

# MEASURING SMART CITIES' PERFORMANCE

Do smart cities benefit everyone?



Scoping note

2nd OECD Roundtable on  
Smart Cities and Inclusive Growth

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# 1 Measuring smart cities' performance: Do smart cities benefit everyone?

While many cities have joined the “smart city” wave over the past two decades, digitalisation has taken centre stage over the past few months to shelter cities from the ever-persistent COVID-19 pandemic. Since the early stage of the outbreak, digital technologies made it possible to relay real-time life-saving information, keep essential public services running (such as healthcare through telemedicine) and bridge social isolation. With countries grappling with repeated episodes of lockdown at different scales and physical distancing requirements reshaping urban environments, many cities are expanding, accelerating and mainstreaming the use of smart city tools. In the longer term, the capacity to leverage the benefits of digital innovation for all will be critical to help cities rebound from the crisis and accelerate the transition to a new urban paradigm for a more sustainable and resilient future.

## Why measure smart cities' performance?

The OECD defines smart cities as “cities that leverage digitalisation and engage stakeholders to improve people’s well-being and build more inclusive, sustainable and resilient societies”. This definition underlines that digitalisation and digital innovation are not an end in itself, but rather aim to improve people’s lives to achieve greater inclusion, sustainability and resilience. By seizing the opportunities offered by the digital transition, including those coming from artificial intelligence, cloud computing and Big Data, smart cities can improve the lives of millions of urban residents, by enhancing people’s safety, increasing energy efficiency in housing, facilitating people’s access to goods and services, boosting participatory policy-making – and many more.

And yet, there is no guarantee that all smart city initiatives automatically improve everyone’s well-being. In some instances, digitalisation may bring about challenges and threats, including (Figure 1):

- **Privacy risks:** while data offers a remarkable asset and opportunity for smart cities, it also entails both a weakness for those cities that have a weaker capacity to collect, store or use data, and a threat when considering privacy concerns related to the storage and use of personal data.
- **Regulatory challenges:** the advent of smart cities is disrupting established models of urban governance because data-driven smart city initiatives may shake traditional notions of urban governance, notably in terms of fair competition, labour laws, government contracts and regulation. The wealth of data that could be collected in cities has the potential to help deliver services more efficiently, but only if the right policy frameworks and regulations are in place to harness benefits and avoid risks.
- **Widening inequalities:** more fundamentally, if the needs of all population groups are not taken into account, smart city initiatives may deepen the digital divide between people who have access to technologies, digital skills and information – who can therefore reap the benefits brought by digitalisation – and people who lack the necessary access and find themselves left behind.



Measuring the performance of smart cities is therefore essential to ensure their effectiveness. With the COVID-19 crisis severely crunching municipal budgets, it is more critical than ever to devise cost-effective solutions to deliver public services. Assessing smart city performance also helps ground policy intervention in solid evidence by guiding decision makers, both at national and local levels, in setting realistic targets, understanding where cities stand vis-à-vis their objectives, tracking progress and adjusting policy interventions for greater efficiency and effectiveness. Ultimately, smart city measurement enhances accountability and helps citizens monitor how governments deliver on their commitments. In this respect, measuring smart city performance is a way to implement Principle 11 of the OECD Principles on Urban Policy, which were welcomed by mayors and ministers of urban policy across OECD countries in March 2019: “Foster monitoring, evaluation and accountability of urban governance and policy outcomes”.<sup>1</sup>

Figure 1. SWOT analysis of smart city initiatives in OECD countries



Source: (OECD, 2020<sup>[1]</sup>)

<sup>1</sup> For further information, see <https://www.oecd.org/cfe/urban-principles.htm>.

## What existing measurement frameworks of smart cities tell us

Many institutions, organisations and sometimes cities themselves have worked on measuring smart cities through a variety of frameworks. In particular:

- **Measurement frameworks tend to use a large number of indicators.** A recent literature review of smart city indicators identifies as many as 1 152 different smart city indicators (Petrova-Antonova and Ilieva, 2018<sup>[2]</sup>). For example, the indicator framework for sustainable, resilient and smart cities, called “Sustainable development in communities – indicators for smart cities” developed by the International Organisation for Standardisation (ISO) has 85 indicators. Another example lies in the 91 Key Performance Indicators (KPIs) for Smart Sustainable Cities (SSC), developed by the United for Smart Sustainable Cities (U4SSC), a UN initiative co-ordinated by ITU (International Telecommunication Union), UNECE (United Nations Economic Commission for Europe) and UN Habitat. CITYKeys has also developed a measurement framework on the performance of smart cities targeted at European cities and includes 75 indicators.
- **Smart city indicators often cover many different dimensions.** For example, Petrova-Antonova and Ilieva (2018<sup>[2]</sup>) classify the 1 152 indicators that they identified into six main categories: nature, governance, economy, mobility, people and living. In their analysis of six internationally applicable standardised frameworks of smart cities, (Huovila, Bosch and Airaksinen, 2019<sup>[3]</sup>) list the following dimensions: natural environment, built environment, water and waste, transport, energy, economy, education, culture, innovation and science, health, well-being and safety, governance and citizen engagement, and ICT. The ISO indicator framework for smart cities has 19 dimensions, including economic, environmental and social dimensions (ISO, 2019<sup>[4]</sup>). The KPIs for SSC developed by U4SSC (2020<sup>[5]</sup>) cover three dimensions – economy, environment, and society and culture – and each of these dimensions is broken down into sub-dimensions. The CITYKeys (2015<sup>[6]</sup>) framework is broken down into five dimensions: people, planet, prosperity, governance and scalability/replicability.
- **Measurement frameworks also differ in the type of indicators that they use.** Some frameworks measure the *inputs* related to smart cities, i.e. the amount of resources that are allocated to smart cities. Some others assess the *outputs* of smart cities, which evaluate progress in implementing smart city solutions, for example via the percentage of households equipped with smart electricity metres. Others measure the *outcomes* of smart cities, i.e. the impact of smart city solutions on achieving smart city objectives. For example, the ISO indicator framework focuses on smart enabling technologies, while the KPIs for SSC include both output and outcome indicators. CITYKeys’ indicators are mostly outcome indicators, i.e. they measure progress towards policy objectives such as CO<sub>2</sub> emissions per capita per year or the percentage of population living in affordable housing. Box 1 offers a brief overview of input, output and outcome indicators.
- **The reach of measurement frameworks varies in practice**, particularly in terms of geographic focus, scale of analysis, main target audience (city authorities, smart city developers or investors), and if and how any evaluation is carried out. For example, while CITYKeys’ framework focuses on European cities, ISO’s and U4SSC’s frameworks aim at reaching cities globally. Many frameworks provide self-assessment tools, such as the U4SSC KPIs, CITYKeys and the ISO standards, together with recommendations for their implementation.

### Box 1. Input, output and outcome indicators

Indicators can be classified into three broad categories according to what they measure: input indicators, output indicators and outcome indicators.

**Input indicators:** Input indicators measure the amount of resources that are allocated to a policy. Typical input indicators are the funds spent on a certain policy or the number of people working on a project. Input indicators therefore provide a measure of the effort that is devoted to pursuing a policy but they do not give any information whether the resources are efficiently spent or whether a policy is effective in achieving an objective.

**Output indicators:** Output indicators measure quantities produced by a policy in order to achieve its objectives, but not progress towards the policy objectives. Outputs are therefore means to achieve a policy objective, but no ends in themselves. Typical output indicators might show the number of motorway kilometres built, the number of people trained to fulfil a task, or the percentage of households equipped in smart energy metres. Output indicators do not tell whether a policy is effective in achieving its desired objective or not.

**Outcome indicators:** Outcome indicators monitor the effectiveness of a policy in achieving its objectives. While outcomes are the underlying motivation behind policies, they can only be affected through the inputs and outputs. Typical outcome indicators might be the reduction in commuting time to the place of work, satisfaction with life or the city, or energy savings.

Source: (OECD, 2016<sup>[7]</sup>).

## What can the OECD bring?

This preliminary overview of existing measurement frameworks on smart cities demonstrates the variety of approaches to assess the performance of smart cities. It also suggests the many complexities faced when attempting to gauge the performance of smart cities. For example, such complexities are related to:

- **Measuring the performance of smart cities *per se*:** Some indicators measure the *degree* of digitalisation in cities, but not the *impact* of digitalisation. Other indicators measure the performance of cities against broad policy objectives that are not necessarily linked to smart city initiatives. Furthermore, it is difficult to assess the link between digitalisation and its impacts on the various dimensions of well-being. For example, some frameworks measure the percentage of households that are equipped with smart energy meters, and other frameworks measure energy consumption per capita, but evidence of the impact of smart meters on energy consumption at the city level remains scarce.
- **Reflecting all dimensions of smart cities' objectives:** Some indicators measure certain dimensions of quality of life (e.g. environmental, economic, social), but they are often incomplete and miss other key aspects such as *inclusion*.
- **Capturing stakeholders' engagement:** Most frameworks or indicators do not consider the degree of *stakeholders' involvement* (e.g. governments, civil society, private sector, academia, etc.) in the design of smart cities. Putting people at the centre of smart cities means co-constructing policies with residents throughout the policy cycle, but this dimension is often omitted in their measurement.
- **Building frameworks that all levels of governments can use:** It is a challenge to shape fully harmonised smart city measurement frameworks that both national and local governments can deploy to measure the performance of smart cities.

- **Comparing cities among themselves:** The lack of harmonised territorial units of analysis often limits international comparability across cities, which in turn constrains the potential for peer-to-peer learning, monitoring progress and partnerships.

Measuring smart city performance is therefore a very complex task. An ideal, harmonised measurement framework for smart cities would need to: (i) allow to capture the impact of digital innovation in cities on outcomes for residents across multiple sectors; (ii) assess whether smart city initiatives benefit everyone rather than selected population groups; (iii) take into account stakeholders' engagement; (iv) be usable by national and local governments alike; and (v) monitor progress over time and across places in a comparable way.

With a view to reach such objectives, the proposed OECD Smart City Measurement Framework can build on existing OECD data and analysis in terms of digitalisation, well-being and inclusiveness (Box 2):

- **OECD work on digital innovation**, notably through the [OECD Going Digital](#) initiative, which analyses not only the degree of digital development, but also the impact of digital innovation on people's lives and well-being (see [How's life in the digital age](#), based on the multi-dimensional [OECD Well-being framework](#)).
- **OECD work on well-being, inclusion and sustainability**, with the recent creation of the [OECD Centre on Well-being, Inclusion, Sustainability and Equal opportunities](#) (WISE). By leveraging the [OECD Inclusive Growth](#) framework, the WISE Centre is collecting new data and information on people's perceptions of income inequality and aims to help align public spending on serving the needs of all people.
- **OECD's expertise in measuring well-being at the territorial level** by using harmonised territorial units of analysis, allowing therefore for **international comparability**. [Functional urban areas](#) (FUAs) encompass how cities "function" economically, based on daily people's commuting flows, rather than how they are delineated by administrative boundaries (Dijkstra, Poelman and Veneri, 2019<sup>[8]</sup>). This joint EU-OECD definition of cities allows for comparisons between cities in different countries, as national definitions of cities are rarely consistent across countries and they rely on administrative or legal boundaries that do not necessarily reflect the functional and economic extent of cities. The [OECD regional well-being](#) work and the OECD web tool for [Measuring the distance to the SDGs in regions and cities](#) allow for assessing well-being levels and the achievement of SDGs where they matter, at the local level.

### Box 2. Selected relevant OECD work for the OECD Smart City Measurement Framework

**Going Digital Toolkit** (OECD, 2019<sup>[9]</sup>) helps countries assess their state of digital development and formulate policy strategies and approaches in response. The toolkit is structured along the seven policy dimensions of the Going Digital Integrated Policy Framework (access, use, innovation, jobs, society, trust, market openness), which cuts across policy areas to ensure a whole-of-economy and society approach to realising the promises of digital transformation for all. It also underlines that digital technologies improve well-being as they spread throughout industries, markets and society.

**How's life in the digital age** (OECD, 2019<sup>[10]</sup>) documents how the ongoing digital transformation is affecting people's lives, based on the multi-dimensional framework used in *How's Life? Measuring well-being* to monitor progress in key dimensions of people's well-being. The aspects of the digital transformation in *How's life in the digital age* sometimes go beyond the outcome indicators under each dimension of the OECD well-being framework. The report therefore presents a range of indicators aiming to capture the most visible impacts of digitalisation on the most salient aspects of people's life.

**The OECD Better Life Index** considers people's living conditions and quality of life today (current well-being) and the resources that will help people's well-being over time. It puts people at the centre of the assessment and focuses on well-being outcomes – i.e. aspects of life that are directly and intrinsically important to people, rather than the inputs and outputs that might be used to deliver these outcomes. It reports both averages and inequalities, and it captures both objective and subjective aspects of life (OECD, 2017<sup>[11]</sup>) and (OECD, 2020<sup>[12]</sup>).

**The OECD Framework for Policy Action on Inclusive Growth**, developed in response to the 2017 OECD Ministerial Council Meeting, is designed to help countries achieve growth on a sustainable basis with rising living standards while respecting environmental boundaries, by providing equal opportunities to all. Moving beyond GDP metrics and statistical averages, this framework puts people at its centre, focuses on well-being outcomes, and emphasises the distribution of outcomes across the population. The Framework highlights three key dynamics that policies can help to catalyse, including: (i) Investing in people and places that have been left behind; (ii) Supporting business dynamism and inclusive labour markets; and (iii) Building efficient and responsive governments.

The **OECD regional well-being tool** provides information about where regions stand on 11 dimensions that matter for people's lives: jobs, income, education, health, civic engagement and governance, safety, access to services, environment, housing, community and life satisfaction (OECD, 2020<sup>[13]</sup>). The tool allows for measuring present well-being and its evolution over time in a region and compare it with 394 other OECD regions based on 13 headline indicators.

**Making Cities Work for All** (OECD, 2016<sup>[14]</sup>) includes a chapter dedicated to the issue of how to measure well-being and inclusiveness in metropolitan areas. Well-being indicators cover several dimensions of people's life, which are grouped into two major policy domains: the first relates to expanding opportunities for people through inclusive education, labour market and income; the second relates to an inclusive urban environment through policies for housing, transport, service provision and subjective measures. Inclusiveness in metropolitan areas is assessed in terms of income inequality.

**Measuring the distance to the SDGs in regions and cities.** The OECD has developed a visualisation web tool to help policymakers measure the distance of regions and cities towards the SDGs (see <http://www.oecd-local-sdgs.org>). The tool covers around 600 regions and 600 cities from OECD and partner countries, and includes more than 100 indicators to monitor progress across the 17 SDGs. These indicators can be visualised individually or as a composite index (OECD, 2020<sup>[15]</sup>).

**The OECD Urban Principles toolkit** (under development) will aim to provide guidance to local and national governments in implementing the [OECD Principles on Urban Policy](#). It will support both cities and countries in assessing and benchmarking their urban policies within a holistic framework and build on good practices across OECD countries.



# 2 Proposal for an OECD Smart City Measurement Framework

Advancing the measurement of smart city performance calls for a comprehensive, multi-dimensional and flexible framework that serves local and national strategic priorities, as well as global sustainable development objectives. The proposed OECD Smart City Measurement Framework endeavours to respond to fundamental questions such as what to measure and how, and for whom the framework is intended. In particular, it aims to encompass not only the degree of digitalisation in cities, but also the level of stakeholders' engagement, and how both contribute to improving the well-being of all urban residents and building inclusive, resilient and sustainable cities. The measurement framework needs to serve as a tool to guide local and national governments in their efforts to reshape city governance, business models and stakeholder engagement through digital innovation.

## What does the OECD Smart City Measurement Framework aim to assess?

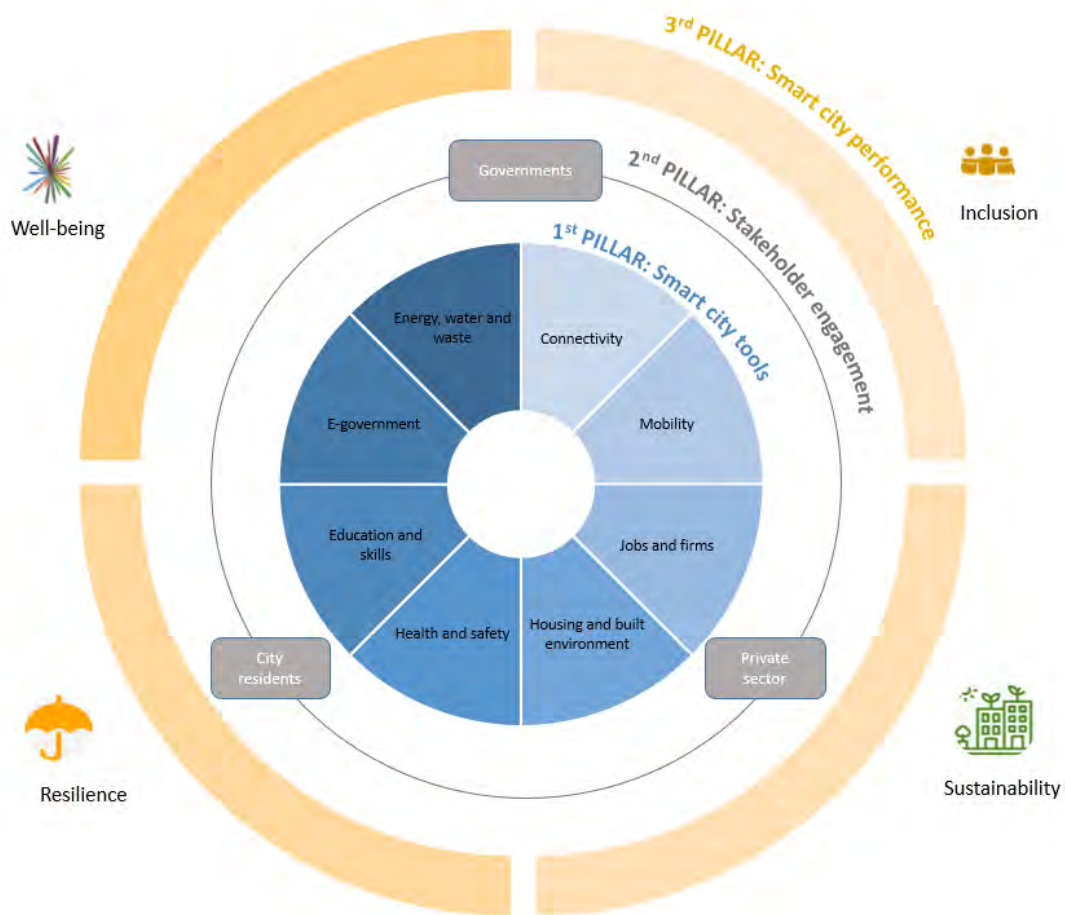
As recalled earlier, the OECD defines smart cities as cities that:

1. leverage digitalisation
2. engage stakeholders
3. to improve people's well-being and to build more inclusive, sustainable and resilient societies.

The OECD Smart City Measurement Framework proposed here will therefore revolve around these three aspects, which are mirrored in the following three pillars (Figure 2):

- **Pillar 1:** Indicators of the degree of digitalisation and digital innovation implemented at the city level (input and output indicators), i.e. the smart city tools
- **Pillar 2:** Indicators of the engagement of various stakeholders in building the smart city
- **Pillar 3:** Indicators of the four core objectives of the smart city (mainly outcome indicators), namely well-being, inclusiveness, sustainability and resilience that are shaped by the smart city tools and engagement (from Pillar 1 and Pillar 2).

Figure 2. OECD Smart City Measurement Framework



Source: OECD.

Bringing these three pillars together, the preliminary proposal for an OECD Smart City Measurement Framework proposes to:

- Focus on people and consider urban residents not only as recipients or users of smart cities, but also as designers of smart cities;
- Encompass not only digitalisation in cities, but also how digital innovation can improve well-being outcomes, inclusion, sustainability and resilience to address local and global urban challenges through digital innovation;
- Enable benchmarking of cities across countries;
- Allow monitoring over time.

The three pillars are briefly outlined in the sections below, together with preliminary sets of indicators proposed for each of them. Indicators should meet the following criteria: simplicity, measurability, availability and comparability across places and times.

### Pillar 1: Smart city tools

The first pillar of the OECD Smart City Measurement Framework addresses the first component of the definition of smart cities, i.e. **the degree of digitalisation and digital innovation implemented at the**

**city level.** As shown in the analysis of existing measurement frameworks of smart cities (see previous section), a wide range of indicators already exist on the degree of digitalisation in a city, covering a variety of areas.

The first step in the definition of Pillar 1 of the OECD Smart City Measurement Framework consists in identifying the needs of urban residents and what matters most to people in cities. Digital technologies are radically transforming the way people communicate, move around in cities, work, live in their homes, get healthcare and education, vote, and consume energy and water, among many other aspects of their lives. The proposed dimensions for the classification of the indicators on smart city tools therefore include: connectivity; mobility; jobs and firms; built environment; health and safety; education and skills; e-government; energy, water and waste.

The second step is the selection of indicators for each of these dimensions. Importantly, these indicators can be input or output indicators of digitalisation as defined in Box 1. Table 1 proposes a preliminary set of possible indicators on smart city tools. This selection of indicators will need to be further discussed and refined, particularly regarding their availability at the city level.

**Table 1. Suggested indicators for smart city tools**

Dimensions	Indicators
Connectivity	% households equipped with internet, wireless broadband coverage; % of households who use digital apps or platforms to connect to local community
Mobility	% of smart traffic lights; % of public transport equipped with real-time information; number of users of sharing economy transportation per 100 000 population; % of public parking spaces equipped with e-payment systems
Jobs and firms	% of job seekers who have access to e-career centres; expenditure in R&D
Housing and built environment	Open-source cadastral data; digital land-use and building permits
Health and safety	% of medical appointments conducted remotely; % of population registered with public alert systems for air and water quality; % of population with online access to their unified health file; % population equipped with real-time alert systems
Education and skills	% of children who have access to e-learning platforms; number of computers, laptops, tablets, or other digital learning devices available per 1 000 primary school students
E-government	% of city services available online; number of municipal smart stations installed per 100 000 population; % of payments to the city that are paid electronically
Energy, water and waste	% of households equipped with smart energy meters; % of buildings with smart electricity meters; % of smart street lights; % of households equipped with smart water meters; % drinking water under water quality monitoring by real-time water quality monitoring station; % of buildings equipped with smart waste systems

Source: OECD.

## Pillar 2: Stakeholder engagement for smart cities

The level of stakeholder engagement as an *input* to the process of shaping a smart city is also central to the OECD smart city definition. Key stakeholders of a smart city include:

- the city/local government (including co-operation with all levels of government);

- the city's residents (including NGOs and knowledge institutions such as universities); and
- the private sector (firms and entrepreneurs).

Stakeholder engagement and partnerships to boost civic engagement and leverage the role of the private sector in decision-making at the city level play a critical role in building smart cities. Stakeholder engagement can take place in different ways, ranging from basic communication and stakeholders' participation and feedback, to full co-production, co-delivery and co-evaluation, which implies a balanced sharing of powers among stakeholders. Digital innovation and technologies can also facilitate new forms of engagement with a broader range of urban residents and other stakeholders, and co-production throughout the policy design and implementation process.

Evaluating stakeholder engagement can have several benefits (OECD, 2015<sup>[16]</sup>), notably because it can help:

- Strengthen the accountability of decision makers by measuring whether public and institutional resources, including stakeholders' time and efforts, are properly used.
- Help determine whether the engagement process was successful and to inventory lessons learnt to improve practice in the future.
- Contribute to anticipating and managing some risks.
- Help map out the different views held by different stakeholders at the start of a process and identify potential challenges that the process may face.

Table 2 below outlines a set of indicators that can help gauge stakeholder engagement based on previous OECD work on Stakeholder Engagement for Inclusive Water Governance (OECD, 2015<sup>[16]</sup>). Moving forward, a survey to collect data from cities could also be envisaged, considering that stakeholder engagement is often difficult to measure and compare across countries.

**Table 2. Examples of indicators on stakeholder engagement**

Dimension	Indicators
Inclusiveness and equity	Informed and transparent identification and selection of stakeholders to be involved in the engagement process
	Broad outreach to inform individuals and organisations
	Stakeholders' motivations and expectations have been clearly identified (e.g. survey)
	Equitable share of representation among categories of stakeholders
Clarity of goals, transparency and accountability	Clear understanding of the framework of the engagement process in terms of line authority, proposed timeline, targeted objectives, expected outcomes, etc.
	Development of a master schedule
	Consistent and appropriate communication between promoters of the engagement process and the stakeholders involved
	Dissemination of concise summaries of stakeholder meetings
Capacity and information	Establishment of a website to educate stakeholders about how they can contribute
	Number of training sessions
	Summary reports are prepared using non-technical language
	Existence of mediation mechanisms
Efficiency and effectiveness	Regular monitoring throughout the engagement process
	Definition of performance measures to gauge the extent of stakeholder engagement
	Successful use of the inputs from the engagement process to achieve the desired outcomes agreed by stakeholders
	Fulfillment of the agreed-upon purpose of the engagement process
Institutionalisation, structuring and integration	Requirements for stakeholder engagement are in place within the organisation
	Charters and the rules of the game are clearly established
Adaptiveness	Outcomes of engagement processes cover short- and long-term issues
	Regular reassessment and establishment of new methods to address gaps where the engagement process is



Source: Based on (OECD, 2015<sub>[16]</sub>).

### Pillar 3: Smart city performance

As discussed in previous sections, the degree of digitalisation of a city does not make a city “smart” in itself. What is central to the smart city definition is how digitalisation helps achieve four core objectives, i.e. improve people’s well-being and foster more inclusive, sustainable and resilient societies. However, at the city level, measuring the impact of digital innovation on well-being, inclusion, sustainability and resilience may face conceptual and practical limitations, in particular:

- Impacts of digital innovation are difficult to isolate (i.e. there is no clear counter-factual), as technologies are evolving rapidly over time and digital transformation coincides with many other economic and social changes that affect well-being, inclusion, sustainability and resilience at the same time.
- The introduction of one smart city tool can have an effect on several outcome indicators at the same time. For example, public transit apps can improve people’s mobility and reduce commuting times, while also decreasing pollution if it fosters more use of public transportation modes. Smart energy meters can help optimise energy consumption, thereby decreasing greenhouse gas emissions and helping people save money on their energy bills at the same time.
- Smart city tools can have both positive and negative impacts at the same time. For example, the installation of surveillance cameras can increase safety, but may also raise privacy concerns.

Despite the difficulty of measuring the impact of digital technologies on well-being, inclusion, sustainability and resilience, evidence of the impact of smart city tools does exist, such as: telemedicine and remote patient monitoring on health outcomes; car-pooling and bike-sharing applications on air quality; smart surveillance on crime rate; water leakage smart detection on water consumption; job e-platforms on job market efficiency; real-time transport applications on commuting times, etc. (McKinsey Global Institute, 2018<sub>[17]</sub>).

The preliminary indicators suggested for smart city performance (Table 3) aim to reflect the four smart city objectives mentioned above, i.e. well-being, inclusion, sustainability and resilience. These indicators will determine what effect, if any, smart city initiatives in a given city have had on multiple dimensions of residents’ lives.

**Table 3. Suggested indicators for smart city performance**

Smart city objectives	Dimensions	Indicators
Well-being	Jobs	Employment rate (%)
		People satisfied with their job (%)
	Income	People with enough money to cover their needs (%)
	Housing	Overcrowding conditions (rooms per inhabitant)
		People satisfied with affordability of housing (%)
	Access to services	Performance of public transport network (ratio between accessibility and proximity to amenities or people)
		People satisfied with public transport (%)
		Average commuting time to place of work (minutes)
	Education	People from 25 to 64 years old with at least tertiary education (%)
	Political participation	Voter turnout (voters in the last national election as a % of the number of persons with voting rights)

	Health	Life expectancy at birth (years)
		People declaring good or very good health (%)
	Environmental quality	Exposure to PM2.5 in µg/m <sup>3</sup> , population weighted (micrograms per cubic metre)
	Personal safety	Percentage of population that feel safe walking alone at night around the area they live
		Transport-related mortality rates (deaths per 100 000 people)
		Percentage of population that have been assaulted or mugged in the previous 12 months
Community	People satisfied with their city (%)	
	People with someone to rely on in case of need (%)	
Life satisfaction	Satisfaction with life as a whole (from 0 to 10)	
Inclusion	Economic	Gini index of disposable income (after taxes and transfers) (from 0 to 1)
		Ratio between average disposable income of top and bottom quintiles
	Gender and LGBT+	Gender gap in employment rate (male-female, percentage points)
		Female research and development personnel as a percentage of total research and development employment
		People that believes their place of residence is a good place to live for gay or lesbian people (%)
	Migrant and ethnic	Migrant gap in employment rate (native-foreign, percentage points)
		People that believes their place of residence is a good place to live for migrants (%)
		People that believes their place of residence is a good place to live for racial and ethnic minorities (%)
	Inter-generational	Children poverty rate (%)
		Elderly poverty rate (%)
Youth unemployment rate (%)		
Young population (from 18 to 24 years old) not in education, employment or training (NEET) (%)		
Sustainability	Energy	Energy consumption per capita (kgoe per person)
		Electricity production from renewable sources (%)
	Climate	CO2 emissions per electricity production (in tons of CO <sub>2</sub> equivalent per gigawatt hours)
		People satisfied with efforts to preserve the environment (%)
	Biodiversity	Change in tree cover (percentage points)
	Material footprint	Municipal waste rate (kilos per capita)
		Municipal waste that is recycled (%)
		Number of motor road vehicles per 100 people
Change in land consumption per capita (squared metre per capita)		
Resilience	Health and social	Active physicians rate (active physicians per 1 000 people)
		People with jobs that can be performed remotely (%)
	Institutions	Population without access to health care (%)
		People with confidence in the national government (%)
		People with confidence in judicial system and courts (%)
		People with confidence in the local police force (%)
People that believe corruption is spread throughout the government in the country (%)		

Source: (OECD, 2020<sup>[18]</sup>)

## Next steps: developing and implementing the measurement framework

Drawing on the discussions and outcomes of the 2<sup>nd</sup> Roundtable of Smart Cities and Inclusive Growth, the next steps in the development and implementation of the OECD Smart City Measurement Framework will include:

- selecting the specific indicators in each pillar
- identifying the right scale of analysis (e.g. municipality or FUA), considering that many smart city policy interventions are more relevant at a metropolitan scale (FUA) rather than a local scale
- defining the sources of data that can be used

- collecting the data and exploring ways to fill data gaps, for example through surveys and other tools to be defined.

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