable impact, but it is essential that cities engage with the private sector in terms of profitability and bankability – but also to deliver services and infrastructure for all, including the most vulnerable population. As underlined by the **Paris School of Economics**, the typical method based on cost-benefit analysis and socioeconomic evaluation is not the right way to address smart city performance. Smart cities are not only about the private company and value for money, but about the collective utility of the project.
- **Differences among cities in levels of economic development and on the urban value chain.** The experience of the **World Economic Forum** demonstrated that there is a plethora of smart city pilot projects in established and economically mature cities (e.g. in the Global North), but the majority of cities located in other parts of the emerging and developing world (e.g. in the Global South) do not have the same capacity to implement smart cities. In this

context, city performance measurement needs to recognise different levels of development in different parts of the world, ranging from San Francisco and Singapore to some parts of Latin America and Africa. The experience of **Cities Alliance** in collecting case studies of smart technologies also raises the question of how to make cities in the Global South smarter by integrating informal activities. **World Enabled** raised the question of how to create a community where cities of all sizes can find best practices even though they may not be at the same level of development and how they can progressively get to different areas of their resiliency markers.

- **Building the capacity of cities to collect and use the right data.** For private companies such as **Lacroix Group** getting the right measurement and quality data is crucial for taking the right decisions to manage the city and for taking real investment decisions on the architecture of a city. For organisations such as **Urban Innovative Action**, if a city's capacity is limited in some important aspects (e.g. how to collect data, how to use the findings, and how to improve the process through evaluation), the development of smart cities could be limited as well. Many cities are struggling to gather relevant data to make decisions about their own services, because the quality of data and what data measure vary. However, there are many ways to obtain data, including a clear opportunity to harness data from publicly available data sources such as Google Maps and open sources. While technology companies seek to sell technological solutions to cities, the proposed solutions may not be the best for each city and it is important to build the capacity to design and select the right type of innovation.
- **Aligning smart city investment with a city's strategic priorities and citizens' needs**. Measurement needs to be tuned to the outcomes that the city is striving to achieve. It is therefore essential to consider the needs of residents, as underlined by **Planet Group**, and to build trust within the community. Political continuity also matters, according to **Eurecat**, because projects tend to be forgotten when the political party in power changes. Engaging citizens from an early stage can help strengthen the initiative, as it will be more difficult for politicians to go against people's will. As expressed by **Paris and Co**, with the rise of innovative projects, evaluation is key – but it's less about deciding what is good vs. what is not good, rather about understanding the specific context and people's perception of the project outcomes. It is important to define the purpose of measurement
- **A multi-criteria approach**. The experience of **Nokia** showed that the focus of measurement can change over time (e.g. after the Fukushima nuclear disaster in 2011), since what was measured or considered "smart" previously was no longer so. Nokia built a new model to accommodate the change of paradigm and put people first, around five components: improving quality of life, safety and security, economy and jobs, hyper-connectivity, and core city services. Other important factors in its model also included agility, resilience and sustainability.
- **Starting small and scaling up after learning from potential failures**. Smart city solutions can start with small scale infrastructure as it does not necessarily need to be a megaproject to transform a city. Measurement is not easy to do due to a natural fear of negative results. As highlighted by **Suez**, there is a need to educate people (including city leaders) about the possibility of failure, because innovation requires failure.

Towards more effective measurement and government accountability

While measuring city performance is essential to guide citizens and policy makers in taking meaningful decisions about increasingly complex urban activities, the measurement issue faces even more acute challenges in an era of digital transformation (Box 3.1). Existing measurement tools struggle to keep up with the rapid pace of the digital transformation. In addition, the range of questions in terms of measurement is daunting. For example, how to measure the disruption of existing business models and

the emergence of new ones, the reorganisation of work or the size of the digital economy? How can the value of data be captured in standardised statistics? Most fundamentally, what are the impacts of digital solutions on the well-being of citizens and society? Much of the information required to respond to these questions already exists or is being developed, but not all. There is also a need for new, complementary data infrastructures capable of tracking the emergence of new activities and monitoring their substitution for traditional ones, on a timely basis wherever these occur (OECD, 2019[23]).

Box 3.1. Nine actions to advance measurement capacity in a digital transformation era

Action 1: Make the digital economy visible in economic statistics

Measuring the digital transformation and its impacts requires the development of indicators that complement the views provided by traditional measurement frameworks, such as those used to measure GDP and trade flows.

Action 2: Understand the economic impacts of digital transformation

Digital technologies are implemented as a part of business processes, together with labour, capital and knowledge capital assets, in order to drive performance. The initial and strongest evidence of their economic impact will likely surface in micro-data before showing up in macro-data. To this end, it is important to be able to link together existing datasets, exploit the potential of administrative records, and develop measures of digital maturity in business that can then be used to analyse the impacts of digital technologies on firm performance.

Action 3: Encourage measurement of the digital transformation's impacts on social goals and people's well-being

The digital transformation is impacting many aspects of people's lives. Accordingly, measurement frameworks are required to capture these aspects including emerging impacts. In this respect, frameworks play a key role in measuring the extent to which digital technologies and new business models can help address societal goals, including those associated with health, ageing populations and climate change.

Action 4: Design new and interdisciplinary approaches to data collection

New interdisciplinary methods of analysis are necessary to understand innovative behaviour, its determinants and its impacts at the level of the individual and the organisation.

Action 5: Monitor technologies underpinning the digital transformation, notably the Internet of Things, AI and Blockchain

A range of rapidly developing technologies such as IoT, AI, and Blockchain are set to drive the next phase of the digital transformation. The general purpose and interdisciplinary nature of these digital technologies underscores the need for a consistent framework to define them, identify the emergence, monitor the development/diffusion, and quantify the economic and social impacts.

Action 6: Improve the measurement of data and data flows

Both the scale of data usage and its importance for many business models and processes has increased exponentially. However, there are significant challenges involved in evaluating data as an input to production. Data flows between organisations in particular can take place quickly and at low cost. Moreover, the value of data is heavily context-dependent. The combination of these factors results in many conceptual and practical measurement challenges.

Action 7: Define and measure skills needs for the digital transformation

The development of the digital economy and its applications, such as "Big data" analytics, cloud computing and mobile applications, increases the demand for certain skills that are often in short supply. New insights could be gained by exploiting and harmonising detailed national surveys on tasks and skills and by working with the business community to define new metrics of skill shortages.

Action 8: Measure trust in online environments

Management of security, privacy and consumer protection risk online, as well as the general level of trust of the population in online environments, have become key policy issues as individuals, businesses and governments shift large parts of their daily activities to the Internet. Alternative approaches currently underway utilise behavioural insights from experiments, for example, Internet-based data could be used to measure various aspects of trust.

Action 9: Establish an impact assessment framework for digital governments

Governments are progressively adopting digital technologies to encourage innovation in service design, operation and delivery. The move from using digital technologies to improve efficiency to using them to influence and shape public governance outcomes should enable governments to better respond to broader policy imperatives such as public trust, social well-being and civic engagement. To address the challenges and seize the opportunities of the digital age, governments should prioritise the establishment of an impact assessment framework to measure the concrete contribution of digital government to broader policy outcomes.

Source: OECD (2019[23]), Measuring the Digital Transformation: A Roadmap for the Future, OECD Publishing, Paris. https://doi.org/10.1787/9789264311992-en

Governments will need to consider three key aspects when building a measurement framework for smart cities and implementing it.

First, it is critical to develop a **comprehensive framework** to measure the extent to which digital innovation in cities is delivering better well-being for all. In some cases, smart cities initiatives have been evaluated for their contribution to societal, environmental, economical, and institutional improvements. Many scorecards and rankings break down the smart categories further, using terminologies such as "smart living" and "smart mobility". As shown in Table 3.3, however, a harmonised and comparable framework is yet to be developed to measure the extent to which digital innovation in cities is delivering better (multi-sectoral) outcomes for residents. Other studies on smart city measurement have revealed that it is hard to identify standardised smart city measurement frameworks, which are widely-used by national and local governments to measure the performance of smart cities (Caird and Hallett, 2019[24]). A comprehensive framework needs to assess how digital innovation affects cities and urban policies, and offers policy solutions to overcome challenges in different cities. For example, such a framework could be structured around the impact of smart city policies on people, places and firms, and the ability of such smart cities to contribute to broader objectives such as efficiency, equity and environmental sustainability. This kind of approach is critical to capture possible trade-offs between different sectors involved in smart city policies. Ultimately, the framework should help mobilise the city's resources in an efficient and effective way to i) address the needs and improve the lives of 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.

Table 3.3. Selected indicator frameworks for smart cities

Dimension	European Smart Cities platform indicators (2007)	New KPIs for a Smart City (2016)	The CITYkeys indicators (2017)	McKinsey Institute (2018)
Economy	Entrepreneurship; Economic trademarks; Productivity; Ability to transform etc.	Cost performance	Employment; Equity; Economic performance; Green economy etc.	Jobs; Cost of living
Environment	Attractiveness of natural conditions; Pollution; Environmental protection; Resource management etc.	Environment/natural resource; Energy	Energy and mitigation; Materials, water and land; Climate resilience; Pollution and waste etc.	Environmental quality
Society & People	Affinity to life long learning; Social and ethnic plurality; Flexibility; Creativity etc.	Accident; Disaster; Crime; Information security; Health; Stress; Barrier free etc.	Health; Safety; Access to services; Education; Diversity; housing etc.	Health; Social connectedness; Safety
Governance	Participation in decision-making; Transparent governance etc.	-	Multilevel governance; Community involvement	-
Mobility	Accessibility; Innovative and safe transport systems etc.	-	-	Time and convenience
Satisfaction	-	Citizens' degree of satisfaction	-	-
Propagation	-	-	Scalability; Replicability	-

Source: OECD elaboration based on Bosch et al. (2017[18])(2017), Hara et al. (2016[25]), MGI (2018[26]), and European Smart Cities website.

Second, apart from its composition, the comprehensive measurement framework needs to be **well aligned with a country or a city's strategies.** It should include a baseline and follow-up evaluation, and allow for measuring outcomes over time to track the time-variant effect of smart cities on society. The European Innovation Partnership on Smart Cities and Communities (EIP-SCC) recommends: i) aligning with city strategies, ii) conducting measurement over time, iii) developing the framework through a stakeholder engagement process, iv) opening up to future innovation, v) supporting open reporting and cities' evaluation of progress (Caird and Hallett, 2019[24]).

Third, a measurement framework should be **flexible and adaptable to different circumstances**. In some cases, local governments are also expected to measure their performance and to release the results to the public. For example, Bristol (UK) has around 150 key performance indicators to measure and release, apart from the potential smart city measurement framework (Caird and Hallett, 2019[24]). This helps improve transparency and accountability, as well as raise awareness on social progress and on areas that require further improvement.

4 Digital innovation and disruption to city governance

The advent of smart cities is disrupting established models of urban governance, notably in terms of fair competition, labour laws, government contracts and regulation. Despite the risks that data-driven smart city initiatives may pose to traditional notions of urban governance, these very same initiatives also have the potential to make urban governance more effective. At a time when many municipal budgets are undergoing cuts, it is critical to find cost-effective solutions to deliver public services. The wealth of data that can be collected in cities today -- while an area that has to be carefully regulated – can help solve problems and deliver services much more efficiently if the right policy frameworks and regulations are in place to harness benefits and avoid risks. Digital technologies can also help engage a broader range of stakeholders in the governance of smart cities. This section will discuss how urban governance can take advantage of digital transformations.

Revisiting business models in smart cities

The urban business environment is changing rapidly with the daily rise of big data and the emergence of integrated platforms that can be seen as monopolies due to their network effects. Establishing the right policy and regulatory frameworks to avoid unfair competition, protect consumers and ensure social equality requires revisiting to be addressed.

Leveraging public-private partnerships

Data was once coined as the “new gold” or “new oil”, but its value will not be fully exploited if public-private partnerships do not evolve to fit the new business environment of smart cities. Public-private partnerships (PPPs) are understood as long term agreements between the government and a private partner whereby the private partner delivers and funds public services using a capital asset, sharing the associated risks. PPPs may deliver public services both with regards to infrastructure assets (such as bridges, roads) and social assets (such as hospitals, utilities, prisons). Using these innovative modes of funding and harnessing synergies is an important component of the OECD’s efforts to support urban stakeholders in the implementation of more effective governance mechanisms through smart city initiatives. However, PPPs are complex and sometimes risky arrangements that require capacity that is not always readily available in government, in particular at the subnational level. Moreover, databases that only include projects with a minimum deal size may well omit subnational PPPs that tend to have lesser value (OECD, 2018[27]).The OECD Recommendation on public governance of PPPs provides guiding principles for governments on managing PPPs (Box 4.1). The recommendations cover three areas: (1) establishing a clear, predictable, and legitimate institutional framework supported by competent and well-resourced authorities; (2) grounding the selection of PPPs in value for money; and (3) using the budget process transparently to minimize fiscal risks and ensure the integrity of the procurement process (OECD, 2012[28]). Furthermore, the OECD Recommendation on Effective Public Investment Across Levels of Government includes a call

to “mobilise private actors and financing institutions to diversify sources of funding and strengthen capacities” at national and subnational levels (OECD, 2014[29]).

Box 4.1. OECD Principles for Public Governance of Public-Private Partnerships

A. Establish a clear, predictable and legitimate institutional framework supported by competent and well-resourced authorities

1. The political leadership should ensure public awareness of the relative costs, benefits and risks of Public-Private Partnerships and conventional procurement. Popular understanding of Public-Private Partnerships requires active consultation and engagement with stakeholders as well as involving end-users in defining the project and subsequently in monitoring service quality.

2. Key institutional roles and responsibilities should be maintained. This requires that procuring authorities, Public-Private Partnerships Units, the Central Budget Authority, the Supreme Audit Institution and sector regulators are entrusted with clear mandates and sufficient resources to ensure a prudent procurement process and clear lines of accountability.

3. Ensure that all significant regulation affecting the operation of Public-Private Partnerships is clear, transparent and enforced. Red tape should be minimised and new and existing regulations should be carefully evaluated.

B. Ground the selection of Public-Private Partnerships in Value for Money

4. All investment projects should be prioritised at senior political level. As there are many competing investment priorities, it is the responsibility of government to define and pursue strategic goals. The decision to invest should be based on a whole of government perspective and be separate from how to procure and finance the project. There should be no institutional, procedural or accounting bias either in favour of or against Public-Private Partnerships.

5. Carefully investigate which investment method is likely to yield most value for money. Key risk factors and characteristics of specific projects should be evaluated by conducting a procurement option pre-test. A procurement option pre-test should enable the government to decide on whether it is prudent to investigate a Public-Private Partnerships option further.

6. Transfer the risks to those that manage them best. Risk should be defined, identified and measured and carried by the party for whom it costs the least to prevent the risk from realising or for whom realised risk costs the least.

7. The procuring authorities should be prepared for the operational phase of the Public-Private Partnerships. Securing value for money requires vigilance and effort of the same intensity as that necessary during the pre-operational phase. Particular care should be taken when switching to the operational phase of the Public-Private Partnerships, as the actors on the public side are liable to change.

8. Value for money should be maintained when renegotiating. Only if conditions change due to discretionary public policy actions should the government consider compensating the private sector. Any re-negotiation should be made transparently and subject to the ordinary procedures of Public-Private Partnership approval. Clear, predictable and transparent rules for dispute resolution should be in place

9. Government should ensure there is sufficient competition in the market by a competitive tender process and by possibly structuring the Public-Private Partnerships program so that there is an ongoing

functional market. Where market operators are few, governments should ensure a level playing field in the tendering process so that non-incumbent operators can enter the market.

C. Use the budgetary process transparently to minimise fiscal risks and ensure the integrity of the procurement process

10. In line with the government's fiscal policy, the Central Budget Authority should ensure that the project is affordable and the overall investment envelope is sustainable.

11. The project should be treated transparently in the budget process. The budget documentation should disclose all costs and contingent liabilities. Special care should be taken to ensure that budget transparency of Public-Private Partnerships covers the whole public sector.

12. Government should guard against waste and corruption by ensuring the integrity of the procurement process. The necessary procurement skills and powers should be made available to the relevant authorities.

Source: OECD (2012[28]), "Recommendation of the Council on Principles for Public Governance of Public-Private Partnerships", OECD Publishing, Paris.

Contractual practices in the digital era need to shift towards more overarching contracts, better mastering their usage and more systematic socio-economic evaluation. While public and private sectors used to operate in siloes, transversal and overarching contracts are now urgently needed to adopt a multi-service approach. In addition to including more performance obligations in the contracts, the public sector also needs to strengthen its capacity to monitor their private partner. Finally, more systematic socio-economic evaluation can help better assess the externalities from the citizens' point of view and to shift from ex ante to ongoing evaluation.

Re-regulation vs. de-regulation

Re-regulation is sometimes necessary rather than instead of de-regulation. In particular, technology companies often control a very large share of their markets, which raises the question to what extent 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 hand, newcomers may complain that rules and regulations designed for traditional market practices are being applied to newly evolved business models in inappropriate ways. On the other hand, there is a gap in rules and regulations for new business models for traditional market players, giving them an unfair advantage. Regulation needs to adjust to new risk sharing and financing conditions as well as support more innovative contracts. This could consist in a mix of traditional regulation (prohibitive) and regulation of co-operation.

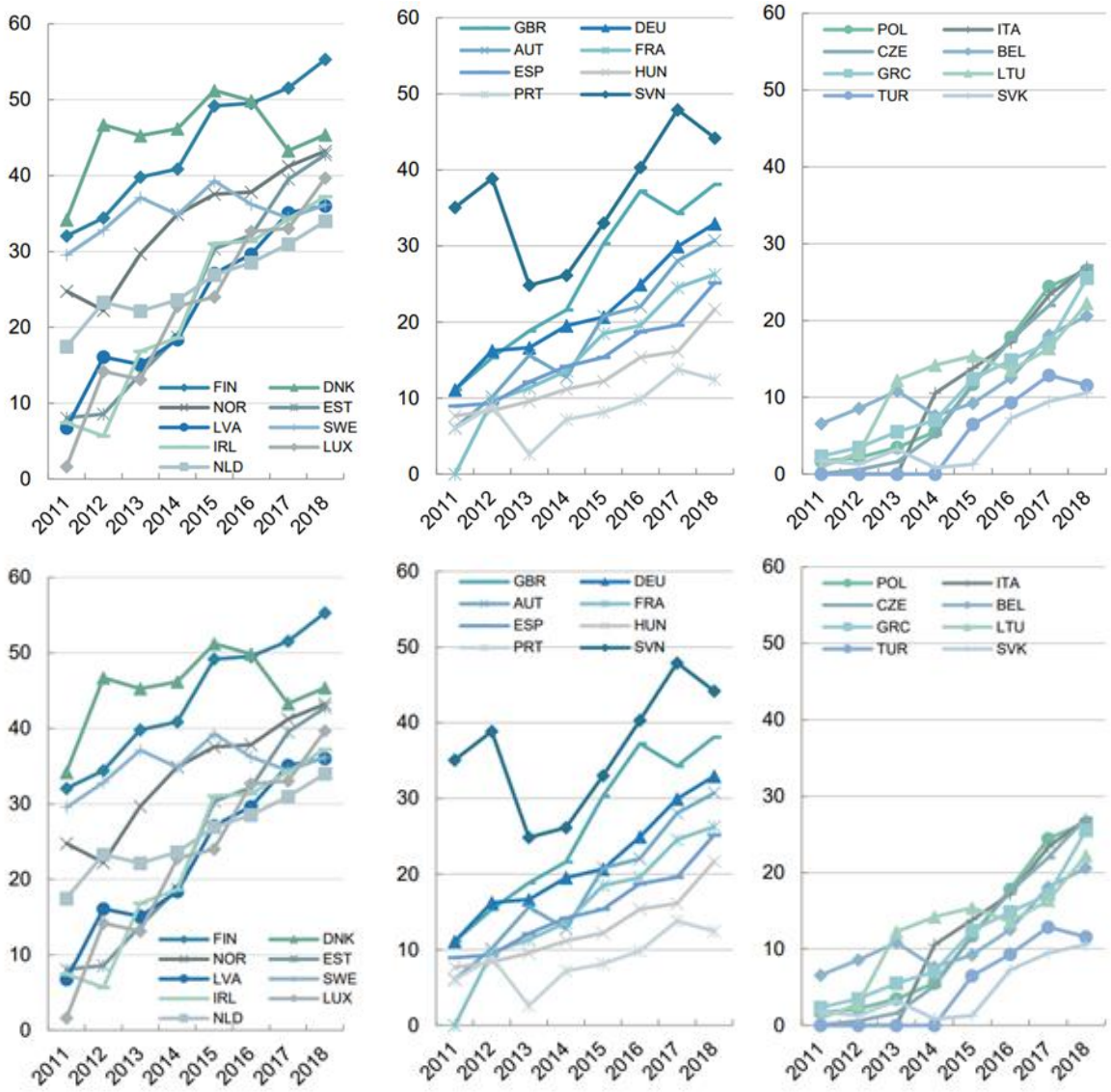
Supporting SMEs

Another aspect in which urban governance will need to shift in the face of digital innovation is in the support given to small and medium enterprises (SMEs). SMEs can face both opportunities and challenges in the transition toward smart. Digital technologies can allow SMEs to improve their market intelligence, reach scale without mass, and access global markets and knowledge networks at relatively low cost (OECD, 2017[30]). The digital age also opens up new opportunities for SMEs to enhance their competitiveness in local and global markets, through product or service innovation and improved production processes. However, in reality many SMEs have not been able to harness the benefits of the digital transition. Evidence shows that SMEs are lagging behind in adopting digital technologies. While, in most countries, the divide is narrow in terms of simple connectivity and web presence, the gap broadens when considering

participation in e-commerce and, especially, more sophisticated applications. For instance, divides in high-speed broadband adaptation between large and small firms are widening (Figure 4.1).

Figure 4.1. Divides in high-speed broadband adoption are widening

Difference in penetration rates between small and large firms, percentage points (%), 2011-18



Source: OECD (2019[31]) OECD SME and Entrepreneurship Outlook 2019, OECD Publishing, Paris.

It is therefore key to support business dynamism by giving opportunities to small business to ensure a broad innovation base and expand it across a city's entire ecosystem. The impact of smart city policies on reducing inequalities and bridging the digital divide is a critical aspect to assess and monitor over time.

Making public procurement smarter

Smart cities also offer an opportunity to rethink public procurement as a tool to achieve more sustainable and inclusive urban development. Public procurement represents 12% of total government spending in

OECD member countries on average, even reaching around 14% in European countries. Digital innovation is offering a chance to make public procurement greener, more innovative and more inclusive. It requires looking at the whole procurement cycle, including not only legal tendering and bureaucratic processes, but also the maintenance, in an effort to ensure effective and efficient public procurement that contributes to social, economic and environmental goals. As shown by the experience of **ICLEI's Sustainable Procurement Centre**, most solutions tend to come before any call for tenders and the pre-procurement stage matters just as much as the procurement stage.

One challenge lies in hiring procurement officials and building their capacities to harness digital technologies for procurement. In this respect, the OECD Recommendation of the Council on Public Procurement has recognised the importance of harnessing digital technologies for public procurement, recommending adherents to "improve the public procurement system by harnessing the use of digital technologies to support appropriate e-procurement innovation throughout the procurement cycle." More specifically, it recommends to:

> *"i) Employ recent digital technology developments that allow integrated e-procurement solutions covering the public procurement cycle. Information and communication technologies should be used in public procurement to ensure transparency and access to public tenders, increasing competition, simplifying processes for contract award and management, driving cost savings and integrating public procurement and public finance information.*
>
> *ii) Pursue state-of-the-art e-procurement tools that are modular, flexible, scalable and secure in order to assure business continuity, privacy and integrity, provide fair treatment and protect sensitive data, while supplying the core capabilities and functions that allow business innovation. E-procurement tools should be simple to use and appropriate to their purpose, and consistent across procurement agencies, to the extent possible; excessively complicated systems could create implementation risks and challenges for new entrants or small and medium enterprises" (OECD, 2015[32]).*

Removing barriers to economic development through Minimal Interoperability Mechanisms (MIMs)

While significant innovation is being produced, it is often not transferable between cities because a city is not a market, thus deployment of a smart initiative in a different city requires another set of solution design. Minimal Interoperability Mechanisms (MIMs) can help create a smart city market by offering a set of common, real-time application programming interfaces (APIs) to access data, context information to structure data, as well as a common but optional data platform to store and serve data. The goal is to help cities move from best practices to self-implementation. The MIMS developed by **Open & Agile Smart Cities** has three main components: context information management; common data models; and ecosystem transactions management (marketplace mechanisms regarding who gets access to which kind of data and how). The MIMS have already been adopted by 140+ cities worldwide, 26 of which are in operation.

Moving from siloes to integrated approaches of smart cities at the functional scale

Implementing smart solutions in cities to harness the benefits of digital innovation requires managing issues that do not necessarily match ministerial or institutional portfolios but rather cut across them. Both the challenges of smart cities and potential solutions go beyond territorial or institutional boundaries. Leveraging the digital transformation thus requires bridging policy silos. Digitalisation provides cities with an opportunity to enhance their organisational and administrative capacity to overcome common challenges in an increasingly constrained fiscal context. It is also important to mention a potential need to modify the classical management rules that are in force in local authorities, and cities where public management rules impose "siloes" by implementing an agile management or by implementing a reform in some current management rules.

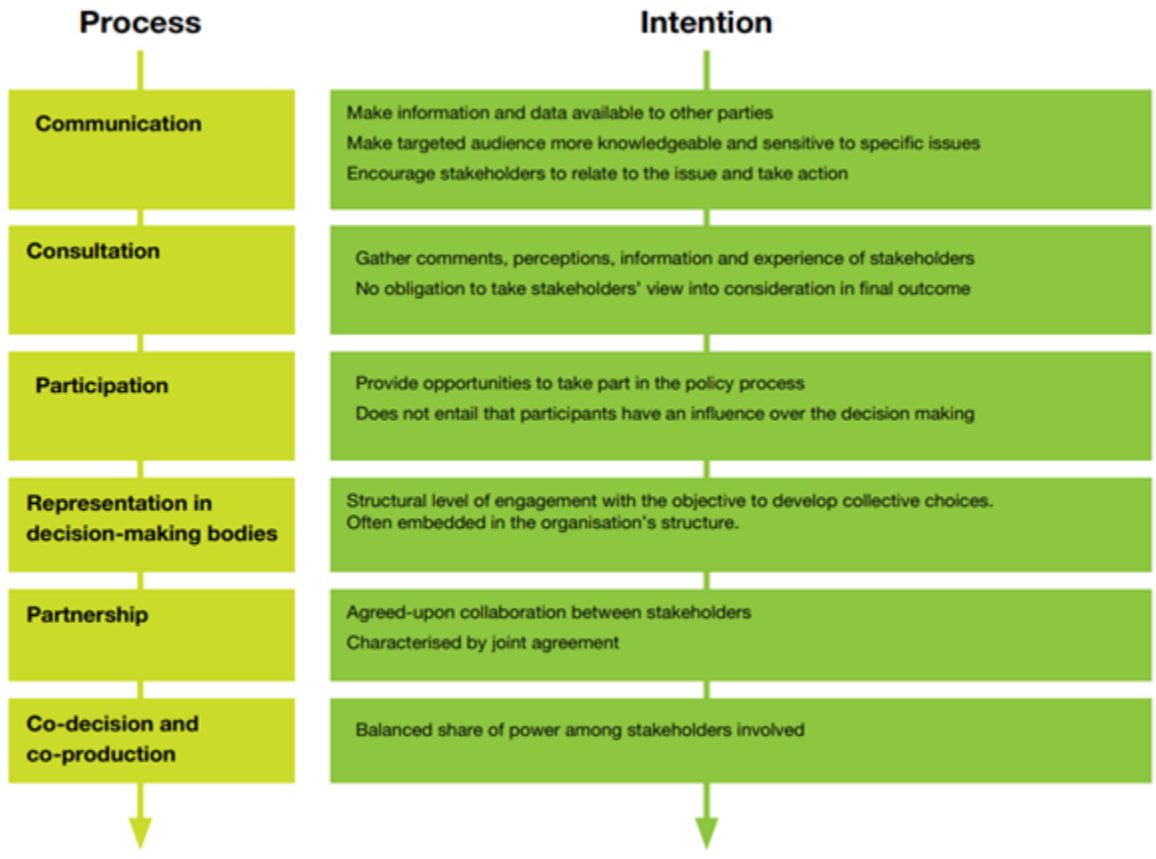
Engaging citizens in smart cities

A continuum of mechanisms to engage stakeholders

Digital technologies are offering new tools to engage citizens and other stakeholders in the definition of the main urban challenges and potential solutions. Citizen and stakeholder engagement can take place on different levels within a continuum of mechanisms through which engagement can take place. Engagement modalities vary from basic communication of information, which represents the weakest form of engagement, to full co-production, co-delivery and co-evaluation, which implies a balanced share of powers among the stakeholders (Figure 4.2). While each of these modalities of engagement has different objectives, impacts and necessary tools for implementation, digital technologies can improve citizen engagement on all levels. Smart cities that put citizens at the centre can therefore serve as a vehicle for social change and sustainability, as illustrated by the experience of the **MegaCities-ShortDocs – Films4SustainableWorld**. This initiative identifies short documentaries raising awareness about the challenges of megacities and associated existing social and environmental solutions around the world.

The governance of smart cities requires addressing important social challenges, for example in terms of ensuring digital inclusion in new forms of public participation. The role of physical “third places” (neither home nor work) to promote knowledge exchange and new skills development is still critical, even in the digital era. Engagement needs to go beyond simply listening to citizens and implies *co-constructing* public policies with citizens.

Figure 4.2. Levels of stakeholder engagement



Source: OECD (2015[34]), *OECD Studies on Water: Stakeholder Engagement for Inclusive Water Governance*, OECD Publishing, http://dx.doi.org/10.1787/9789264231122-en.

Putting new data at the service of smart cities

The uptake of new technologies, including cloud computing, social media and mobile technology, has brought about new forms of public engagement. Digitally enabled participation is changing people's expectations about their relationship with governments. The OECD Recommendation on Digital Government Strategies highlights the need for a shift from the government simply anticipating the needs of citizens and businesses towards citizens and businesses determining their own needs and addressing them in partnership with governments.

Data can help enable citizen-driven approaches, for example through open government data and crowdsourced data. Leveraging *Open Government Data* (OGD) for more inclusive policy making implies adopting community-oriented approaches to engage non-government actors, such as civil society, academia and businesses. Various country experiences in the OECD can offer interesting insights in this regard (Box 4.2). Moreover, governments increasingly use *crowdsourced data* to get real-time detailed information on public service delivery and infrastructure needs, and facilitate adequate 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 or any other urban challenges. One such example from the Roundtable was the application developed by the city of Curitiba (Brazil), which allows residents to send photos with GPS location to the city services to solve any type of urban management issue that they encounter.

Box 4.2. Community-Based Approaches To Open Government Data (OGD) In OECD Countries

UK: The United Kingdom has championed a user-oriented approach to open data release in a range of ways, including: establishing a public inventory of government data; creating an online data-request process (through data.gov.uk) so that citizens can directly apply for datasets; establishing an Open Data User Group (made up of government representatives, civil society, academia and business stakeholders) to advise government on public sector data that should be prioritised for release as open data, and the Release of Data Fund to remove barriers to releasing public data, support projects that build capacity among data owners, and build new platforms and services with open data. The government is now exploring ways to further embed these mechanisms into its approach to open data release.

France: In France, the Prime Minister's Open Government Data unit Etalab holds monthly lunch-time events (Bonjour Data) that are free for any interested parties to attend and discuss ideas and issues around OGD (https://www.etalab.gouv.fr/qui-sommes-nous). In parallel to this unstructured, open-for-all set of meetings, the French government has been actively engaging government and non-government actors through its DataConnexions network.

Germany: The German government held a public consultation in 2015 about the directions to take on Open Government Data (www.open-data-aktionsplan.de/). Germany has had a beta version of its open data portal in place for some time (www.govdata.de/). The public online consultation represents an intensified commitment to OGD and allows the public to influence the national government's open data action plan for the near future. It is important to underline that this online consultation is only one step of a larger process that will now lead to workshops, drafting of an action plan and eventually resubmission of the draft action plan for public consultation before it becomes the German federal government's official action plan.

Spain: In Spain, a number of collaboration channels have been established among actors of the open data community the Public Private Partnership Forum on the Re-use of Public Sector Information, an open web community for partnerships between different stakeholders, and a virtual community of public

administrations. These communities address issues that might hamper the publication of information (technological, regulatory and standardisation of information) and share good practices. Moreover, they collaborate in the activities related to open data, including the Catalogue of Public Information datos.gob.es, currently with 8 492 datasets; initiatives of promotion and support, training, and participation in national and international events; and the DCAT-based standard for interoperability. Spain received the Award for Innovation in Public Administration 2013 and the EU Prize LAPSI platform 2012.

Source: OECD (2015[33]), "Policy Shaping and Policy Making: The Governance of Inclusive Growth", OECD Publishing, Paris

Urban governance must also protect the interests of citizens while encouraging innovation and competition. With uncertainty over how laws and regulations pertain to the digital economy, some municipalities have either restricted or barred sharing platforms from operating, for example by putting limits on Uber services or the number of days residents can rent out their properties on accommodation sharing sites. With citizens increasingly concerned about the potential misuse of their data, privacy and ownership have become major priorities in the smart city agenda. The shift from an economy of infrastructure to an economy of users and applications will only work if data is perceived as being in safe hands. If misuse of data and insufficient citizen engagement trigger mistrust, social change may stall.

An OECD survey on Innovation Capacity in Cities (OECD, 2019[34]) demonstrates that making data actionable remains a concern for cities. Cities produce a large amount of data, and these data have the potential to improve the way cities operate. However, survey results show that data availability by policy sector remains uneven. Cities collect more data on areas such as transport (64%), policing and law enforcement (57%), land use/zoning (51%), and housing (47%). Cities collect less data on areas such as social welfare and inclusion (32%), blight (29%), tourism (29%), and culture (20%). This is likely due to the differing natures of these policy sectors, since law enforcement and transportation are more easily quantified according to statistical metrics than cultural work, which is likely to produce qualitative assessments.

Sharing and upscaling smart city solutions for the benefit of all

Many smart city projects are at a showcasing stage and need to be expanded if they are to achieve the intended policy goals. Some innovative projects that are currently tested as pilot projects enjoy special conditions in terms of budget, human resources and regulatory frameworks, which will no longer be available when the projects are scaled up. Effective upscaling will require a balance between desired policy goals and constraints, as well as carefully designed strategic steps to develop pilot projects at a larger scale (WHO, 2010[35]) (Box 4.3).

Box 4.3. Nine steps for developing a scaling-up strategy

Step 1. Planning actions to increase the scalability of the innovation

Step 2. Increasing the capacity of the user organization to implement scaling-up

Step 3. Assessing the environment and plans to increase the potential for scaling-up success

Step 4. Increasing the capacity of the resource team to support scaling up

Step 5. Making strategic choices to support vertical scaling up (institutionalization)

Step 6. Making strategic choices to support horizontal scaling up (expansion/replication)

Step 7. Determining the role of diversification

Step 8. Planning actions to address spontaneous scaling up

Step 9. Finalizing the scaling-up strategy and identifying next steps

Source: WHO (2010[35]), *Nine Steps for Developing a Scaling-up Strategy*.

Although new smart city projects are launched every day, many of them are small pilots with no potential for upscaling and fade out after a subsidised stage Vilajosana et al. (2013[36]).

Winden and Buuse (2017[37]) propose three upscaling types for smart city solutions. Among them, two are related to smart city projects from regional perspective: expansion and replication. First, *expansion* means that a pilot project is further deployed with new partners or users, or by enlarging its geographical coverage. This type of upscaling is more likely to occur with transport or energy projects, for example. Second, *replication* means that a pilot project is reproduced in another context, for example in other areas. Key factors for upscaling include:

- Ambidextrous management. Upscaling requires proper management to ensure the transition from a pilot stage to an exploitation stage. Different competencies are required at each of the two stages.
- Knowledge transfer. By nature, upscaling requires transferring “know-what” and “know-how” from one place to another. In this regard, a contextualisation of knowledge and understanding of different cultural contexts matter for successful upscaling.
- Regulatory and legal frameworks. In the case of public procurement, for example, a local government can be a launching customer when a pilot project yields a good result, and then contribute to the upscaling. However, public procurement regulations can imply that companies from the successful pilot projects cannot take for granted that they will win the bid for the upscaling stage.
- Data interoperability. Smart city projects heavily depend on data exchange between organizations and systems. Therefore, upscaling is hindered when there are no widely accepted technical standards.

Applying this framework to the case of smart city policies in Korea offers some interesting insights. Overall, Korea’s environment for promoting smart cities still has some advantages over other international contexts. Due to rapid economic growth, new cities and old declining cities coexist in Korea, which means that different models of smart cities can be applied as appropriate (Lee and Chang, 2019[10]). Korea also has abundant experience in transitioning from pilot projects to large scale ones. As discussed earlier, fifty cities and counties had implemented some form of ubiquitous city (U-City) project by 2012, and more than sixty smart cities are currently identified. This diversified environment has allowed the Korean government to develop ambidextrous management. Furthermore, by transplanting smart city projects from one city to another, knowledge has also been contextualised. Legal reforms (shifting from a U-City law to a smart city law), shifting from a construction-driven approach to a connection/enhancement oriented approach, and recent deregulation (through “regulatory sandboxes”) offer good assets to expand and replicate Korean smart cities abroad. On the other hand, as Walravens and Ballon (2013[38]) argue, a lack of interoperable technological platforms to manage data, i.e. technical compatibility issues, can also be a barrier to expand the Korean smart city model to other countries. Lessons from Korea, particularly from the U-City experience, suggest that cities need to define what kind of smart city they want to be and what goals it

seeks to achieve before determining smart city policy instruments. In this context, the role of the government is to create an optimal environment for new potential businesses, for example by removing regulatory obstacles, establishing an open data policy to increase citizen participation and setting up global networks to facilitate global market access. A data platform that enables data sharing and data integration is a critical factor for creating innovative urban ecosystems.

5 Ways forward

The digital revolution is offering an unprecedented window of opportunity to improve the lives of millions of urban residents today and tomorrow. But there is no guarantee that the rapid diffusion of new technologies will automatically benefit citizens across the board. The need to link smart cities to inclusive growth and the enabling role that national governments can play to support innovative solution delivery, capacity building and upscaling smart city efforts. Challenges relate to adequately measuring smart city efforts and key dimensions shape effective measurement, including the issue of scale (FUAs) and awareness about different types of measurement (benchmarking, self-assessment, etc.). From a governance perspective, business and contract models need to be more flexible to adapt to rapidly changing urban environments. Finally, given the wide range of citizen engagement mechanisms, it is important to match the tools to the type of engagement and involve stakeholders throughout the policy cycle.

Going forward, the OECD Smart Cities Programme will seek to support local and national governments with metrics, best practices and policy recommendations to help leverage digitalisation to deliver better results and impact for residents in cities, including to tackle and rebound from the COVID-19 crisis.

During the final session of the 1st OECD Roundtable on Smart Cities and Inclusive Growth, participants were divided into three small groups and engaged in an interactive discussion to co-shape the next steps of the OECD Programme on Smart Cities and Inclusive Growth.

What activities/outputs/deliverables on smart cities and inclusive growth would be most relevant/useful?

Guidelines and principles were chosen as the most relevant outputs, closely followed by indicators and a repository of best practices (Figure 5.1). Some challenged raised during the discussion included the difficulty of applying guidelines to different cities and the need to recognise the diversity of local contexts. It was also suggested to connect guidelines, indicators and best practices and to shape practical guidelines for their implementation. Participants stressed that the OECD's powerful convening power could help break down silos, support capacity building and develop a common framework on smart cities.

Figure 5.1. Activities, outputs and deliverables

Activities / outputs / deliverables			
Data/indicators			
88%	15/17 votes	**12%**	2/17 votes
Guidelines/principles			
84%	16/19 votes	**16%**	3/19 votes
Others: without specification			
71%	5/7 votes	**29%**	2/7 votes
Repository of best practices			
70%	14/20 votes	**30%**	6/20 votes
Workshop/events			
33%	5/15 votes	**67%**	10/15 votes
Synthesis report			
6%	1/17 votes	**94%**	16/17 votes
Others: Reports that are 100+ pages			
0%	0/1 vote	**100%**	1/1 vote

High priority

Low priority

Source: 1st OECD Roundtable on Smart Cities and Inclusive Growth.

Which players need to be engaged further to build smart and inclusive cities?

Cities were considered the most important players, but regional and particularly national governments also ranked high (Figure 5.2). It was recognised that all levels of governments face a lack in their capacity to address the challenges of building a smart city and that they need to work together. There was a divergence of choices related to the academia/research community and the financial sector, since they ranked both as high priority and as low priority. Concerning the private sector, it was suggested to make a distinction according to the scale and type of firms. The fact that citizens are not necessarily represented by NGOs was also highlighted.

Figure 5.2. Players

Players					
Cities					
	100%	12/12 votes		**0%**	0/12 votes
National government					
	100%	8/8 votes		**0%**	0/8 votes
Other: all					
	86%	6/7 votes		**14%**	1/7 votes
Regions					
	80%	4/5 votes		**20%**	1/5 votes
Private sector					
	63%	5/8 votes		**37%**	3/8 votes
Financial sector					
	38%	5/13 votes		**62%**	8/13 votes
Academia / research					
	23%	3/13 votes		**77%**	10/13 votes
NGOs					
	22%	2/9 votes		**78%**	7/9 votes

High priority
Low priority

Source: 1st OECD Roundtable on Smart Cities and Inclusive Growth.

Participants also suggested involving a wide range of players, such as start-ups and accelerators, the creative/artistic sector (e.g. start-ups, cultural industries), clusters, supranational entities and international or macro-regional organisations, think tanks and consultancy firms, national governments of developing countries, sectoral representatives (e.g. energy, water/waste water), public financial agencies, finance controlling players, blended finance, citizens and academic committees. It was reiterated that all players need to work together and that the OECD could play a major role in bringing national governments on board.

What successful examples can you share on smart cities and inclusive growth?

Examples and stories at city level were considered the most relevant, followed by those at civil society level and at national level (Figure 5.3). The lowest priority was given to initiatives “led by private sector”. Analysing examples of public-private partnerships was seen as particularly relevant.

Figure 5.3. Examples, cases and stories

Examples / cases / stories			
At city level			
92%	22/24 votes	**8%**	2/24 votes
Led by the civil society			
68%	13/19 votes	**32%**	6/19 votes
At national level			
50%	6/12 votes	**50%**	6/12 votes
Led by the private sector			
32%	6/19 votes	**68%**	13/19 votes
Others: all			
25%	1/4 votes	**75%**	3/4 votes

Source: 1st OECD Roundtable on Smart Cities and Inclusive Growth.

Participants also shared a large variety of interesting examples, cases and stories, including (but not limited to): the city of Paris (*Réinventer Paris*, *Quartier d'Innovation Urbaine* and the *Programme Accélérateur Ville Intelligente et Citoyenne*); the city of Nantes (Nantes City Lab); the city of Melbourne (love letters to trees); the city of Fujisawa (Sustainable Smart Town); the city of Amsterdam (sharing economy); Singapore (Smart Nation); Kigali (Smart Africa) in Rwanda; MIT (Tree Maps); Inclusiva Sella of Quito, Ecuador; the "Map me happy" initiative; etc. Participants also suggested examples of private companies working on smart cities projects such as Sidewalks, Cisco and others that are developing smart cities tools and running pilot initiatives such as education programmes for youth.

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Annex A. List of participants of the 1st OECD Roundtable on Smart Cities and Inclusive Growth

Table A A.1. Annex A. List of participants of 1st OECD Roundtable on Smart Cities and Inclusive Growth

Organisation	Title	Name	First name	Position
2THINKNOW	Mr	HIRE	Christopher	Director Data
Ansa Services	Mr	SAINT BRIS	Henry	Consultant
	Ms	GASQUET	Pauline	Consultant
Arup	Mr	DOYLE	Tom	Consultant
Belgium	Ms	GERARD	Sophie	Attachée, Délégation de Belgique auprès de l'OCDE
Bouygues Group	Mr.	FOREST	Emmanuel	Executive Vice-President, European and Institutional Affairs
	Mr	PITTI	Francois	Strategic marketing Group Director
Bpifrance	Ms.	VINÇON LEITE	Joana	Investment analyst
Brazil	Ms.	BARBOSA	Andrezza	Diplomat, Embassy of Brazil
	Ms	ALVES	Roseli	Policy Analyst, Federal Government
Canada	Ms.	KNECHT	Brigit	Senior Policy Advisor, Infrastructure Canada, Smart Cities Challenge
	Mme	CHOUINARD	Marie-France	Agent de programme
CEEP	Mr.	LE COUTOUR	Alexis	Chargé de mission Services Publics, European Centre of Employers and Enterprises providing Public Services and Services of general interest
CIAC	Mr.	DEVENOGE	Frédéric	Director
Cisco	Mr	BERNARD	Bruno	Public Affairs director
Cities Alliance	Mr.	MUDADI	Keith	Programme Analyst
Curitiba, Brazil	Mr.	PIMENTEL	Eduardo	Vice Mayor
	Mr.	SCHMEISKE	Oscar	Architect
Czech Republic	Ms.	REZKOVA	Karolina	Third Secretary - Education, Science and Innovation, Health, Social Affairs, Environment, Agriculture, Public Governance, Transport

	Dr.	HUSAROVA	Katarina	Civil Servant, Ministry of Regional Development
Danube University	Dr.	VIALE PEREIRA	Gabriela	Associate Researcher
ENGIE	Mr.	VANDENBERGE	Vincent	Head of Digital Platform Livin'
	Mr.	DRUMM	Eamon	Smart City Business Developer
	Mr	CHAPON	Sylvain	Strategic executive
ENPC	Mr	MHENNI	Mohamed	Student, École nationale des ponts et chaussées
ESSEC	Ms.	TCHERDAKOFF	Deyi	Senior Advisor to the Dean and President, École Supérieure des Sciences Economiques et Commerciales
EURECAT	Dr.	ELELMAN	Richard	Head of Politics
Eurocities	Ms.	BORDELOT	Federica	Policy Advisor
Federal University of Mato Grosso do Sul	Dr.	ABADI	Almotaz	Managing Director
Finland	Mr.	MAIJALA	Olli	Ministerial Adviser, Ministry of the Environment
FMDV	Mr.	HABEAU	Jean François	Executive Director, Global Fund for Cities Development (Fond Mondial pour le Développement des Villes)
France	Mr.	STORA	Florent	Counsellor for Education
	M.	TAUPENAS	Daniel-Yves	Conseiller gouvernance publique
Global Trust Registry	Mr.	PIVETTA	Guillermo	Eexecutive Vice President
Greece	Ms.	KOUTSOURI	Marina	Special Service for Strategy, Planning and Evaluation, Ministry of Economy & Development
Hungarian Energy and Public Utility Regulatory Authority	Ms.	FÖLDEÁK	Anna	Coordinator assistant
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ICLEI	Mr.	HIDSON	Mark	Global Director, Sustainable Procurement Centre
ICRAF	Dr.	MEHMOODULHASSAN	Muhammad	Head of Capacity Development, World Agroforestry Centre
IGES	Mr	KEOGH	Eric	CEO, Impact Global Emission Solutions
IHEID	Ms.	BHATIA	Shradha	Student, The Graduate Institute of International and Development Studies
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	Ms.	MILLET	Laure	Assistant, Permanent Delegation of Japan to the OECD
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	Mr.	KIM	Byoungsoo	Research Fellow of Smart City Innovation Center, Korea Agency for Infrastructure Technology Advancement
Korea	H.E.	KO	Hyoung-Kwon	Ambassador of Korea to the OECD
	Mr.	KWON	Hyuck Jin	Director General for Urban Policy Bureau, Ministry of Land, Infrastructure and Transport
	Mr.	BAE	Sungho	Director of Urban Economy Division, Ministry of Land, Infrastructure and Transport
	Mr.	JUNG	Jaewon	Senior Deputy Director of Urban Economy Division, Ministry of Land, Infrastructure and Transport
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Portugal	Mr.	AREOSA FEIO	Paulo	Counsellor
Positive Planet International	Dr	MILLS	Sophie	Director of Programmes
Raisecrown Group	Mr.	ROWAN	Peter	Strategy Sustainable Finance Advisor
Slovak Republic	Mr.	JURIK	Dusan	First Secretary
	Mr.	HORVATH	Martin	Advisor

Smart Cities Club	Mr.	JURIK	Miloslav	Chairman
Smart City Expo World Congress	Ms	GARRIDO	Cristina	Program Curator
Sogetrel	Mr	BOULLE	Thibault	Smart City Business Developer
Sorbonne Business School	Dr.	CHABAUD	Didier	Professor
	Mr.	SAGEOT-CHOMEL	Lucas	Secrétaire Exécutif
	Mr.	HAN	Seunghoon	Intern
SoteKo	Ms.	FIAMOR	Roxana Dela	Co-Founder/COO
SUEZ	Mr	HERVET	Bruno	Executive Vice President Smart & Resourceful Cities
	Mr.	AUDOUIN	Christophe	Competitive & strategic intelligence manager
	Ms.	LECLERC	Joannie	Dialogue and Societal Impact Director
	Mr	MUNOZ	Jose	V.P. Euro-Mediterranée
TrustBlock Solutions Ltd.	Dr.	FARIAS S.	Lorena	Director
Turin school of regulation	Dr	SBANDATI	Andrea	Consultant
Turkey	Mr	SARI	Volkan Idris	Expert, Ministry of Industry and Technology
TWI	Ms	MANTEL	Catherine	VP Business Development
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United Way Worldwide	Mr.	BERZONSKY	Gregory	Vice President of Global Engagement and Adviser to the President
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University Paris XII	Mr.	BORDEAUX	Pierre	Maitre de conférences associé
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