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SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS, NEXT-GENERATION NETWORKS, INTERNET OF THINGS AND SMART CITIES

Internet of things and smart cities and communities – Evaluation and assessment

Key performance indicators for smart sustainable cities to assess the achievement of sustainable development goals

Recommendation ITU-T Y.4903

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Recommendation ITU-T Y.4903

Key performance indicators for smart sustainable cities to assess the achievement of sustainable development goals

Summary

Recommendation ITU-T Y.4903 provides key performance indicators (KPIs) for smart sustainable cities (SSCs) and general principles for selecting KPIs to help cities achieve sustainable development goals (SDGs).

This Recommendation provides a means to benchmarking and disseminating best practices in utilizing ICTs and other technologies to enhance cities' sustainability and connect their smart strategies to the SDGs through an inclusive process.

These KPIs are designed to evaluate the role and performance of information communication technologies (ICTs) in the three dimensions of a city: economics, environment, and society and culture. The indicators are uniquely coordinated to allow cities to measure their progress on reaching the ambitious targets set by the SDGs.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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Economy, environment, information and communication technologies (ICTs), key performance indicators (KPIs), smart sustainable cities (SSCs), society and culture, sustainable development goals (SDGs).

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Introduction

These key performance indicators for smart sustainable cities have been developed to provide cities with a consistent and standardised method to collect data and measure the performance and progress of:

- achieving the Sustainable Development Goals (SDGs);
- becoming a smarter city; and
- becoming a more sustainable city.

The indicators enable cities to measure their progress over time, compare their performance to other cities and through analysis and sharing allow for the dissemination of best practices and set standards for progress in meeting the SDGs at the city level.

Each indicator forms part of a holistic view of a city's performance in three dimensions; economy, environment, and society and culture. Each of these dimensions provides a separate view of progress and when reported together provides a holistic view of a smart sustainable city (SSC).

Within each dimension, there are sub-dimensions that focus on more specific areas of performance and progress. An example is the ICT Infrastructure sub-dimension which provides a more in-depth view of how ICTs are deployed and used within a city.

The indicators are further subdivided into core and advanced indicators. Core indicators are those that should be able to be reported on by all cities. They provide a basic outline of smartness and sustainability, and higher levels of performance can generally be achievable. Advanced indicators provide a more in-depth view of a city and measure progress on more advanced initiatives; however, they may be beyond the current capabilities of some cities to report or implement.

Each indicator has been chosen through a process of review and input by ITU members as well as international experts and UN agencies, programmes and secretariats to ensure that the data collected supports the SDGs, is relevant to measuring progress to becoming smarter and more sustainable.

To ensure that cities are more easily able to collect data and to ensure that reported indicator values are consistent, each indicator has a description for:

- the rationale for choosing the indictor;
- how the indicator should be interpreted;
- what benchmarking trends are considered desirable;
- the methodology for calculating the value to be reported; and
- potential sources of data.

This collection methodology for the key performance indicators for smart sustainable cities provides cities with a methodology on how to collect data or information from key performance indicators (KPIs) for smart sustainable cities. This set of KPIs for SSC was developed to establish the criteria to assess the smartness and sustainability of a city, and to provide cities with the means for self-assessments towards SDGs.

Recommendation ITU-T Y.4903

Key performance indicators for smart sustainable cities to assess the achievement of sustainable development goals

1 Scope

This Recommendation outlines the key performance indicators (KPIs) for smart sustainable cities (SSCs) and establishes the criteria to evaluate ICT's contributions in making cities smarter and more sustainable and provide cities with the means for self-assessment in order to achieve the sustainable development goals (SDGs). Evaluating these indicators can help cities as well as their stakeholders understand to what extent they may be perceived as achieving their smart and sustainable goals. This Recommendation is expected to drive corporations and partnerships at all levels in unlocking the full potential of cities' smart strategies, developing transformative solutions to tackle smart sustainable cities' challenges and achieving the SDGs. The KPIs are based on key dimensions of a city: economics, environment, and society and culture.

This Recommendation is aimed at cities and related administrations, but can be utilized by a variety of stakeholders, such as public and private partners and academia, to enable strategy development, information sharing, understand the city's progress, and assess the SSC's development.

The intention of identifying the KPIs is to establish a means to evaluate cities' performances and their progress towards becoming smarter and more sustainable and to provide the cities with the means for self-assessments. Cities are encouraged to periodically check their performances against the recommended indicators listed in this Recommendation in order to improve their performance. These KPIs are not intended to be used for the cross-evaluation of cities with respect to their performance and progress becoming smarter and more sustainable.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T Y.4901] Recommendation ITU-T Y.4901/L.1601 (2016), *Key performance indicators related to the use of information and communication technology in smart sustainable cities*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 city [b-ITU-T Y.4900]: An urban geographical area with one (or several) local government and planning authorities.

3.1.2 ICT companies [ITU-T Y.4901]: Companies which provide products and/or services with respect to information and communication technologies.

3.1.3 key performance indicator [b-ITU-T Y.4051]: Indicators representing the resource usage effectiveness or efficiency of a given system.

3.1.4 knowledge economy [b-OECD KE]: Economies which are directly based on the production, distribution and use of knowledge and information.

3.1.5 smart sustainable city [b-ITU-T Y.4900]: A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) 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, environmental, as well as cultural aspects.

NOTE – City competitiveness refers to policies, institutions, strategies and processes that determine the city's sustainable productivity.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AQI	Air Quality Index
BEV	Battery Electric Vehicle
BMI	Body Mass Index
BPL	Broadband-over-Power Line
CAIDI	Customer Average Interruption Duration Index
CO_2	Carbon Dioxide
COP	Child Online Protection
EU	European Union
EV	Electric Vehicle
FAO	Food and Agriculture Organisation
FCEV	Fuel Cell Electric Vehicle
GDP	Gross Domestic Product
GDWQ	Guidelines for Drinking Water Quality
GHG	Greenhouse Gas
ICD	International Classification of Diseases
ICT	Information and Communication Technology
IP	Internet Protocol
ISO	International Organization for Standardization
KPI	Key Performance Indicator
LAN	Local Area Network
OECD	Organization for Economic Co-operation and Development
PHEV	Plug-in Hybrid Electric Vehicle
PM10	Particulate Matter up to 10 micrometres in size
PM2.5	Particulate Matter up to 2.5 micrometres in size
PPP	Purchasing Power Parity

QoL	Quality of Life
R&D	Research and Development
RAMOS	Reproductive-Age Mortality Studies
REEV	Range Extended Electric Vehicle
REX	Range Extender
RTU	Remote Terminal Unit
SAIFI	System Average Interruption Frequency Index
SCADA	Supervisory Control and Data Acquisition
SDG	Sustainable Development Goal
SMEs	Small and Medium-sized Enterprises
SSC	Smart Sustainable Cities
TCP	Transmission Control Protocol
UITP	International Association of Public Transport
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations International Children's Emergency Fund
USD	United States Dollars
WHO	World Health Organization

5 Conventions

None.

6 General principles for selecting key performance indicators

The selection of KPIs is based on the following principles:

– Independent: The KPIs should be independent or almost-orthogonal (i.e., overlap of the KPIs should be avoided as much as possible) and changes to an indicator should not impact the evaluation of or preferences given to other indicators.

– Reliable: The concept of each indicator should be clear, simple and easy to understand. A widely-accepted definition of the KPI not open to different interpretations assists different users to interpret it in the same way. Also, the calculation of the associated data should be intuitive and simple.

– Measurable: The KPIs should be defined in a way that the value can be measured and comparable scientifically between different phases of urban development, which means the KPIs should be comparable over time and space. The measurement should be as objective as possible. The historic and current data should be either available or easy to collect.

– Achievable: The goal of the KPIs should be achievable and the set of indicators should cover relevant aspects of the SSC. It should also be possible to extend and amend the set of KPIs according to the actual stage of development.

– Relevant: The KPIs should provide insight into the progress of the city in obtaining goals and executing its strategy. The indicators for evaluation should be aligned to the measured subject. The index system should reflect the level of general development for a particular aspect.

– Timely: It is important to express the value of the KPI over time. Every KPI has a meaning only if the time dimension in which it is realized is known. KPIs are also able to deal with emerging issues in SSC construction.

7 Key performance indicators structure

This section contains the structure of the key performance indicators and is divided into three dimensions:

- economy
- environment
- society and culture.

Table 1 – List of KPIs on economy dimension

Dimension	Sub-dimension	Category	KPI	Type	Type
Economy	ICT	ICT infrastructure	Household Internet access	Core	SMART
			Fixed broadband subscriptions	Core	SMART
			Wireless broadband subscriptions	Core	SMART
			Wireless broadband coverage	Core	SMART
			Availability of WIFI in public areas	Advanced	SMART
		Water and sanitation	Smart water meters	Core	SMART
			Water supply ICT monitoring	Advanced	SMART
		Drainage	Drainage/Storm water system ICT monitoring	Advanced	SMART
		Electricity supply	Smart electricity meters	Core	SMART
			Electricity supply ICT Monitoring	Advanced	SMART
			Demand response penetration	Advanced	SMART
		Transport	Dynamic public transport information	Core	SMART
			Traffic monitoring	Core	SMART
			Intersection control	Advanced	SMART
		Public sector	Open data	Advanced	SMART
			e-government	Advanced	SMART
			Public sector e-procurement	Advanced	SMART
	Productivity	Innovation	R&D expenditure	Core	STRUCTURAL
			Patents	Core	STRUCTURAL
			Small and medium-sized enterprises	Advanced	STRUCTURAL
		Employment	Unemployment rate	Core	STRUCTURAL
			Youth unemployment rate	Core	STRUCTURAL
			Tourism sector employment	Advanced	STRUCTURAL
			ICT sector employment	Advanced	STRUCTURAL

Table 1 – List of KPIs on economy dimension

Dimension	Sub-dimension	Category	KPI	Type	Type
Economy	Infrastructure	Water and sanitation	Basic water supply	Core	SUSTAINABLE
			Potable water supply	Core	SUSTAINABLE
			Water supply loss	Core	SUSTAINABLE
			Waste-water collection	Core	SUSTAINABLE
			Household sanitation	Core	SUSTAINABLE
		Waste	Solid waste collection	Core	SUSTAINABLE
		Electricity supply	Electricity system outage frequency	Core	STRUCTURAL
			Electricity system outage time	Core	STRUCTURAL
			Access to electricity	Core	STRUCTURAL
		Transport	Public transport network	Core	SUSTAINABLE
			Public transport network convenience	Advanced	SUSTAINABLE
			Bicycle network	Core	SUSTAINABLE
			Transportation mode share	Advanced	SUSTAINABLE
			Travel time index	Advanced	SUSTAINABLE
			Shared bicycles	Advanced	SUSTAINABLE
			Shared vehicles	Advanced	SUSTAINABLE
			Low-carbon emission passenger vehicles	Advanced	SUSTAINABLE
		Buildings	Public building sustainability	Advanced	SUSTAINABLE
			Integrated building management systems in public buildings	Advanced	SMART
		Urban planning	Pedestrian infrastructure	Advanced	SUSTAINABLE
			Urban development and spatial planning	Advanced	SUSTAINABLE

Table 2 – List of KPIs on environment dimension

Dimension	Sub-dimension	Category	KPI	Type	Type
Environment	Environment	Air quality	Air pollution	Core	SUSTAINABLE
			GHG emissions	Core	SUSTAINABLE
		Water and sanitation	Drinking water quality	Core	SUSTAINABLE
			Water consumption	Core	SUSTAINABLE
			Freshwater consumption	Core	SUSTAINABLE
			Waste-water treatment	Core	SUSTAINABLE
		Waste	Solid waste treatment	Core	SUSTAINABLE
		Environmental quality	EMF exposure	Core	SUSTAINABLE
			Noise exposure	Advanced	SUSTAINABLE
		Public space and nature	Green areas	Core	SUSTAINABLE
			Green area accessibility	Advanced	SUSTAINABLE
			Protected natural areas	Advanced	SUSTAINABLE
			Recreational facilities	Advanced	SUSTAINABLE
	Energy	Energy	Renewable energy consumption	Core	SUSTAINABLE
			Electricity consumption	Core	SUSTAINABLE
			Residential thermal energy consumption	Core	SUSTAINABLE
			Public building energy consumption	Core	SUSTAINABLE

Table 3 – List of KPIs on society and culture dimension

Dimension	Sub-dimension	Category	KPI	Type	Type
Society and culture	Education, health and culture	Education	Student ICT access	Core	SMART
			School enrolment	Core	STRUCTURAL
			Higher education degrees	Core	STRUCTURAL
			Adult literacy	Core	STRUCTURAL
		Health	Life expectancy	Core	STRUCTURAL
			Maternal mortality rate	Core	STRUCTURAL
			Physicians	Core	STRUCTURAL
			In-patient hospital beds	Advanced	STRUCTURAL
			Health insurance/ Public health coverage	Advanced	STRUCTURAL
			Electronic health records	Advanced	SMART
		Culture	Cultural expenditure	Core	STRUCTURAL
			Cultural infrastructure	Advanced	STRUCTURAL
	Safety, housing and social inclusion	Housing	Informal settlements	Core	STRUCTURAL
			Housing expenditure	Advanced	STRUCTURAL
		Social inclusion	Gender income equity	Core	STRUCTURAL
			Gini coefficient	Core	STRUCTURAL
			Poverty	Core	STRUCTURAL
			Voter participation	Core	STRUCTURAL
			Childcare availability	Advanced	STRUCTURAL
		Safety	Natural disaster-related deaths	Core	SUSTAINABLE
			Disaster-related economic losses	Core	SUSTAINABLE
			Resilience plans	Advanced	SUSTAINABLE

Table 3 – List of KPIs on society and culture dimension

Dimension	Sub-dimension	Category	KPI	Type	Type
			Population living in disaster-prone areas	Advanced	SUSTAINABLE
			Emergency service response time	Advanced	STRUCTURAL
			Police service	Core	STRUCTURAL
			Fire service	Core	STRUCTURAL
			Violent crime rate	Core	STRUCTURAL
			Traffic fatalities	Core	STRUCTURAL
		Food security	Local food production	Advanced	SUSTAINABLE

8 Key performance indicators numbering convention

The following table contains the structure of how the KPI labels (KPI No.) have been attributed.

Table 4 – KPI numbering convention

XX –		**X(XX):**		**X(XX):**		**Number**	**C or A**
Dimension		**Sub-dimension**		**Category**		**1, 2, 3, etc.**	**C: Core A: Advanced**
EC	Economy	E	Energy	AQ	Air Quality		
EN	Environment	EH	Education, Health and Culture	B	Buildings		
SC	Society and culture	EN	Environment	C	Culture		
		I	Infrastructure	D	Drainage		
		ICT	ICT	E	Energy		
		P	Productivity	ED	Education		
		SH	Safety, Housing and Social Inclusion	EM	Employment		
				EQ	Environmental Quality		
				ES	Electricity Supply		
				FS	Food Security		
				H	Health		
				HO	Housing		
				IN	Innovation		
				ICT	ICT Infrastructure		
				PS	Public Sector		
				PSN	Public Spaces and Nature		
				SA	Safety		
				SI	Social Inclusion		
				T	Transport		
				UP	Urban Planning		
				WA	Waste		
				WS	Water and Sanitation		

9 Key performance indicators – Economy dimension

The following section contains the indicators related to the economy dimension.

Dimension	**Economy**				
Sub-dimension	**ICT**				
Category	**ICT infrastructure**				
KPI name	**Household Internet access**				
KPI No.	**EC: ICT: ICT: 1C**	**Type:**	**Core**	**Type:**	**Smart**
Definition/ Description	Percentage of households with Internet access				
Rationale/ Interpretation/ Benchmarking	This indicator demonstrates the access to information and technology connectivity given that connectivity across regions and between countries is correlated to economic prosperity, development and growth. This in turn underscores a city inhabitant's access to knowledge, data, news and communication to use for economic productivity, i.e., training, education, research, business management, ideas exchange, etc. Data that includes any household's access via a fixed or mobile network at any given time should be collected. An increasing trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: number of households with Internet access. Denominator: total number of households. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	The data may be collected from the local statistics department or may need to be extrapolated from national data. Annual surveys of households may be another method for data collection to obtain the percentage of households with Internet access. This percentage will then be applied to the in-scope population. The data may also be collected from local Internet service providers and telecommunications companies.				
SDG reference(s)	SDG indicator 17.8.1: Proportion of individuals using the Internet.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**ICT infrastructure**				
KPI name	**Fixed broadband subscriptions**				
KPI No.	**EC: ICT: ICT: 2C**	**Type:**	**Core**	**Type:**	**Smart**
Definition/ Description	Percentage of households with fixed (wired) broadband				
Rationale/ Interpretation/ Benchmarking	This indicator demonstrates the access to information and technology connectivity and is important given that connectivity across regions, and between countries, is correlated to economic prosperity, development and growth. Moreover, penetration into households means that communication is possibly received through multiple mediums such as the Internet, cable, etc. A higher penetration rate means that more of the population has access to knowledge and communications, as well as technologies to receive and send information and communications (i.e., mobile phones, computers, television, etc.). The average penetration rate (according to OECD) is about 30%. Fixed (wired) broadband subscriptions refer to subscriptions for high-speed access to the public Internet (a TCP/IP connection). High-speed access is defined as a downstream speed equal to, or greater than, 256 kbits/s. Fixed (wired) broadband includes broadband through cable modem, DSL, fibre and other fixed (wired) broadband technologies (such as Ethernet LAN, and broadband-over-power line (BPL) communications). Mobile cellular network subscriptions are not included. An increasing trend and higher values are considered positive.				
Source(s)	NOTE – OECD Statistics. Retrieved from <http://www.oecd.org/sti/broadband/broadband-statistics-update.htm>				
Methodology	Calculate as: Numerator: number of fixed broadband subscriptions. Denominator: total number of households. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	The data may be collected from local statistics department or may need to be extrapolated from national data. Data may also be collected from local Internet service providers and telecommunications companies.				
SDG reference(s)	SDG indicator 17.6.2: Fixed Internet broadband subscriptions per 100 inhabitants, by speed. SDG indicator 17.8.1: Proportion of individuals using the Internet.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**ICT infrastructure**				
KPI name	**Wireless broadband subscriptions**				
KPI No.	**EC: ICT: ICT: 3C**	**Type:**	**Core**	**Type:**	**Smart**
Definition/ Description	Wireless broadband subscriptions per 100 000 inhabitants				
Rationale/ Interpretation/ Benchmarking	This indicator demonstrates the access to information and technology connectivity and is important given that connectivity across regions and between countries is correlated to economic prosperity, development and growth. At the same time, this indicator reveals the level of advancement of connectivity technology available to the population. This in turn indicates the breadth of sophisticated communication and connectivity technology used. A higher penetration rate means that more of the population have access to knowledge and communication, as well as technology (i.e., mobile phones, computers, television, etc.) to receive and send information and communications. Wireless broadband subscriptions include wireless broadband through satellite broadband, terrestrial fixed wireless broadband and mobile cellular network subscriptions. An increasing trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: number of wireless broadband subscriptions. Denominator: one 100 000th of the city's population.				
Unit	Number/100 000 inhabitants				
Data sources/ Relevant databases	The data may be collected from local statistics departments or may need to be extrapolated from national data. The data may also be collected from local Internet service providers and telecommunications companies.				
SDG reference(s)	SDG indicator 17.8.1: Proportion of individuals using the Internet. SDG indicator 9.C.1: Percentage of population covered by a mobile network, by technology. SDG indicator 5.B.1: Proportion of individuals who own a mobile telephone, by sex.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**ICT infrastructure**				
KPI name	**Wireless broadband coverage**				
KPI No.	**EC: ICT: ICT: 4C**	**Type:**	**Core**	**Type:**	**Smart**
Definition/ Description	Percentage of the city served by wireless broadband (3G, 4G and 5G)				
Rationale/ Interpretation/ Benchmarking	This indicator demonstrates the access to information and technology connectivity and is important given that connectivity across regions and between countries is correlated to economic prosperity, development and growth. Smart city applications in many cases are accessed through mobile applications. In order to use these applications in an efficient manner, high speed mobile Internet capabilities are required. The coverage of high-speed mobile Internet from providers is key to enable these capabilities. A value of 100% coverage should be pursued for at least 3G networks. An increasing trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: area of city covered by mobile services (km^2). Denominator: total area of the city (km^2). Multiply by 100. Each service should be reported on separately (3G, 4G and 5G).				
Unit	Percentage				
Data sources/ Relevant databases	Data may be collected from local mobile service providers.				
SDG reference(s)	SDG indicator 17.8.1: Proportion of individuals using the Internet. SDG indicator 9.C.1: Percentage of population covered by a mobile network, by technology. SDG indicator 5.B.1: Proportion of individuals who own a mobile telephone, by sex.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**ICT infrastructure**				
KPI name	**Availability of Wi-Fi in public areas**				
KPI No.	**EC: ICT: ICT: 5A**	**Type:**	**Advanced**	**Type:**	**Smart**
Definition/ Description	Number of public Wi-Fi hotspots in the city				
Rationale/ Interpretation/ Benchmarking	Several mega-cities have set-up Wi-Fi hotspots at public venues, thereby providing travelling users, as well as their citizens, with increased access to Internet at little or no cost. Such actions empower citizens and promotes the use of e-services without the burden of network costs. Cities should report only those Wi-Fi spots operated by the city (or on behalf of the city) that are free of charge.				
Source(s)	[ITU-T Y.4901] NOTE 1 – United Nations E-Government Survey 2020. Retrieved from <https://www.un.org/development/desa/publications/publication/2020-united-nations-e-government-survey> NOTE 2 – Connecting the Unconnected: Working together to achieve the Connect 2020 Agenda targets. Retrieved from <http://broadbandcommission.org/Documents/ITU_discussion-paper_Davos2017.pdf>				
Methodology	Calculate as: Total number of Wi-Fi hotspots provided by the city administration (excluding commercial entities)				
Unit	Number				
Data sources/ Relevant databases	Information can be derived from: i) information Wi-Fi hotspots from a telecommunications regulatory agency/ ICT ministry; tourism agencies, Wi-Fi hotspots service providers, etc.; ii) city administration or national entity of statistics and census. Collection method: This information can be gathered from: 1) WIFI service provider statistics; 2) databases.				
SDG reference(s)	SDG target 9.C: Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**Water and sanitation**				
KPI name	**Smart water meters**				
KPI No.	**EC: ICT: WS: 1C**	**Type:**	**Core**	**Type:**	**Smart**
Definition/ Description	Percentage implementation of smart water meters				
Rationale/ Interpretation/ Benchmarking	Water is becoming an increasingly scarce commodity and many cities are located in areas where water shortages exist. Future trends also indicate that this problem will persist in these areas. The conservation of water resources is key to the long-term sustainability of cities and the use of smart water meters can allow for better monitoring of water consumption patterns. A smart water meter is an electronic device that provides real-time measurement of water consumption and transmits those measurements to water utility providers and customers. These measurements can be effective in some conservation programmes (such as leak detection) and for providing information to customers on their consumption habits. An increasing trend in implementation and higher values are considered positive.				
Source(s)	NOTE – Smart Meters and Domestic Water Usage. Retrieved from <http://www.fwr.org/econom/SmartMeters.pdf>				
Methodology	Calculate as: Numerator: number of smart water meters installed. Denominator: total number of water meters installed. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected from local water utilities.				
SDG reference(s)	SDG target 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity. SDG indicator 6.4.1: Change in water-use efficiency over time.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**Water and sanitation**				
KPI name	**Water supply ICT monitoring**				
KPI No.	**EC: ICT: WS: 2A**	**Type:**	**Advanced**	**Type:**	**Smart**
Definition/ Description	Percentage of the water distribution system monitored by ICT				
Rationale/ Interpretation/ Benchmarking	The city should report on the extent that a supervisory control and data acquisition (SCADA) system (or similar system) has been implemented to cover the water supply system. The system may include the following features: ▪ central control facility; ▪ level transducers that track water levels in reservoirs and tanks; ▪ pressure transducers in pipes that ensure that water is pumped and is flowing efficiently; ▪ flowmeters that measure the actual delivery of water; and ▪ pressure-sustaining and pressure-reducing valves that open and close incrementally to adjust the rate at which the water flows. ICT control has shown to be effective in improving the efficiency of a water supply system and an effective tool for determining areas of water loss. An increasing trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: length of system monitored by ICT (km). Denominator: total length of total system (km). Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected from local water utilities.				
SDG reference(s)	SDG target 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity. SDG indicator 6.4.1: Change in water-use efficiency over time.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**Drainage**				
KPI name	**Drainage / Storm water system ICT monitoring**				
KPI No.	**EC: ICT: D: 1A**	**Type:**	**Advanced**	**Type:**	**Smart**
Definition/ Description	Percentage of drainage/storm water system monitored by ICT				
Rationale/ Interpretation/ Benchmarking	Optimal control techniques in urban drainage networks help generate control strategies ahead of time, based on current and past readings of the telemetry system, to minimize flooding and control sewer overflow. Real-time control of an urban drainage system may be local or global. When local control is applied, flow regulation devices only use measurements taken at its specific location. While this control structure is applicable in many simple cases, in a large city, with an interconnected sewerage network and a complex network of actuators and sensors, it may not be the most efficient alternative. Conversely, global control, which computes control actions taking into account real-time measurements all through the network, is likely to make the best use of the infrastructure capacity and all the available sensor information. ICT control has shown to be effective in improving the efficiency of a drainage system and can minimize instances of urban flooding. An increasing trend and higher values are considered positive.				
Source(s)	NOTE – Optimal control of urban drainage systems. Retrieved from <http://www.iri.upc.edu/files/scidoc/680-Optimal-control-of-urban-drainage-systems.-A-case-study.pdf>				
Methodology	Calculate as: Numerator: length of system monitored by ICT (km). Denominator: total length of total system (km). Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected from local authorities responsible for drainage.				
SDG reference(s)	SDG target 6.2: By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**Electricity supply**				
KPI name	**Smart electricity meters**				
KPI No.	**EC: ICT: ES: 1C**	**Type:**	**Core**	**Type:**	**Smart**
Definition/ Description	Percentage implementation of smart electricity meters				
Rationale/ Interpretation/ Benchmarking	The implementation of smart meters allows for a more direct and real-time measurement of the load on an electricity grid and the consumption habits of consumers. Real-time data can allow for more real-time pricing of electricity and the implementation of tools to manage energy usage and peak demand. A smart electricity meter is an electronic device that provides more real-time measurements related to electricity consumption and transmits those measurements directly to electricity utility providers and customers. These measurements can be effective in some conservation programmes, such as demand management and for providing information to customers on their consumption habits. An increasing trend in implementation and higher values are considered positive.				
Source(s)	NOTE – Department of Energy. Electric Meters. Retrieved from <https://energy.gov/energysaver/electric-meters>				
Methodology	Calculate as: Numerator: number of smart electricity meters installed. Denominator: total number of electricity meters installed. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected through the local electrical utility.				
SDG reference(s)	SDG target 7.3: By 2030, double the global rate of improvement in energy efficiency.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**Electricity supply**				
KPI name	**Electricity supply ICT monitoring**				
KPI No.	**EC: ICT: ES: 2A**	**Type:**	**Advanced**	**Type:**	**Smart**
Definition/ Description	Percentage of electricity supply system monitored by ICT				
Rationale/ Interpretation/ Benchmarking	The city should report on the extent that a supervisory control and data acquisition (SCADA) system (or similar system) has been implemented to cover the electricity supply system. Modern SCADA systems replace the manual labour to perform electrical distribution tasks and manual processes in distribution systems with automated equipment. SCADA maximizes the efficiency of power distribution systems by providing features such as real-time views into the operations, data trending and logging, maintenance of desired voltages, currents and power factors, alarms generation, etc. SCADA performs automatic monitoring, protecting and controlling of various equipment in distribution systems with the use of intelligent electronic devices (or RTUs). It restores the power service during fault conditions and also maintains the desired operating conditions. SCADA improves the reliability of supply by reducing duration of outages while providing cost-effective operations of the distribution system. Therefore, SCADA supervises the entire electrical distribution system. The major functions of SCADA can be categorized into the following types: ▪ substation control; ▪ feeder control; and ▪ end user load control. ICT control has shown to be effective in improving the efficiency of an electricity supply system. An increasing trend and higher values are considered positive.				
Source(s)	NOTE – SCADA Systems for Electrical Distribution. Retrieved from <http://www.electricaltechnology.org/2015/09/scada-systems-for-electrical-distribution.html#components_of_typical_scada_system>				
Methodology	Calculate as: Numerator: length of system monitored by ICT (km). Denominator: total length of total system (km). Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected through the local electrical utility.				
SDG reference(s)	SDG target 7.3: By 2030, double the global rate of improvement in energy efficiency.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**Electricity supply**				
KPI name	**Demand response penetration**				
KPI No.	**EC: ICT: ES: 3A**	**Type:**	**Advanced**	**Type:**	**Smart**
Definition/ Description	Percentage of electricity customers with demand response capabilities				
Rationale/ Interpretation/ Benchmarking	Demand response provides an opportunity for consumers to play a significant role in the operation of the electric grid by reducing or shifting their electricity usage during peak periods in response to time-based rates or other forms of financial incentives. Demand response programmes are being used by some electric system planners and operators as resource options for balancing supply and demand. Demand response is defined as "changes in electricity use by demand-side resources from their normal consumption patterns in response to changes in the price of electricity, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized." (Federal Energy Regulatory Commission). An increasing trend and higher values are considered positive.				
Source(s)	NOTE – Federal Energy Regulatory Commission. Demand Response and Advance Metering. Retrieved from <https://www.ferc.gov/industries-data/electric/power-sales-and-markets/demand-response/reports-demand-response-and>				
Methodology	Calculate as: Numerator: number of demand response enabled electricity customers. Denominator: total number of electricity customers. Multiply by 100				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected through the local electrical utility.				
SDG reference(s)	SDG target 7.3: By 2030, double the global rate of improvement in energy efficiency.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**Transport**				
KPI name	**Dynamic public transport information**				
KPI No.	**EC: ICT: T: 1C**	**Type:**	**Core**	**Type:**	**Smart**
Definition/ Description	Percentage of urban public transport stops for which traveller information is dynamically available to the public in real time				
Rationale/ Interpretation/ Benchmarking	Traffic congestion is becoming a major problem in many global cities and cities are investing in public transport as one of the most efficient ways to move people around the city. Providing riders with information on the status of the system along with the arrival and travel times (i.e., dynamic information) will encourage transit use. The information reported for each stop must contain at least the arrival of the next vehicle/train/etc. It is also encouraged to provide travel times to other destinations. The information can be provided at the stop itself through screens or through other electronic means such as the official website or a mobile application. The information should be dynamic so that it is current and updated regularly rather than simply being posted as a static timetable. An increasing trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: number of stops and stations with dynamic information available. Denominator: total number of stops and stations. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected from transportation agencies serving the city.				
SDG reference(s)	SDG target 11.2: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**Transport**				
KPI name	**Traffic monitoring**				
KPI No.	**EC: ICT: T: 2C**	**Type:**	**Core**	**Type:**	**Smart**
Definition/ Description	Percentage of major streets monitored by ICT				
Rationale/ Interpretation/ Benchmarking	Monitoring of major streets can allow for the implementation of services to better manage traffic congestion and traffic flow. Monitoring can be done using in-road sensors or cameras (or a combination of the two). Cities should report on major streets, which would include arterial roads and highways only. Residential streets should not be included. An increasing trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: length of major streets monitored by ICT (km). Denominator: total length of major streets (km). Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected from municipal, regional or national transportation and roads departments.				
SDG reference(s)	SDG target 11.2: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**Transport**				
KPI name	**Intersection control**				
KPI No.	**EC: ICT: T: 3A**	**Type:**	**Advanced**	**Type:**	**Smart**
Definition/ Description	Percentage of road intersections using adaptive traffic control or prioritization measures				
Rationale/ Interpretation/ Benchmarking	The use of adaptive traffic control or prioritization measures at intersections will allow for the traffic signals to respond to traffic patterns. Adaptive traffic control or prioritization includes measures such as embedded road sensors that change traffic signals based on actual vehicles flow or other similar sensors that provide the same function. This can lead to less idling time for cars at intersections and better traffic flow. Cities should report only on signal-controlled intersections. An increasing trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: number of intersections with adaptive traffic control. Denominator: total number of signal-controlled intersections. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be obtained from local or national transportation / traffic authorities.				
SDG reference(s)	SDG target 11.2: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**Public sector**				
KPI name	**Open data**				
KPI No.	**EC: ICT: PS: 1A**	**Type:**	**Advanced**	**Type:**	**Smart**
Definition/ Description	Percentage and number of inventoried open datasets that are published				
Rationale/ Interpretation/ Benchmarking	Open data can provide many benefits for cities and for its inhabitants. Open data government information, available as machine-readable open data, can facilitate government transparency, accountability and public participation in government. Open data can be seen as structured data that is machine-readable, freely shared, used and built on without restrictions. There are also benefits to be gained by opening government data sets to the public, so as to enable economic growth through technological innovation by the private sector. This will also help foster the development of new applications and services for inhabitants. An increasing trend and higher values are considered positive.				
Source(s)	NOTE – Open data principles. Retrieved from <http://open.canada.ca/en/open-data-principles#toc94>				
Methodology	Calculate as: Numerator: total number of open data sets published. Denominator: total number of data sets. Multiply by 100. For this indicator the numerator should also be reported.				
Unit	Percentage and number				
Data sources/ Relevant databases	Data can be collected through municipal ICT departments.				
SDG reference(s)	SDG target 16.6: Develop effective, accountable and transparent institutions at all levels. SDG target 16.7: Ensure responsive, inclusive, participatory and representative decision-making at all levels.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**Public sector**				
KPI name	**e-government**				
KPI No.	**EC: ICT: PS: 2A**	**Type:**	**Advanced**	**Type:**	**Smart**
Definition / Description	Number of public services delivered through electronic means				
Rationale/ Interpretation/ Benchmarking	E-government aims at improving the relationship between people and their government, through advanced electronic and mobile services. It aims at making public services delivery more effective, accessible and responsive to people's needs. It also aims at increasing participation in decision-making and making public institutions more transparent and accountable. Furthermore, the United Nations General Assembly has recognized the role of information and communication technology in promoting sustainable development and supporting public policies and service delivery. The United Nations General Assembly has also specifically affirmed the "potential of e-government in promoting transparency, accountability, efficiency and citizen engagement in public service delivery." Also, OECD countries support the idea that e-government can help improve efficiency in government and improve online access to information and service quality, enabling the delivery of services to citizens and businesses on their terms and at their convenience. This indicator focuses on the number of services available and can include websites, mobile applications, text messages, etc. An increasing trend and higher values are considered positive when in accordance with a city's strategy.				
Source(s)	NOTE 1 – United Nations E-government Survey 2020. Retrieved from <https://www.un.org/development/desa/publications/publication/2020-united-nations-e-government-survey> NOTE 2 – OECD. Implementing E-government in OECD Countries. Retrieved from: <http://www.oecd.org/mena/governance/36853121.pdf>				
Methodology	Calculate as: number of public services available through online service.				
Unit	Number				
Data sources/ Relevant database	Data can be collected through surveys of municipal departments/websites. NOTE – Information is also available through UN e-Government Development Index: <https://publicadministration.un.org/egovkb/en-us/About/Overview/-E-Government>				
SDG reference(s)	SDG target 16.6: Develop effective, accountable and transparent institutions at all levels. SDG target 16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels.				

Dimension	Economy				
Sub-dimension	**ICT**				
Category	**Public sector**				
KPI name	**Public sector e-procurement**				
KPI No.	**EC: ICT: PS: 3A**	**Type:**	**Advanced**	**Type:**	**Smart**
Definition/ Description	Percentage of public sector procurement activities that are conducted electronically				
Rationale/ Interpretation/ Benchmarking	The movement of procurement transactions (bids, requests for proposal (RFP), invoices, payments) to electronic platforms can facilitate efficiency in government operations and allow for a wider base of suppliers to access potential government business. Cities should take into account all transactions that occur during the procurement process through various methods such as websites, web portals, mobile applications, etc. Cities that have moved a particular service to 100% electronic delivery can then use that as the basis for reporting. A higher value and an increasing trend are considered positive.				
Methodology	Calculate as: Numerator: number of public sector procurement activities conducted online. Denominator: total number of public sector procurement activities. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant sdatabase	Data can be obtained through city departments with procurement functions and IT departments.				
SDG reference(s)	SDG target 16.6: Develop effective, accountable and transparent institutions at all levels. SDG target 16.7: Ensure responsive, inclusive, participatory and representative decision-making at all levels.				

Dimension	Economy				
Sub-dimension	**Productivity**				
Category	**Innovation**				
KPI name	**R&D expenditure**				
KPI No.	**EC: P: IN: 1C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Research and development expenditure as a percentage of city GDP				
Rationale/ Interpretation/ Benchmarking	R&D is defined as research and development activities in natural sciences and engineering, social sciences and humanities and other inter-departmental disciplines. This includes any creative systematic activity undertaken to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this knowledge to devise new applications. R&D also includes fundamental research, applied research in such fields as agriculture, medicine, industrial chemistry, and experimental development work leading to new devices, products or processes. The Frascati Manual defines R&D as "creative work undertaken on a systematic basis in order to increase the stock of knowledge (including knowledge of humans, culture and society), and the use of this stock of knowledge to devise new applications." Data collection methodology for this indicator could be adapted from the Frascati manual (an internationally recognized methodology for collecting R&D statistics). An increasing trend and higher values are considered positive.				
Source(s)	NOTE 1 – UNESCO Sustainable Development Goal 9.5. Retrieved from <http://uis.unesco.org/en/topic/sustainable-development-goal-9-5> NOTE 2 – UNECE. Promotion in Services Sector. Retrieved from <http://www.unece.org/fileadmin/DAM/ceci/publications/icp3.pdf> NOTE 3 – OECD Frascati Manual. Retrieved from <http://www.oecd.org/sti/inno/frascati-manual.htm>				
Methodology	Calculate as: Numerator: R&D expenditure (USD). Denominator: City GDP (USD). Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be sourced through municipal economics departments, business associations or through interpretation of national economic statistics.				
SDG reference(s)	SDG indicator 9.5.1: Research and development expenditure as a percentage of GDP.				

Dimension	Economy				
Sub-dimension	**Productivity**				
Category	**Innovation**				
KPI name	**Patents**				
KPI No.	**EC: P: IN: 2C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Number of new patents granted per 100 000 inhabitants per year.				
Rationale/ Interpretation/ Benchmarking	Patents demonstrate the efficacy of a country to turn research into products which can add value to end users. Healthy patent activity advances science and indicates the economic strength of a city. Patents enable inventors to profit financially and help businesses, researchers and academics advance in their field through information sharing. An increasing trend and higher values are considered positive and may indicate a more innovative urban environment.				
Methodology	Calculate as: Numerator: total number of new patents issued to residents and organizations of the city. Denominator: one 100 000th of the city's population.				
Unit	Number/100 000 inhabitants				
Data sources/ Relevant databases	Patents are granted by regional or national patent offices though some international bodies also track patents. Data can be found through organizations such as WIPO (World Intellectual Property Organization), national or regional patent offices, or through national research institutions.				
SDG reference(s)	SDG target 9.B: Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities.				

Dimension	Economy				
Sub-dimension	**Productivity**				
Category	**Innovation**				
KPI name	**Small and medium-sized enterprises**				
KPI No.	**EC: P: IN: 3A**	**Type:**	**Advanced**	**Type:**	**Structural**
Definition/ Description	Percentage of small and medium-sized enterprises (SMEs)				
Rationale/ Interpretation/ Benchmarking	Organizations such as the European Commission, Asian Development Bank and World Bank consider SMEs important for ensuring economic growth, job creation, innovation, competition and social integration. Small and medium-sized enterprises (SMEs) are non-subsidiary, independent firms which employ less than a given number of employees. This number varies across countries. The most frequent upper limit designating an SME is 250 employees, as in the European Union. However, some countries set the limit at 200 employees, while the United States considers SMEs to include firms with fewer than 500 employees. Small firms are generally those with fewer than 50 employees, while micro-enterprises have at most 10, or in some cases 5 workers. For this indicator cities should report on firms with fewer than 250 employees. An increasing trend and higher values are considered positive.				
Source(s)	NOTE – OECD Statistic. Retrieved from <https://stats.oecd.org/glossary/detail.asp?ID=3123>				
Methodology	Calculate as: Numerator: number of SMEs. Denominator: total number of enterprises. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected through local, regional, or national business registration data.				
SDG reference(s)	SDG indicator 9.3.1: Percentage of small-scale industries with a total industry value added.				

Dimension	Economy				
Sub-dimension	**Productivity**				
Category	**Employment**				
KPI name	**Unemployment rate**				
KPI No.	**EC: P: EM: 1C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Percentage of the total city labour force that is unemployed				
Rationale/ Interpretation/ Benchmarking	Unemployment is a measure of economic health. Rising unemployment signals a weak economy with slow growth and low spending. Central banks often set national targets. For instance, the target of 5-7% unemployment rate in North America would be unacceptable in Japan where 3% is the norm; and would be unrealistically optimistic for Greece which has a 23% unemployment rate. The term "unemployed" includes all persons of working age who are: a) without work during the reference period, i.e., not paid employment or self-employment; b) currently available for work, i.e., were available for paid employment or self-employment during the reference period; and c) seeking work, i.e., specific steps were taken in a specified recent period to seek paid employment or self-employment. For purposes of international comparability, the period of job search is often defined as the preceding four weeks. A declining trend and lower values are considered positive.				
Source(s)	NOTE – ILO. Guidelines for producers and users of statistical and legal framework indicators. Retrieved from <http://www.ilo.org/wcmsp5/groups/public/---dgreports/---integration/documents/publication/wcms_229374.pdf>				
Methodology	Calculate as: Numerator: total number of the city labour force that is unemployed. Denominator: total number of the city labour force. Multiply by 100. As an alternative, and where available, government statistics can be directly reported instead of calculating the indicator value.				
Unit	Percentage				
Data sources/ Relevant databases	The preferred official national data source for this indicator is a household-based labour force survey. The population census and/or other household surveys with an appropriate employment module may also be used to obtain the required data. Unemployment registers can serve as instruments to collect data on unemployment levels. As an example, these registers are commonly used in many EUROSTAT Member States to supplement the information obtained in quarterly labour force surveys.				
SDG reference(s)	SDG indicator 8.5.2: Unemployment rate by sex, age group and people with disabilities.				

Dimension	Economy				
Sub-dimension	**Productivity**				
Category	**Employment**				
KPI name	**Youth unemployment rate**				
KPI No.	**EC: P: EM: 2C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Percentage of the city youth labour force that is unemployed				
Rationale/ Interpretation/ Benchmarking	Youth unemployment is indicative of a country's economic health. In periods of economic contraction, new hires are often fired first, resulting in youth being hit especially hard. Higher rates of youth unemployment are correlated with lower productivity, competitiveness, limited lifetime earnings and lower happiness. Youth unemployment leads to increases in public spending, income inequality, feelings of isolation and marginalization, burdens on youth and families, mental health issues and emigration of talent. Since youth unemployment is correlated with national unemployment figures, city benchmarks should take national rates into consideration. Unemployed youth shall refer to individuals: ▪ who are above the legal working age and under 24 years of age; ▪ who are currently without work; ▪ who are actively seeking work in a recent past period (past four weeks); and ▪ who are currently available for work. Youth who did not look for work but have a future labour market stake (arrangements for a future job start) are counted as unemployed (International Labour Organization). A declining trend and lower values are considered a positive sign of progress.				
Source(s)	NOTE – ILO. Key indicators of youth labour markets: Concepts, definitions and tabulations. Retrieved from <http://www.ilo.org/wcmsp5/groups/public/@ed_emp/documents/instructionalmaterial/wcms_140860.pdf>				
Methodology	Calculate as: Numerator: total number of the city youth labour force that is unemployed. Denominator: total number of the city youth labour force. Multiply by 100. As an alternative, and where available, government statistics can be directly reported instead of calculating the indicator value.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected from local or national bodies, including municipal sites or government statistical agencies.				
SDG reference(s)	SDG indicator 8.5.2: Unemployment rate by sex, age group and people with disabilities. SDG target 8.6: By 2020, substantially reduce the proportion of youth not in employment, education or training.				

Dimension	Economy				
Sub-dimension	**Productivity**				
Category	**Employment**				
KPI name	**Tourism sector employment**				
KPI No.	**EC: P: EM: 3A**	**Type:**	**Advanced**	**Type:**	**Structural**
Definition/ Description	Percentage of the city labour force working in the tourism sector				
Rationale/ Interpretation/ Benchmarking	Tourism creates income and employment which can be major contributors to a country's GDP. Increased tourism can also sustain SMEs and attract foreign capital, investors and businesses, contributing to economic growth.				
Methodology	Calculate as: Numerator: number of employees in the tourism sector. Denominator: total number of the city labour force. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected through labour surveys and government departments with responsibility for tourism.				
SDG reference(s)	SDG indicator 8.9.1: Tourism direct GDP as a proportion of total GDP and in growth rate.				

Dimension	Economy				
Sub-dimension	**Productivity**				
Category	**Employment**				
KPI name	**ICT sector employment**				
KPI No.	**EC: P: EM: 4A**	**Type:**	**Advanced**	**Type:**	**Structural**
Definition/ Description	Percentage of the city labour force working in the ICT sector				
Rationale/ Interpretation/ Benchmarking	This indicator refers to the total workforce involved in the ICT sector as a proportion of the total business workforce. ICT workforce (or ICT employment) consists of those persons employed in businesses which are classified under the ICT sector. In other words, ICT employment is defined as the people working in the information and communication technology (ICT) sector. Total business workforce represents all persons engaged in domestic production in the business sector. This indicator is measured as a percentage of business sector employment. An ICT sector can be defined as a manufacturing and service industry whose products capture, transmit or display data and information electronically. For manufacturing industries, the products of a candidate industry (OECD, 2017): ▪ must be intended to fulfil the function of information processing and communication including transmission and display; and ▪ must use electronic processing to detect, measure and/or record physical phenomena or control a physical process. For services industries, the products of a candidate industry: ▪ must be intended to enable the function of information processing and communication by electronic means. Given that the smart city infrastructure relies on ICTs, it is essential that the ICT sector has the required workforce to carry forth the research and facilitate advancements related to digital technologies. A higher percentage indicates higher number of workers in the ICT sector.				
Source(s)	NOTE – OECD (2005). Partnership on measuring ICT for development. Retrieved from <https://www.itu.int/ITU-D/ict/partnership/material/CoreICTIndicators.pdf> and OECD 2017 – <https://data.oecd.org/ict/ict-employment.htm>				
Methodology	Calculate as: Numerator: number of employees in the ICT sector. Denominator: total number of the city labour force. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	This indicator is typically calculated using data from the national account tables. Where ICT sector industries are not present in a country's national accounts by activity tables, estimates are made based on business survey results (often provided specifically for the ICT sector by national standards organizations) (OECD, 2017) Information can be derived from: i) human resources department of ICT companies; ii) statistics department; and iii) Labour Office. Collection method: This information can be gathered from: i) databases ii) surveys.				
SDG reference(s)	SDG target 8.3: Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro, small and medium-sized enterprises, including through access to financial services.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Water and sanitation**				
KPI name	**Basic water supply**				
KPI No.	**EC: I: WS: 1C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Percentage of households with access to a basic water supply				
Rationale/ Interpretation/ Benchmarking	Access to drinking water is a fundamental need and a vital human right. About 1.1 billion people have no access to any type of improved drinking source of water. 1.6 million people die every year from diarrhoeal diseases attributable to a lack of safe drinking water and basic sanitation. The health and economic benefits of improved water supply to households and individuals are well documented. Basic water sources include: piped water, public tap, borehole or pump, protected well, protected spring or rainwater. An improving trend and higher values are considered positive.				
Source(s)	NOTE 1 – Integrated Monitoring Guide for SDG 6 – UN Water 2016. Retrieved from <http://www.unwater.org/publications/integrated-monitoring-guide-sdg-6/> NOTE 2 – Progress on drinking water, sanitation and hygiene: 2017 update and Sustainable Development Goal baselines. Retrieved from <http://www.unwater.org/publication_categories/whounicef-joint-monitoring-programme-for-water-supply-sanitation-hygiene-jmp/>				
Methodology	Calculate as: Numerator: number of city households with access to basic water sources. Denominator: total number of city households. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected through the local water utility.				
SDG reference(s)	SDG indicator 6.1.1: Percentage of population using safely managed drinking water services.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Water and sanitation**				
KPI name	**Potable water supply**				
KPI No.	**EC: I: WS: 2C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Percentage of households with a safely managed drinking water service				
Rationale/ Interpretation/ Benchmarking	This indicator measures the percentage of the urban and rural population using safely managed drinking water services, as defined by the WHO/UNICEF Joint Monitoring Programme. This indicator goes beyond the "basic water supply" indicator as it has been designed to incorporate an assessment of the quality and safety of the water people use. Households are considered to have access to a safely managed drinking water service when they use water from a basic source on premises. The term 'safely managed' is proposed to describe a higher threshold of service for water. This includes measures for protecting supplies and ensuring water is safe to drink. A house shall not be considered to have access to a safely managed drinking water service when an individual house or group is served by a conduit system built, for example, of wood, bamboo, or rubber hose, connected directly to a river, well, or to another house. An improving trend and higher values are considered positive.				
Source(s)	NOTE – WHO/UNICEF. Joint Monitoring Programme for Water Supply and Sanitation. Retrieved from <https://www.washdata.org/>				
Methodology	Calculate as: Numerator: number of city households with a safely managed drinking water service. Denominator: total number of city households. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected through the local water utility.				
SDG reference(s)	SDG indicator 6.1.1:Percentage of population using safely managed drinking water services.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Water and sanitation**				
KPI name	**Water supply loss**				
KPI No.	**EC: I: WS: 3C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Percentage of water loss in the water distribution system				
Rationale/ Interpretation/ Benchmarking	Water loss from distribution systems is a problem in almost all conurbations around the world but can be a serious issue in areas where water is scarce. This problem deserves immediate attention and appropriate action to reduce avoidable stress on scarce and valuable water resources. Reducing water losses in urban drinking water supply networks could make a substantial contribution to making progress in achieving SDG 6. Water losses in urban networks not only lead to economic losses for the utilities, but also reduce the number of people that have access to water. Where urban water supplies are concerned, minimizing losses from the system to the lowest technically feasible level is an urgent requirement. Water supplied is the actual volume of water supplied by the utility to the distribution system. Utilized water is volume of water that is actually billed by the water supply utility. The differences between the two values can be derived from multiple sources but are generally due to leaks in the system and unauthorized use. A declining trend and lower values are considered positive.				
Source(s)	NOTE 1 – Integrated Monitoring Guide for SDG 6 – UN Water 2016. Retrieved from <http://www.unwater.org/publications/integrated-monitoring-guide-sdg-6/> NOTE 2 – Progress on drinking water, sanitation and hygiene: 2017 update and Sustainable Development Goal baselines. Retrieved from <http://www.unwater.org/publication_categories/whounicef-joint-monitoring-programme-for-water-supply-sanitation-hygiene-jmp/>				
Methodology	Calculate as: Numerator: volume of water supplied minus the volume of utilized water (l/year). Denominator: total volume of water supplied (l/year). Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be provided through the local water supply utility.				
SDG reference(s)	SDG target 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Water and sanitation**				
KPI name	**Waste-water collection**				
KPI No.	**EC: I: WS: 4C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Percentage of households served by waste-water collection				
Rationale/ Interpretation/ Benchmarking	The collection of wastewaters is key to allow for centralized treatment which reduces the incidence of a variety of waterborne diseases. A reliable waste-water collection system is a major indicator of the level of local development and of community health. Water pollution from human waste is less of a problem in countries that can afford to treat sewage and wastewater. These countries usually have effective collection systems in place. An improving trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: number of city households served by waste-water collection. Denominator: total number of city households. Multiplied by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data should be collected from local utilities that operate wastewater facilities.				
SDG reference(s)	SDG target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Water and sanitation**				
KPI name	**Household sanitation**				
KPI No.	**EC: I: WS: 5C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Percentage of households with access to basic sanitation facilities				
Rationale/ Interpretation/ Benchmarking	The WHO/UNICEF Joint Monitoring Programme defines access to water supply and sanitation in terms of the types of technology and levels of service afforded. Basic sanitation facilities are able to maintain certain levels of hygiene and ensure that humans do not come in direct contact with human excreta. To be effective, facilities must be correctly constructed and properly maintained. Basic facilities include: • flush or pour-flush to piped sewer system, septic tank or pit latrine; • ventilated improved pit latrine; • pit latrine with slab; and • composting toilet. Access to adequate excreta disposal facilities is an important requirement if adverse health effects of poor sanitation are to be avoided. This indicator thus provides a measurement of both the potential exposure of the population to infectious agents associated with poor sanitation, and of the action taken to improve domestic sanitation. The indicator can be used: i) to help target and plan efforts to improve access to sanitation and to monitor progress of such measures; ii) to assess levels of social inequality and deprivation; and iii) to help investigate the link between sanitary conditions and specific health effects. Good sanitation is important for urban and rural populations, but the risks are greater in urban areas where contact with waste is more difficult to avoid. An improving trend and higher values are considered positive.				
Source(s)	NOTE 1 – Integrated Monitoring Guide for SDG 6 – UN Water 2016. Retrieved from <http://www.unwater.org/publications/integrated-monitoring-guide-sdg-6/> NOTE 2 – Progress on drinking water, sanitation and hygiene: 2017 update and Sustainable Development Goal baselines. Retrieved from <http://www.unwater.org/publication_categories/whounicef-joint-monitoring-programme-for-water-supply-sanitation-hygiene-jmp/>				
Methodology	Calculate as: Numerator: total number of city households with access to basic sanitation and facilities. Denominator: total number of city households. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	NOTE – WHO-UNICEF Joint Monitoring Programme for Water Supply and Sanitation <https://www.washdata.org/>				
SDG reference(s)	SDG indicator 6.2.1: Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Waste**				
KPI name	**Solid waste collection**				
KPI No.	**EC: I: WA: 1C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Percentage of households with regular solid waste collection				
Rationale/ Interpretation/ Benchmarking	The percentage of inhabitants served by regular solid waste collection is an indicator of city health, cleanliness and quality of life. Solid waste systems contribute in many ways to public health, the local economy, the environment, and the social understanding and education about the latter. Regular waste collections can include household collections, regular 'dumpmaster' group collections, but not local dumps to which the household must carry rubbish. Solid waste collection should occur at least once a week. An improving trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: number of city households that are served by solid waste collection. Denominator: total number of city households. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	This information could be provided by municipal bodies, public services and major private contractors dealing with solid waste collection and disposal. Data may be obtained from specific studies carried out on solid waste for specific projects. Parastatal and private companies dealing with solid waste treatment shall be able to provide information on selected disposal methods. Solid waste experts as well as NGOs working in this area may also be consulted.				
SDG reference(s)	SDG indicator 11.6.1: Percentage of urban solid waste regularly collected and with adequate final discharge with regard to the total waste generated by the city. SDG indicator 12.4.2: Treatment of waste, generation of hazardous waste, hazardous waste management, by type of treatment.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Electricity supply**				
KPI name	**Electricity system outage frequency**				
KPI No.	**EC: I: ES: 1C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Average number of electrical interruptions per customer per year				
Rationale/ Interpretation/ Benchmarking	The reliability of the electricity network is vital for long-term economic sustainability of a city. The System Average Interruption Frequency Index (SAIFI) is used as a standard reliability indicator by electric power utilities globally. SAIFI is the average number of interruptions that a customer would experience over a specific time-period, and is calculated as: $SAIFI = \frac{\sum \lambda_i N_i}{\sum N_i}$ λ_i is the failure rate N_i is the number of customers Data should be reported for a 12-month period.				
Methodology	Calculate as: Numerator: sum of customer interruptions. Denominator: total number of customers served.				
Unit	Number				
Data sources/ Relevant databases	NOTE – Data can be provided by the local electrical utility. IEEE Standard 1366-1998 at <https://www.ieee.org/standards/index.html>				
SDG reference(s)	SDG target 7.1: By 2030, ensure universal access to affordable, reliable and modern energy services.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Electricity supply**				
KPI name	**Electricity system outage time**				
KPI No.	**EC: I: ES: 2C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Average length of electrical interruptions				
Rationale/ Interpretation/ Benchmarking	The reliability of the electricity network is vital for long-term economic sustainability of a city. The Customer Average Interruption Duration Index (CAIDI) is used as a standard reliability indicator by electric power utilities globally and indicates how long it will take to restore electricity once an outage has occurred. $CAIDI = = \frac{\sum U_i N_i}{\sum \lambda_i N_i}$ U_i is the annual outage time λ_i is the failure rate N_i is the number of customers Data should be reported for a 12-month period.				
Methodology	Calculate as: Numerator: sum of all customer interruption durations (mins). Denominator: total number of customer interruptions.				
Unit	Minutes				
Data sources/ Relevant databases	NOTE – Data can be provided by the local electrical utility. IEEE Standard 1366-1998 at <https://www.ieee.org/standards/index.html>				
SDG reference(s)	SDG target 7.1: By 2030, ensure universal access to affordable, reliable and modern energy services.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Electricity supply**				
KPI name	**Access to electricity**				
KPI No.	**EC: I: ES: 3C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Percentage of households with authorized access to electricity				
Rationale/ Interpretation/ Benchmarking	Electricity and other modern energy services are an essential component of providing basic social services. Lack of access to modern energy services contributes to poverty and deprivation and limits economic development. Furthermore, adequate, affordable and reliable energy services are necessary to guarantee sustainable, economic and human development. Unlawful connections make the development of an electricity grid less viable as authorized users must pay higher rates to compensate for funds lost due to unauthorized connections. An improving trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: number of city households with an authorized connection to the electrical system. Denominator: total number of city households. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be obtained from local electricity utility providers.				
SDG reference(s)	SDG indicator 7.1.1: Proportion of population with access to electricity.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Transport**				
KPI name	**Public transport network**				
KPI No.	**EC: I: T: 1C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Length of public transport network per 100 000 inhabitants				
Rationale/ Interpretation/ Benchmarking	Public transport shall include both high capacity (e.g., heavy rail, metro, subway systems and commuter rail systems) and light capacity (e.g., light rail streetcars and trams, buses, trolleybuses). One-way length is defined as a transit line that is 10 km long (back and forth). It should be noted that 20 km is counted as two-way length. Cities shall report only on the length of lines within city boundaries. An improving trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: length of public transport lines within city boundaries (km) (one-way length). Denominator: one 100 000th of the city's population.				
Unit	Kilometres/100 000 inhabitants				
Data sources/ Relevant databases	Data can be collected from local transportation, road departments and local transit authorities.				
SDG reference(s)	SDG target 11.2: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Transport**				
KPI name	**Public transport network convenience**				
KPI No.	**EC: I: T: 2A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Percentage of the city population that has convenient access (within 0.5 km) to public transport				
Rationale/ Interpretation/ Benchmarking	The total length of the public transport system does not necessarily provide information on accessibility and investments in public transport can be more expensive if need and demand are not taken into account. The International Association of Public Transport (UITP) recognizes that the access to public transport is considered convenient when an officially recognized stop is accessible within a distance of 0.5 km. An improving trend and higher values are considered positive.				
Source(s)	NOTE – UITP. Public Transport Trends. Retrieved from <http://www.uitp.org/public-transport-trends>				
Methodology	Calculate as: Numerator: total number of city inhabitants living within 0.5km of a public transport stop. Denominator: total number of city inhabitants. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be obtained through overlays of GIS data from the city and local public transport operator information.				
SDG reference(s)	SDG target 11.2: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Transport**				
KPI name	**Bicycle network**				
KPI No.	**EC: I: T: 3C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Length of bicycle paths and lanes per 100 000 population				
Rationale/ Interpretation/ Benchmarking	A transportation system within a city that emphasizes the use of bicycles can be a method to reduce traffic congestion. Cycling has a lower environmental impact than the other vehicles and is a low-cost transportation means. Therefore, bicycles are more accessible to lower income inhabitants and provide health benefits to users. Bicycle lanes are to be counted if they are separated from the road by defined road markings. Bicycle paths are to be counted if they are separate roadways or lanes separated from the road by physical barriers. An improving trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: km of bicycle paths/lanes. Denominator: one 100 000th of the city's population.				
Unit	Kilometres / 100 000 inhabitants				
Data sources/ Relevant databases	Data can be collected from municipal transportation and road authorities.				
SDG reference(s)	SDG target 11.2: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Transport**				
KPI name	**Transportation mode share**				
KPI No.	**EC: I: T: 4A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	The percentage of people using various forms of transportation to travel to work				
Rationale/ Interpretation/ Benchmarking	Passenger transport mode share refers to the percentage of passenger journeys or trips by the main mode of transport and is typically reported through travel surveys. Since traffic congestion is generally highest during the time when people are travelling to and from work, collecting data during these periods is most relevant to initiate actions to reduce congestion. Cities should report on the modes of public transportation, personal vehicles, bicycles, walking, and paratransit going to and from work. An improving trend and higher values for public and more sustainable options are considered positive.				
Source(s)	NOTE 1 – Transport Mode Shares. Retrieved from <https://www.lta.gov.sg/ltaacademy/doc/J11Nov-p60PassengerTransportModeShares.pdf> NOTE 2 – Paratransit. Retrieved from <https://www.transitwiki.org/TransitWiki/index.php/Paratransit_Services>				
Methodology	Calculate as: Numerator: number of travellers using a specific transportation mode. Denominator: total number of travellers. Multiply by 100. Report on modes: public transportation, personal vehicles, bicycles, walking, paratransit.				
Unit	Percentage				
Data sources/ Relevant databases	Data would be gathered from local road and transport authorities and local transit authorities. Data may be available from transportation surveys.				
SDG reference(s)	SDG target 11.2: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Transport**				
KPI name	**Travel time index**				
KPI No.	**EC: I: T: 5A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Ratio of travel time during the peak periods to travel time at free flow periods				
Rationale/ Interpretation/ Benchmarking	This indicator is a measure of congestion that focuses on each trip and each mile of travel. A value of 1.30 indicates that a 20-minute free-flow trip takes 26 minutes during the peak. For more focused systems of mixed freeway and arterial facilities (no local streets) a TTI of under 2.5 is roughly indicative of generally uncongested conditions and good signal coordination. For a system of solely unsignalized facilities (freeways, highways, 2-lane rural roads), a TTI of over 1.4 is indicative of the facility being relied on in excess of its capacity over the entire length of the analysis period. The following should be taken into consideration for this indicator: • TTI <= 1.5 is "Good"; • TTI between 1.5 and 2.5 is "Potentially Acceptable"; and • TTIs > 2.5 is "Less Desirable".				
Source(s)	NOTE – US Department of Transportation. Traffic Analysis Toolbox Volume VI: Definition, Interpretation, and Calculation of Traffic Analysis Tools Measures of Effectiveness. Retrieved from <https://ops.fhwa.dot.gov/publications/fhwahop08054/sect6.htm>				
Methodology	Calculate as: Numerator: travel time during peak periods (min). Denominator: travel time during free-flow periods (min).				
Unit	Ratio				
Data sources/ Relevant databases	Data can be obtained from local or national transportation authorities.				
SDG reference(s)	SDG target 11.2: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Transport**				
KPI name	**Shared bicycles**				
KPI No.	**EC: I: T: 6A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Number of shared bicycles per 100 000 inhabitants				
Rationale/ Interpretation/ Benchmarking	Many cities globally are now implementing a variety of bicycle sharing services either run by local community groups or non-profit organizations, the municipality, or in conjunction with private operators. Shared bicycle services can provide instant transportation options for residents and visitors and avoid the use of automobiles or motorized public transport, thereby reducing traffic congestion, noise, and air pollution. An improving trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: number of shared bicycles available. Denominator: one 100 000th of the city's population.				
Unit	Number/100 000 inhabitants				
Data sources/ Relevant databases	Data can be collected from municipal transportation agencies and/or bicycle sharing service operators.				
SDG reference(s)	SDG target 11.2: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Transport**				
KPI name	**Shared vehicles**				
KPI No.	**EC: I: T: 7A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Number of shared vehicles per 100 000 inhabitants				
Rationale/ Interpretation/ Benchmarking	Shared vehicles are defined as vehicles available for short-term rentals (often by the hour) through a commercial business, public agency or with a cooperative. Shared vehicles provide an alternative form of transportation for those inhabitants who do not need to have a personal vehicle (due to the limited number of travels they engage in). This may reduce the number of personal vehicles within a city, and may also mean that a city does not have to build as many parking facilities or that road space can be better utilized for travel rather than parking. An improving trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: number of shared vehicles. Denominator: one 100 000th of the city's population.				
Unit	Number/100 000 inhabitants				
Data sources/ Relevant databases	Data can be collected from providers of car sharing services.				
SDG reference(s)	SDG target 11.2: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Transport**				
KPI name	**Low-carbon emission passenger vehicles**				
KPI No.	**EC: I: T: 8A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Percentage of low-carbon emission passenger vehicles				
Rationale/ Interpretation/ Benchmarking	"Plug-in hybrids, sometimes called Plug-in Hybrid-Electric Vehicles (PHEVs), are hybrids with high-capacity batteries that can be charged by plugging them into an electrical outlet or charging station. They can store enough electricity to significantly reduce their fuel use under typical driving conditions." (US Department of Energy) "All-electric vehicles (EVs) run on electricity only. They are propelled by one or more electric motors powered by rechargeable battery packs. EVs have several advantages over conventional vehicles: ▪ e**nergy efficient**: EVs convert about 59%–62% of the electrical energy from the grid to power at the wheels. Conventional gasoline vehicles only convert about 17%–21% of the energy stored in gasoline to power at the wheels.*; ▪ e**nvironmentally friendly**: EVs emit no tailpipe pollutants, although the power plant producing the electricity may emit them. Electricity from nuclear, hydro, solar, or wind-powered plants causes no air pollutants; and ▪ p**erformance benefits**: Electric motors provide quiet, smooth operation and stronger acceleration and require less maintenance than internal combustion engines (ICEs)." (US Department of Energy) Cities should count both PHEV and EV as low emission vehicles. An improving trend and higher values are considered positive.				
Source(s)	NOTE 1 – US Department of Energy. Plug-in Hybrids. Retrieved from <https://www.fueleconomy.gov/feg/phevtech.shtml> NOTE 2 – US Department of Energy. All-Electric Vehicles. Retrieved from <http://fueleconomy.gov/feg/evtech.shtml>				
Methodology	Calculate as: Numerator: number of low emission vehicles registered (PHEV & EV). Denominator: number of total vehicles. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected from government agencies that register passenger motor vehicles.				
SDG reference(s)	SDG target 11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Buildings**				
KPI name	**Public building sustainability**				
KPI No.	**EC: I: B: 1A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Percentage area of public buildings with recognized sustainability certifications for ongoing operations.				
Rationale/ Interpretation/ Benchmarking	Buildings can account for a significant proportion of the GHG emissions and resource use within a city. Sustainability certifications have shown that buildings going through the process of certifying and striving for higher levels of certification will generally use less energy and water. Such buildings also show increased levels of recycling and composting and are more comfortable for occupants. Certifications for public buildings can in particular demonstrate what is possible and provide leadership to the private sector. Certifications are only acceptable if they are for ongoing building operations and maintenance. Certifications for design should not be included as the design stage normally is only 5-10% of a building's total life cycle impact. Standards to be included are: BREEAM, LEED, CASBEE, BOMA BEST, BCA Green Mark, Passive House, etc. Other standards that are equivalent to the above can be reported. An improving trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: floor area of public buildings with certification to a recognized standard for ongoing building operations (m^2). Denominator: total floor area of public buildings (m^2). Multiply by 100. Report by certification scheme.				
Unit	Percentage				
Data sources/ Relevant databases	NOTE – Data can be obtained through the facilities group within the city and through the websites of various certification agencies, such as: http://www.breeam.com/ http://www.usgbc.org/LEED/ http://www.ibec.or.jp/CASBEE/english/ http://passivehouse.com/index.html				
SDG reference(s)	SDG target 11.3: By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries. SDG target 7.3: By 2030, double the global rate of improvement in energy efficiency.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Buildings**				
KPI name	**Integrated building management systems in public buildings**				
KPI No.	**EC: I: B: 2A**	**Type:**	**Advanced**	**Type:**	**Smart**
Definition/ Description	Percentage area of public buildings using integrated ICT systems to automate building management				
Rationale/ Interpretation/ Benchmarking	Buildings with ICT systems have the capacity to provide citizens with a secure living and working environment by ensuring aspects like energy efficiency and water consumption are maintained at acceptable levels. Additionally, such buildings also account for the dynamic utilization of building space based on need and availability. ICT systems include building management, communication, and control systems for parameters (like energy, water, etc.). Smart buildings (using ICTs) often have the following features: • Adapts to the comfort of inhabitants: These building "learn" from inhabitants' behaviour and attempts to maximize their comfort. • Promotes energy efficiency: Such buildings can significantly reduce energy consumption and facilitate cost saving. • Ensures safety: Smart buildings can detect fire, water and gas leaks, faulty equipment and possible theft. Such buildings often have self-diagnostic systems to deal with these situations. • Protects health: Smart buildings assure that appropriate temperature, light intensity, air condition parameters are maintained, etc. • Provides assistance: These buildings can improve the quality of life of the elderly and disabled individuals living alone by provision of home assistance (when required). A higher percentage indicates a greater number of buildings with ICT systems.				
Source(s)	NOTE – Eugeny. I. Batov. The distinctive features of "smart" buildings. Theoretical Foundation of Civil Engineering. 2015. [b-Eugeny]				
Methodology	Calculate as: Numerator: floor area of public buildings using ICT-based systems for integrated management in the city (m^2) Denominator: total floor number of public buildings (m^2) Multiply by 100				
Unit	Percentage				
Data sources/ Relevant databases	Data can be obtained from the department of urban planning or city buildings councils or associations. Collection method: This information can be gathered from: i) buildings registry of the city; and ii) smart buildings programmes.				
SDG reference(s)	SDG indicator 11.1.1: Proportion of urban population living in slums, informal settlements or inadequate housing. SDG target 11.C: Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Urban planning**				
KPI name	**Pedestrian infrastructure**				
KPI No.	**EC: I: UP: 1A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Percentage of the city designated as a pedestrian/car free zone				
Rationale/ Interpretation/ Benchmarking	Pedestrian zones (also known as car free zones) are areas of a city that are reserved for pedestrian use only. Most, or all, automobile or truck traffic is prohibited (except for emergency vehicles or occasional deliveries or taxis). Pedestrian zones tend to improve the local areas in terms of pollution, noise, liveability and safety for pedestrians although sometimes these negative impacts are shunted to neighbouring areas. Generally, a higher value and an upward trend are considered more sustainable.				
Methodology	Calculate as: Numerator: total area of pedestrian/car free zones. Denominator: total city area. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data may be collected from city Geographical Information Systems (GIS) data or planning departments.				
SDG reference(s)	SDG target 11.3: By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.				

Dimension	Economy				
Sub-dimension	**Infrastructure**				
Category	**Urban planning**				
KPI name	**Urban development and spatial planning**				
KPI No.	**EC: I: UP: 2A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Existence of urban development and spatial planning strategies or documents at the city level				
Rationale/ Interpretation/ Benchmarking	Well-managed urbanization techniques generate economic prosperity, socio-cultural progress and environmental sustainability. Poorly managed urbanization causes increased inequality, growth of slums and negative climate change impacts. Successful urban development and planning requires evidence-based design, implementation and management. For each primary and secondary city (as defined by United Nations Department of Economic and Social Affairs), the following terms are to be considered: *Urban Planning*: The process of urban planning has been conducted if "urban planning documents" are available for each primary and secondary city in scope. *Smart*: This includes the existence of evidence-based and innovative methodology (including data innovations like spatial analytics, GIS, big data) to provide information on the urban plan outputs. *Innovation*: This means novel, original and useful. *Sustainable*: Urban plans should have (all) these five principles/elements to be considered "sustainable": 1) compact – avoiding urban sprawl [yes/no]; 2) connectivity – places and locations to demonstrate high connectivity [yes/no]; 3) integration – mixed urban land use [yes/no]; 4) socially inclusive [yes/no]; and 5) resilient to climate change [yes/no]. If a city has only implemented 1, 2, 3, 4 out of 5 principles, it is only partially planned.				
Source(s)	NOTE – Cities Alliance. Retrieved from <https://www.citiesalliance.org/>				
Methodology	To collect the data for the measurement: Step 1: Identify city (in scope). Step 2: Deduce whether there is an urban plan for the city. Step 3: Examine if urban plans contain all five sustainability principles/elements (if the plans are digitalized and, on the web, then consider using automated web queries with semantics to examine these elements). If an urban plan has a smart methodology (as defined above) and meets all five sustainable urban plan principles, then it qualifies as a smart sustainable city's urban plan. If these principles are only partially met, mark as "partial" for further development.				
Unit	Yes or no. To be rated based on information provided.				
Data sources/ Relevant databases	Urban planning websites and data repositories of local, municipal and/or national governments.				
SDG reference(s)	SDG indicator 11.a.1: Proportion of population living in cities that implement urban and regional development plans integrating population projections and resource needs, by size of city. SDG target 11.3: By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.				

10 Key performance indicators – Environment dimension

The following section contains the indicators related to the environment dimension.

Dimension	**Environment**				
Sub-dimension	**Environment**				
Category	**Air quality**				
KPI name	**Air pollution**				
KPI No.	**EN: EN: AQ: 1C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Air quality index (AQI) based on reported value for: Particulate matter (PM10, and PM2.5); NO_2 (nitrogen dioxide); SO_2 (sulphur dioxide); and O_3 (ozone).				
Rationale/ Interpretation/ Benchmarking	High population density and the concentration of industry exert great pressure on local environments. Air pollution, from households, industry power stations and transportation (motor vehicles), is often a major problem. As a result, the greatest potential for human exposure to ambient air pollution and subsequent health problems occur in urban areas. Improving air quality is a significant aspect of promoting sustainable human settlements. The indicator provides a measure of the state of the environment in terms of air quality and is an indirect measure of population exposure to air pollution, which is a matter of health concern in urban areas. The indicator may be used to monitor trends in air pollution as a basis for prioritising policy actions: a) to map levels of air pollution in order to identify hotspots or areas in need of special attention; b) to help assess the number of people exposed to excess levels of air pollution; c) to monitor levels of compliance with air quality standards; d) to assess the effects of air quality policies; and e) to help investigate links between air pollution and health effects. World Health Organization (WHO) air quality guidelines exist for all the pollutants of this indicator. Many countries have established their own air quality standards for many of these pollutants. A declining trend and lower values are considered positive.				
Source(s)	NOTE – WHO. Media Centre. Retrieved from <http://www.who.int/mediacentre/factsheets/fs313/en/>				
Methodology	Calculate as: Numerator: mass of pollutant collected (µg). Denominator: volume of air sampled (m^3). Report as annual mean concentration for each pollutant.				
Unit	µg / m^3				
Data sources/ Relevant databases	NOTE 1 – WHO Air quality guidelines – global update 2005 <https://www.who.int/publications/i/item/WHO-SDE-PHE-OEH-06-02> NOTE 2 – WHO Annual mean concentration of particulate matter of less than 2.5 microns of diameter (PM2.5) [µg /m^3] in urban areas <http://apps.who.int/gho/data/node.sdg.11-6-data?lang=en> NOTE 3 – AirBase – The European air quality database <http://www.eea.europa.eu/themes/air/interactive/pm10>				
SDG reference(s)	SDG target 11.6: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality, municipal and other waste management. SDG indicator 11.6.2: Annual mean levels of fine particulate matter (e.g., PM2.5 and PM10) in cities (population weighted).				

Dimension	Environment				
Sub-dimension	**Environment**				
Category	**Air quality**				
KPI name	**GHG emissions**				
KPI No.	**EN: EN: AQ: 2C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Greenhouse gas (GHG) emissions per capita				
Rationale/ Interpretation/ Benchmarking	In order to prevent the most severe impacts of climate change, countries have signed up to the United Nations Framework Convention on Climate Change (UNFCCC) and agreed to cooperate with the aim of limiting the increase in global average temperature and the resulting climate change impacts. In this context, the industrialized countries need to annually prepare and submit precise and regularly updated inventories of greenhouse gas (GHG) emissions. "Internationally, the main instrument to limit greenhouse gas (GHG) emissions is the Kyoto Protocol, which was adopted in 1997 and commits its Parties by setting internationally binding emission reduction targets." The Kyoto Protocol runs in two commitment periods; the first one started in 2008 and ended in 2012, whereas the second started in 2013 and will end in 2020. At the same time the European Union (EU) has set its climate change mitigation objective for 2020, committing itself to reduce its emissions by at least 20% compared to 1990 levels (30% subject to the conclusion of a comprehensive international climate change agreement). Methodologies for determining GHG emissions include but are not limited to: i) The Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC); ii) BSI Norm: PAS 2070 on Specification for the assessment of greenhouse gas emissions of a city; iii) Intergovernmental Panel on Climate Change IPCC Guidelines for National Greenhouse Gas Inventories; iv) Global Protocol for Community-Scale GHG Emissions' (GPC), (2012 Accounting and Reporting Standard); and v) ISO 14064 series on Greenhouse Gases. Benchmarking should be based on the "Doha Amendment to the Kyoto Protocol" (UNFCCC). A declining trend and lower values are considered positive.				
Source(s)	NOTE 1 – UNFCCC. Kyoto Protocol. Retrieved from <http://unfccc.int/kyoto_protocol/items/2830.php> NOTE 2 – UNFCCC. Kyoto Protocol Doha Amendment. Retrieved from <http://unfccc.int/kyoto_protocol/doha_amendment/items/7362.php>				
Methodology	Calculate as: Numerator: total GHG emissions (Tonnes eCO_2). Denominator: total number of city inhabitants. NOTE – In eCO_2, "e" means "equivalent", and every other greenhouse gas is converted into CO_2.				
Unit	Tonnes eCO_2/capita				
Data sources/ Relevant databases	NOTE – United nations Greenhouse Gas Inventory Data: <https://unfccc.int/ghg_data/items/3800.php>				
SDG reference(s)	SDG target 11.6: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality, municipal and other waste management. SDG indicator 13.2.1: Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other).				

Dimension	Environment				
Sub-dimension	**Environment**				
Category	**Water and sanitation**				
KPI name	**Drinking water quality**				
KPI No.	**EN: EN: WS: 1C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Percentage of households covered by an audited Water Safety Plan				
Rationale/ Interpretation/ Benchmarking	Water safety and quality are fundamental to human development and well-being. Providing access to safe water is one of the most effective instruments in promoting health and reducing poverty. WHO produces international norms on water quality and human health in the form of guidelines that are used as the basis for regulation and standard setting worldwide. The guidelines for drinking water quality (GDWQ) promote the protection of public health by advocating for the development of locally relevant standards and regulations (health-based targets), adoption of preventive risk management approaches covering catchment to consumer (water safety plans) and independent surveillance to ensure that water safety plans are being implemented and effective and that national standards are being met. Cities should measure the quality of drinking water against the most recent WHO Guidelines for Drinking Water Quality Fourth Edition. An improving trend and higher values are considered positive.				
Source(s)	NOTE 1 – WHO – Guidelines for drinking water quality. Retrieved from <http://apps.who.int/iris/bitstream/10665/254637/1/9789241549950-eng.pdf?ua=1> NOTE 2 – WHO. Water Sanitation. Retrieved from <http://www.who.int/water_sanitation_health/water-quality/en/> NOTE 3 – Progress on drinking water, sanitation and hygiene: 2017 update and Sustainable Development Goal baselines. Retrieved from: <https://www.washdata.org/>				
Methodology	Calculate as: Numerator: number of compliant samples to WHO Guidelines. Denominator: total number of samples. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	NOTE – WHO Guidelines on drinking water quality. Retrieved from <http://apps.who.int/iris/bitstream/10665/254637/1/9789241549950-eng.pdf?ua=1> <http://www.who.int/water_sanitation_health/water-quality/en/>				
SDG reference(s)	SDG indicator 6.1.1: Proportion of population using safely managed drinking water services.				

Dimension	Environment				
Sub-dimension	**Environment**				
Category	**Water and sanitation**				
KPI name	**Water consumption**				
KPI No.	**EN: EN: WS: 2C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Water consumption per capita				
Rationale/ Interpretation/ Benchmarking	Consumption of water per person depends on: • the availability and price of water; • the climate; and • the uses of water (drinking, bathing, washing, and gardening). In many cities, potable water supply is not constant, and households rely on a few hours to tap the available water during the day. Water consumption is much higher in cities of higher income countries. Typically, people in cities of developed countries use 272 litres per day while the average in Africa is 53 litres per day. North American cities use, on average, double the amount of water per person than Western European cities, and seven times that of African cities. Water consumption should include all water used within the city. Water consumption per capita should be in line with the sustainable water resources available. A declining trend and lower values are considered positive.				
Source(s)	NOTE – Urban Indicators Toolkit. Retrieved from <http://www.conei.sp.gov.br/ind/urbanindicators_urbanobservatory.pdf>				
Methodology	Calculate as: Numerator: total amount of water consumption in cities (ℓ/day). Denominator: total number of city inhabitants.				
Unit	ℓ / day / capita.				
Data sources/ Relevant databases	NOTE – Data can be obtained from water supply utilities. United Nations (2002): GLOBAL URBAN INDICATORS DATABASE <https://unhabitat.org/global-urban-indicators-database>				
SDG reference(s)	SDG indicator 6.4.1: Change in water-use efficiency over time.				

Dimension	Environment				
Sub-dimension	**Environment**				
Category	**Water and sanitation**				
KPI name	**Freshwater consumption**				
KPI No.	**EN: EN: WS: 3C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Freshwater consumption				
Rationale/ Interpretation/ Benchmarking	The purpose of this indicator is to show the degree to which total freshwater resources are being exploited to meet a country's water demand. It is a measure of a country's pressure on its water resources and therefore on the sustainability of its water use. The indicator shows the extent to which water resources are already used, and the need for adjusted supply and demand management policies. It can also give an indication of increasing competition and conflict surrounding freshwater scarcity. Increased water scarcity, measured by an increase in the value of the indicator, has negative effects on the sustainability of the natural resources' base and subsequent negative effects on economic development. On the other hand, very low values of the indicator can indicate that there still is potential for increase in water use in a sustainable way. "Water withdrawals, or water abstractions, are defined as freshwater taken from ground or surface water sources, either permanently or temporarily, and conveyed to a place of use. If the water is returned to a surface water source, abstraction of the same water by the downstream user is counted again in compiling total abstractions: this may lead to double counting. The data includes abstractions for public water supply, irrigation, industrial processes and cooling of electric power plants. Mine water and drainage water are included, whereas water used for hydroelectricity generation is normally excluded. This indicator is measured in m3 per capita (a cubic meter is the equivalent of one thousand 1 litre bottles)". (OECD) Only 3% of the water in the world is freshwater. Depending on the location of cities, water for consumption can be derived from a variety of sources. A higher percentage indicates a higher level of consumption from fresh water sources.				
Source(s)	NOTE 1 – Millennium Development Goals Indicators. Retrieved from <https://unstats.un.org/UNSD/MDG/Metadata.aspx?IndicatorId=0&SeriesId=768> NOTE 2 – Proportion of Total Water Resources Used. Retrieved from <http://www.un.org/esa/sustdev/natlinfo/indicators/methodology_sheets/freshwater/total_water_resources_used.pdf> NOTE 3 – Precipitation Measurement Missions. Retrieved from <https://pmm.nasa.gov/applications/freshwater-availability> NOTE 4 – OECD. Water Withdrawals. Retrieved from <https://data.oecd.org/water/water-withdrawals.htm>				
Methodology	Calculate as: Numerator: total amount of freshwater resources. Denominator: total amount of water consumption. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Information on volume of water from fresh water or intake sources can be received from city water utility/ies. Hydrological data could also be requested from the ministry of environment and national water authority. Collection method: This information can be gathered from: 1) registers of treated water from water supply systems.				
SDG reference(s)	SDG indicator 6.4.2: Level of water stress: freshwater withdrawal as a proportion of available freshwater resources.				

Dimension	Environment				
Sub-dimension	**Environment**				
Category	**Water and sanitation**				
KPI name	**Waste-water treatment**				
KPI No.	**EN: EN: WS: 4C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Percentage of wastewater receiving treatment (Primary, Secondary, Tertiary)				
Rationale/ Interpretation/ Benchmarking	Improvement of water treatment reduces the incidence of a variety of waterborne diseases. A reliable waste-water treatment system is a major indicator of the level of local development and of community health. Water pollution from human waste is less of a problem in countries that can afford to treat sewage and wastewater. Water pollution can be minimized with adequate investment in treatment systems. The percentage of wastewater treated is an indicator of water quality management. All forms of treatment include treatment to permit water release into water resources of different levels of environmental sensitivity. They are: i) primary treatment which screen and sediment sewage to remove grosser debris; ii) secondary treatment which reduce biological oxygen demand (BOD10) to acceptable levels by microbial oxidation using activated sludge or a trickle filter; and iii) tertiary treatment which reduces BOD still further through micro-straining or filtering, the microbial removal of phosphates and nitrates, and disinfection using chlorine or ozone. An improving trend and higher values are considered positive.				
Source(s)	NOTE – FAO, Wastewater Treatment. Retrieved from: <http://www.fao.org/docrep/t0551e/t0551e05.htm>				
Methodology	Calculate as: Numerator: total amount of wastewater that has undergone (primary /secondary / tertiary) treatment (ℓ). Denominator: total amount of wastewater collected (ℓ). Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	This information is usually known by municipal authorities and is available from the main water supply and treatment companies.				
SDG reference(s)	SDG indicator 6.3.1: Percentage of wastewater safely treated.				

Dimension	Environment				
Sub-dimension	**Environment**				
Category	**Waste**				
KPI name	**Solid waste treatment**				
KPI No.	**EN: EN: WA: 1C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	The percentage of solid waste dealt with in the following ways should be reported on: a) disposed to sanitary landfills; b) burnt in an open area; c) incinerated; d) disposed to an open dump; e) recycled; and f) other (with regard to total amount of solid waste produced).				
Rationale/ Interpretation/ Benchmarking	Many cities generate more solid waste than can be readily disposed of and the use of open pits to burn waste is more common in cities in developing countries or countries with economies in transition, which can lead to adverse effects on the environment and health. The following treatment categories can be prioritized: • disposal to sanitary landfill is preferable to burning in open areas or disposal in open dumps; • solid waste recycling in a regulated facility is preferable to burning and dumping; and • solid waste incineration and energy production is preferable to dumping and burning in open areas. An improving trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: total amount of solid waste that is disposed to landfills/incinerated/burnt in an open area/disposed in an open dump/other/recycled (tonnes). Denominator: total amount of solid waste produced (tonnes). Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected from municipalities, municipal contractors or private contractors responsible for solid waste collection and disposal.				
SDG reference(s)	SDG indicator 11.6.1: Percentage of urban solid waste regularly collected and with adequate final discharge with regard to the total waste generated by the city.				

Dimension	Environment				
Sub-dimension	**Environment**				
Category	**Environmental quality**				
KPI name	**EMF exposure**				
KPI No.	**EN: EN: EQ: 1C**	**Type:**	**Core**	**Type:**	**Smart**
Definition/ Description	Percentage of mobile network antenna sites in compliance with EMF exposure guidelines				
Rationale/ Interpretation/ Benchmarking	The deployment of mobile network antenna sites and similar smart sustainable city wireless infrastructure often receive opposition, which usually increases with the density of such installations. This opposition may be linked to concerns about potential health risks caused by exposure to EMF, as well as to concerns about aesthetics, impacts on property values, or issues such as privacy of information. With respect to EMF exposure, these fields are often imperceptible to and poorly comprehended by the general public. This can generate social conflicts due to public distrust and rejection and lead to delays in the deployment of new wireless technologies. In this context, city officials and elected representatives need to develop transparent policies and mechanisms for the implementation of wireless facilities [b-ITU-T K.83] and [b-ITU-T K.113]. Large disparities between national limits and international guidelines can foster confusion for regulators and policy makers and increase public anxiety [b-ITU-T K.91]. These factors have motivated WHO to build a framework for developing health-based EMF standards which address how to develop science-based quantitative EMF exposure limits. It is intended for national advisory and/or regulatory bodies that are either developing new standards for EMF or reviewing the basis of their existing standards. Cities shall confirm compliance through a statistically valid audit programme for mobile network antenna sites and provide data as to the verification programme and results [b-ITU-T K.61]. Sites shall be counted only if they are part of a verification programme and results show no area of non-compliance [b-ITU-T K.52]. An improving trend and higher values are considered positive.				
Source(s)	NOTE 1 – WHO EMF Standards -Framework for developing health-based EMF standards. Retrieved from <http://www.who.int/peh-emf/standards/framework/en/> NOTE 2 – [b-ITU-T K.52]. Retrieved from <https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=13131> NOTE 3 – [b-ITU-T K.61]. Retrieved from <https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=9139> NOTE 4 – [b-ITU-T K.83]. Retrieved from <https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=11037> NOTE 5 – [b-ITU-T K.91]. Retrieved from <https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=11634> NOTE 6 – [b-ITU-T K.113]. Retrieved from <https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=12666> NOTE 7 – [b-ITU-T K.121]. Retrieved from <https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=13137>				
Methodology	Calculate as: Numerator: number of sites complying with WHO guidelines. Denominator: total number of sites. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	NOTE 1 – ITU EMF Guide. Retrieved from <http://emfguide.itu.int/emfguide.html> NOTE 2 – International Commission on Non-Ionizing Radiation Protection (ICNIRP) International Guidelines. Retrieved from <https://emfguide.itu.int/pdfs/emfgdl.pdf>				
SDG reference(s)	SDG target 16.B: Promote and enforce non-discriminatory laws and policies for sustainable development.				

Dimension	Environment				
Sub-dimension	**Environment**				
Category	**Environmental quality**				
KPI name	**Noise exposure**				
KPI No.	**EN: EN: EQ: 2A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Percentage of inhabitants exposed to excessive noise levels.				
Rationale/ Interpretation/ Benchmarking	Exposure to prolonged levels of excessive noise can lead to negative health effects and affect the ability of residents to enjoy outdoor/indoor city life. Exposure to noise shall be calculated in accordance with the requirements of ISO 1996-2:1987 Acoustics – Description and measurement of environmental noise. Excessive noise exposure should be mapped the area of the city where the noise level [LDEN (day-evening-night)] exceeds 55 dB(A). A lower value and a declining trend are positive indicators.				
Methodology	Calculate as: Numerator: number of city inhabitants exposed to noise levels [LDEN (day-evening-night)] over 55 dB(A). Denominator: total number of city inhabitants. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected through municipal/national environmental departments.				
SDG reference(s)	SDG target 11.6: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.				

Dimension	Environment				
Sub-dimension	**Environment**				
Category	**Public space and nature**				
KPI name	**Green areas**				
KPI No.	**EN: EN: PSN: 1C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Green area per 100 000 inhabitants				
Rationale/ Interpretation/ Benchmarking	Green areas are important to the sustainability of a city. The benefits of green spaces include capturing pollutants, reducing the "heat island" effect and providing recreational spaces. Green spaces can include parks, gardens, recreational areas, natural areas or other open green spaces. An improving trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: total area of green space in the city (m^2) (public and private). Denominator: one 100 000^{th} of the city's population.				
Unit	m^2 / 100 000 inhabitants				
Data sources/ Relevant databases	Data may be obtained through municipal parks and recreation departments, planning departments, aerial surveys or GIS data.				
SDG reference(s)	SDG indicator 11.7.1: The average share of the built-up area of cities that is open space for public use for all, disaggregated by age group, sex and persons with disabilities.				

Dimension	Environment				
Sub-dimension	**Environment**				
Category	**Public space and nature**				
KPI name	**Green area accessibility**				
KPI No.	**EN: EN: PSN: 2A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Percentage of inhabitants with accessibility to green areas.				
Rationale/ Interpretation/ Benchmarking	Green areas are important to the sustainability of a city. The benefits of green spaces include capturing pollutants, reducing the "heat island" effect and providing recreational spaces. Green spaces can include parks, gardens, recreational areas, natural areas or other open green spaces. However, it is also important to note whether city inhabitants have ready access to these spaces, as such spaces lead to a higher quality of life for the city's inhabitants. An improving trend and higher values are considered positive.				
Source(s)	NOTE – This indicator is based on the WHO/EURO indicator suggested for accessibility of green spaces and the methodological guidance. Retrieved from <http://www.euro.who.int/__data/assets/pdf_file/0005/321971/Urban-green-spaces-and-health-review-evidence.pdf?ua=1>				
Methodology	Calculate as: Numerator: number of inhabitants living with 300 m of a publicly accessible green space of at least 0.5 ha. Denominator: total number of city inhabitants. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data may be obtained from municipal parks and recreation departments, planning departments, aerial surveys or GIS data overlaid with population data or maps.				
SDG reference(s)	SDG indicator 11.7.1: The average share of the built-up area of cities that is open space for public use for all, disaggregated by age group, sex and persons with disabilities.				

Dimension	Environment				
Sub-dimension	**Environment**				
Category	**Public space and nature**				
KPI name	**Protected natural areas**				
KPI No.	**EN: EN: PSN: 3A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Percentage of city area protected as natural sites				
Rationale/ Interpretation/ Benchmarking	Protected natural areas of a city are important to allow for habitats for native species to maintain biodiversity. Natural areas should be as large as possible and contiguous for maximum benefit. A 'protected area' refers to a clearly defined geographical space, recognized, dedicated, and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. An improving trend and higher values are considered positive.				
Source(s)	NOTE – IUCN. Urban Protected Areas – Profiles and best practice guidelines. Retrieved from <https://www.iucn.org/content/urban-protected-areas-profiles-and-best-practice-guidelines>				
Methodology	Calculate as: Numerator: area of protected natural areas preserved by law or other effective means (m^2). Denominator: total city area (m^2). Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data may be obtained through municipal parks and recreation departments, planning departments, aerial surveys or GIS data.				
SDG reference(s)	SDG indicator 15.1.2: Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type. SDG indicator 15.B.1: (a) Official development assistance on conservation and sustainable use of biodiversity and ecosystems; and (b) revenue generated and finance mobilized from biodiversity-relevant economic instruments. SDG target 14.5: By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information.				

Dimension	Environment				
Sub-dimension	**Environment**				
Category	**Public space and nature**				
KPI name	**Recreational facilities**				
KPI No.	**EN: EN: PSN: 4A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Area of total public recreational facilities per 100 000 inhabitants				
Rationale/ Interpretation/ Benchmarking	Recreational facilities are important to maintain the health of city inhabitants and for providing opportunities for inhabitants to publicly assemble and keep contact. Both indoor and outdoor facilities that are publicly owned or publicly accessible, should be counted. Indoor facilities include (but are not limited to) gymnasiums, community centres, swimming pools, arenas, or similar facilities dedicated to recreation. Outdoor facilities include (but are not limited to) sports fields, parks, wooded areas, or similar areas dedicated to recreation. Only the actual indoor floor space or outdoor land space dedicated to recreation should be included. A higher value and an increasing trend are seen as positive.				
Methodology	Calculate as: Numerator: total area of indoor and outdoor facilities (m^2). Denominator: one 100 000th of the city's population.				
Unit	m^2/100 000 inhabitants				
Data sources/ Relevant databases	Data can be obtained through municipal recreations, planning and sports departments and GIS data.				
SDG reference(s)	SDG indicator 11.7.1: The average share of the built-up area of cities that is open space for public use for all, disaggregated by age group, sex and persons with disabilities.				

Dimension	Environment				
Sub-dimension	**Energy**				
Category	**Energy**				
KPI name	**Renewable electricity consumption**				
KPI No.	**EN: E: E: 1C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Percentage of renewable energy consumed in the city				
Rationale/ Interpretation/ Benchmarking	The use of energy from renewable sources can lead to the longer-term sustainability of an urban area; provide for more independence of electricity supply; and lead to the reduction of GHG emissions related to electricity generation. Renewable sources include geothermal, solar, wind, hydro, tide, wave energy and biomass, etc. A higher value and increasing trend are generally considered more sustainable.				
Methodology	Calculate as: Numerator: total consumption of electricity from renewable sources (kWh/yr). Denominator: total city electricity consumption (kWh/yr). Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be obtained through local utility providers.				
SDG reference(s)	SDG indicator 7.2.1: Renewable energy share in the total final energy consumption.				

Dimension	Environment				
Sub-dimension	**Energy**				
Category	**Energy**				
KPI name	**Electricity Consumption**				
KPI No.	**EN: E: E: 2C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Electricity consumption per capita.				
Rationale/ Interpretation/ Benchmarking	Electricity is a key component driving economic activity in a city. However, the generation of electricity can also be a key contributor of GHG emissions. The city shall report all electricity consumed for residential, commercial, institutional and industrial purposes. A declining trend and lower values are considered positive.				
Methodology	Calculate as: Numerator: Total consumption of electricity (kWh/year). Denominator: Total number of city inhabitants.				
Unit	kWh/year/capita				
Data sources/ Relevant databases	Data can be collected from local electricity utilities.				
SDG reference(s)	SDG target 7.3:By 2030, double the global rate of improvement in energy efficiency.				

Dimension	Environment				
Sub-dimension	**Energy**				
Category	**Energy**				
KPI name	**Residential thermal energy consumption**				
KPI No.	**EN: E: E: 3C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Residential thermal energy consumption per capita				
Rationale/ Interpretation/ Benchmarking	Thermal energy, along with water and electricity, form the three main areas of utility resource consumption in cities. Thermal energy consumption is also a significant contributor of GHG emissions associated with a city. Hence, measurements and initiatives to reduce thermal energy consumption are needed to address climate change. Yearly trends would indicate changes in efficiency. Thermal energy sources to be included would be natural gas, oil, coal, etc. for domestic space, cooking and water heating purposes. A declining trend and lower values are considered positive.				
Methodology	Calculate as: Numerator: total consumption of thermal energy (Gj/year). Denominator: total number of city inhabitants.				
Unit	Gj/year/capita				
Data sources/ Relevant databases	Data can be collected from local utilities supplying thermal sources of energy.				
SDG reference(s)	SDG target 7.3:By 2030, double the global rate of improvement in energy efficiency.				

Dimension	Environment				
Sub-dimension	**Energy**				
Category	**Energy**				
KPI name	**Public building energy consumption**				
KPI No.	**EN: E: E: 4A**	**Type:**	**Additional**	**Type:**	**Sustainable**
Definition/ Description	Energy consumption of public buildings				
Rationale/ Interpretation/ Benchmarking	Buildings can account for a significant proportion of energy use, GHG emissions and resource use within a city. Energy efficiency and energy reduction in buildings can reduce GHG emissions, conserve resource and mitigate against climate change. Energy consumption shall include electricity, fuel oil, natural gas, steam and other forms of thermal energy. Thermal energy should be converted to the equivalent kWh. Low values should be pursued. A declining trend is positive.				
Methodology	Calculate as: Numerator: total energy consumption by public buildings (ekWh/yr). Denominator: total floor space of public buildings (m^2).				
Unit	ekWh/m^2/year				
Data sources/ Relevant databases	Data can be collected from municipal facilities departments and local utilities.				
SDG reference(s)	SDG target 7.3: By 2030, double the global rate of improvement in energy efficiency.				

11 Key performance indicators – Society and culture dimension

The following section contains the indicators related to the Society and culture dimension.

Dimension	**Society and culture**				
Sub-dimension	**Education, health and culture**				
Category	**Education**				
KPI name	**Student ICT access**				
KPI No.	**SC: EH: ED:1C**	**Type:**	**Core**	**Type:**	**Smart**
Definition/ Description	Percentage of students with classroom access to ICT facilities				
Rationale/ Interpretation/ Benchmarking	ICT skills determine the effective use of ICTs. The lack of such skills continues to be one of the key barriers keeping people, and in particular women and vulnerable groups, from fully benefitting from the potential of information and communication technologies. This indicator will help make the link between ICT usage and impact, and help measure and track the level of proficiency of ICT users. ICT facilities can be measured to include those with Internet connectivity, computer labs, ICT modules, digital learning, etc. Cities should collect data both from public and private schools as well as recognized religious and home schools that meet defined governmental standards. An improving trend and higher values are considered positive.				
Source(s)	NOTE – Indicator of Sustainable Development. Retrieved from <http://www.un.org/esa/sustdev/natlinfo/indicators/guidelines.pdf>				
Methodology	Calculate as: Numerator: students with classroom access to ICT facilities. Denominator: total number of students enrolled in schools. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected from local school boards / authorities or regional / national education departments or through education surveys.				
SDG reference(s)	SDG indicator 4.4.1: Percentage of youth/adults with information and communication technology (ICT) skill by type of skill. SDG indicator 4.a.1: Proportion of schools offering basic services, by type of service. SDG target 5.B: Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women.				

Dimension	Society and culture				
Sub-dimension	**Education, health and culture**				
Category	**Education**				
KPI name	**School enrolment**				
KPI No.	**SC: EH: ED:2C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Percentage of school-aged population enrolled in schools				
Rationale/ Interpretation/ Benchmarking	Education is essential to human development. It is also an indicator of the future potential of a city, its inhabitants and work force. A city should report on public and private enrolment as well as recognized religious and home schools that meet defined governmental standards. An improving trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: number of students in primary and secondary levels in public and private schools. Denominator: total number of the school-aged population. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Enrolment data can be collected from local school boards / authorities or regional / national education departments.				
SDG reference(s)	SDG target 4.1:By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes.				

Dimension	Society and culture				
Sub-dimension	**Education, health and culture**				
Category	**Education**				
KPI name	**Higher education degrees**				
KPI No.	**SC: EH: ED: 3C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Higher level education degrees per 100 000 inhabitants				
Rationale/ Interpretation/ Benchmarking	Higher-level education broadly refers to all post-secondary education, including, but not limited to, universities. Universities are clearly a key part of all higher-level education systems. Additionally, the diverse and growing set of public and private institutions in every country – colleges, technical training institutes, community colleges, nursing schools, research laboratories, centres of excellence, online distance learning centres, and many more – forms a network of institutions that support the production of higher-order capacity necessary for development. (World Bank) Higher education can also be divided into post-secondary non-tertiary. This often directly prepares students for the labour market. Tertiary level education includes what is commonly understood as academic education and advanced vocational or professional education such as bachelor's or equivalent level, master's or equivalent level, and doctoral or equivalent level. (ISCED, 2011) An improving trend and higher values are considered positive.				
Source(s)	NOTE 1 – World Bank. Tertiary Education. Retrieved from <http://www.worldbank.org/en/topic/tertiaryeducation#what_why> NOTE 2 – International Standard Classification of Education (ISCED) 2011. Retrieved from <http://www.uis.unesco.org/Education/Documents/isced-2011-en.pdf>				
Methodology	Calculate as: Numerator: number of city inhabitants holding at least one higher-level education degree. Denominator: one 100 000th of the city's population.				
Unit	Number/100 000 inhabitants				
Data sources/ Relevant databases	Data can be collected from local or regional departments of education or through national census data.				
SDG reference(s)	SDG target 4.3: By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university.				

Dimension	Society and culture				
Sub-dimension	**Education, health and culture**				
Category	**Education**				
KPI name	**Adult literacy**				
KPI No.	**SC: EH: ED: 4C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Adult literacy rate				
Rationale/ Interpretation/ Benchmarking	The indicator is a direct measure of the skill levels of youth and adults. Adult literacy rate is defined as "the percentage of population aged 15 years and over who can both read and write with understanding a short simple statement on his/her everyday life." (UNESCO) Generally, 'literacy' also encompasses 'numeracy', the ability to make simple arithmetic calculations. An improving trend and higher values are considered positive.				
Source(s)	NOTE 1 – UNESCO Education Indicators: Technical Guidelines. Retrieved from <http://uis.unesco.org/sites/default/files/documents/education-indicators-technical-guidelines-en_0.pdf> NOTE 2 – ITU-D Statistics. Retrieved from <http://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2015/methodology.aspx>				
Methodology	Calculate as: Numerator: number of adult city inhabitants who are deemed literate. Denominator: total number of adult city inhabitants. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	The data may be collected from local education or labour force departments or may need to be interpreted from national data. The indicator is a direct measure of the skill levels of youth and adults. It may also be collected from the following sources: United Nations Educational, Scientific and Cultural Organization (UNESCO) and UNESCO/UIS (UNESCO Institute of Statistics), including the Education for All 2000 Assessment [1].				
SDG reference(s)	SDG indicator 4.6.1: Percentage of population in a given group achieving at least a fixed level of proficiency in functional (a) literacy and (b) numeracy skills.				

Dimension	Society and culture				
Sub-dimension	**Education, health and culture**				
Category	**Health**				
KPI name	**Life expectancy**				
KPI No.	**SC: EH: H:1C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Average life expectancy				
Rationale/ Interpretation/ Benchmarking	"Life expectancy at birth reflects the overall mortality level of a population. It indicates the average number of years that a new-born is expected to live if current mortality rates continue to apply and summarizes the mortality pattern that prevails across all age groups – children and adolescents, adults and the elderly." (WHO, 2006) An improving trend and higher values are considered positive.				
Source(s)	NOTE – WHO Definitions. Retrieved from <http://www.who.int/whosis/whostat2006DefinitionsAndMetadata.pdf>				
Methodology	Calculate as: average number of years that a new-born is expected to live if current mortality rates continue to apply.				
Unit	Years				
Data sources/ Relevant databases	The data may be collected from local health departments or may need to be interpreted from regional or national data. NOTE – It is also possible to extract this data from WHO tables: <https://www.who.int/data/gho/data/indicators/indicator-details/GHO/life-expectancy-at-birth-(years)>				
SDG reference(s)	SDG target 3.4: By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.				

Dimension	Society and culture				
Sub-dimension	**Education, health and culture**				
Category	**Health**				
KPI name	**Maternal mortality rate**				
KPI No.	**SC: EH: H: 2C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Maternal deaths per 100 000 live births				
Rationale/ Interpretation/ Benchmarking	"Maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. To facilitate the identification of maternal deaths in circumstances in which cause of death attribution is inadequate, the International Classification of Diseases (ICD) 10 introduced an additional category: Pregnancy-related death. This is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death." (WHO, 2006). A declining trend and lower values are considered positive.				
Source(s)	NOTE 1 – WHO statistics. Retrieved from <https://www.who.int/data/gho/data/indicators/indicator-details/GHO/maternal-mortality-ratio-(per-100-000-live-births)> NOTE 2 – The WHO Application of ICD-10 to deaths during pregnancy, childbirth and the puerperium: ICD-MM. Retrieved from <http://apps.who.int/iris/bitstream/10665/70929/1/9789241548458_eng.pdf>				
Methodology	Calculate as: Numerator: number of maternal deaths in a year. Denominator: number of live births in a year. Divide result by 100 000.				
Unit	Number/100 000 live births.				
Data sources/ Relevant databases	Sources may include vital registration, household surveys, census, health service records and specific studies on reproductive age mortality (RAMOS). Measuring maternal mortality accurately is difficult except where comprehensive registration of deaths and their causes exist. Elsewhere, censuses or surveys can be used to measure levels of maternal mortality. Data derived from health services records are problematic where not all births take place in health facilities. Reproductive-age mortality studies (RAMOS) use triangulation of different sources of data on deaths of women of reproductive age including record review and/or verbal autopsy to accurately identify maternal deaths. Based on multiple sources of information, RAMOS are considered the best way to estimate levels of maternal mortality. Estimates derived from household surveys are usually based on information retrospectively collected about the deaths of sisters of the respondents and could refer back up to an average 12 years and they are subject to wide confidence intervals. For countries without any reliable data on maternal mortality, statistical models are applied. Global and regional estimates of maternal mortality are developed every five years, using a regression model.				
SDG reference(s)	SDG indicator 3.1.1: Maternal mortality ratio.				

Dimension	Society and culture				
Sub-dimension	**Education, health and culture**				
Category	**Health**				
KPI name	**Physicians**				
KPI No.	**SC: EH: H:3C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Number of physicians per 100 000 inhabitants.				
Rationale/ Interpretation/ Benchmarking	"The availability of physicians is an important indicator of the strength of a city's health system. There is evidence that the number of physicians is positively associated with immunization coverage, outreach of primary care, and infant, child and maternal survival. The classification of health workers used is based on criteria for vocational education and training, regulation of health professions, and activities and tasks of jobs, i.e., a framework for categorizing key workforce variables according to shared characteristics. The WHO framework largely draws on the latest revisions to the internationally standardized classification systems of the International Labour Organization (International Standard Classification of Occupations), United Nations Educational, Scientific and Cultural Organization (International Standard Classification of Education), and the United Nations Statistics Division (International Standard Industrial Classification of All Economic Activities). Depending on the nature of each country's situation and the means of measurement, data is available for up to nine categories of health workers in the aggregated set, and up to 18 categories in the disaggregated set. The latter essentially reflects attempts to better distinguish some subgroups of the workforce according to assumed differences in skill level and skill specialization". (WHO, 2016) Physicians include generalist medical practitioners and specialist medical practitioners. The city shall report on the number of licensed physicians and report as full-time equivalence (FTE). An improving trend and higher values are considered positive.				
Source(s)	NOTE – WHO. Global Health Workforce Database. Retrieved from <https://www.who.int/data/gho/data/themes/topics/health-workforce>				
Methodology	Calculate as: Numerator: number of general or specialized physicians working in the city (FTE). Denominator: one 100 000th of the city's population.				
Unit	Number/100 000 inhabitants.				
Data sources/ Relevant databases	Data may be collected from local health authorities, local/public hospitals and/ or labour force surveys.				
SDG reference(s)	SDG indicator 3.C.1: Health worker density and distribution.				

Dimension	Society and culture				
Sub-dimension	**Education, health and culture**				
Category	**Health**				
KPI name	**In-patient hospital beds**				
KPI No.	**SC: EH: H: 4A**	**Type:**	**Advanced**	**Type:**	**Structural**
Definition/ Description	Number of in-patient public hospital beds per 100 000 inhabitants.				
Rationale/ Interpretation/ Benchmarking	The number of in-patient public hospital beds is one of the few available indicators which monitor the level of a health service delivery. Service delivery is an important part of health systems, and in-patient public hospital bed density is one of the few indicators that can be collected worldwide. (WHO 2006) Hospital beds shall include in-patient and maternity beds. This shall include beds in wards which are closed for reasons such as lack of health staff and building works. It shall also include beds for patients admitted who require continual assistance, incubators and specialized care. It may not include day care beds, pre-anaesthesia beds, wake-up beds, beds for members of a patient's family, and beds for hospital staff. (ISO 37120:2014) An in- patient is someone who is formally admitted[1] (or 'hospitalised') to an institution for treatment and/or care and stays for a minimum of one night in the hospital or other institutions providing in-patient care. A higher value should be pursued based on health and economic factors. An increasing trend is considered positive.				
Source(s)	NOTE 1 – OECD. Glossary of Statistical Terms. Retrieved from <https://stats.oecd.org/glossary/detail.asp?ID=1364> NOTE 2 – ISO 37120:2014. Sustainable development of communities – Indicators for city services and quality of life. NOTE 3 – World Health Statistics. 2020. Retrieved from <https://www.who.int/publications/i/item/9789240005105>				
Methodology	Calculate as: Numerator: total number of in-patient hospital beds (public and private). Denominator: one 100 000th of the city's population.				
Unit	Number/100 000 inhabitants.				
Data sources/ Relevant databases	Data can be collected from local health departments or from hospital facility records or hospital surveys.				
SDG reference(s)	SDG target 3.8: Achieve universal health coverage, including financial risk protection, access to quality essential healthcare services and access to safe, effective, quality and affordable essential medicines and vaccines for all.				

[1] Formal admission is based on whether the patient is treated by a doctor or by other medical staff in the facility. Only patients of doctors are formally admitted into the hospital patient registry. Other individuals whose cases are dealt with by other medical personnel (including, nurses, paramedics, etc.) are not considered patients of the hospitals and records of their visit are not retained beyond a period of 1-2 years. Additionally, outpatient consultations with doctors at a hospital or clinic do not constitute formal admission. However, records of these outpatient visits are kept in the hospital registry for the full retention period (based on the country's laws).

Dimension	Society and culture				
Sub-dimension	**Education, health and culture**				
Category	**Health**				
KPI name	**Health insurance/Public health coverage**				
KPI No.	**SA: EH: H: 5A**	**Type:**	**Advanced**	**Type:**	**Structural**
Definition/ Description	Percentage of inhabitants covered by basic health insurance or a public health system				
Rationale/ Interpretation/ Benchmarking	Lack of health insurance coverage or a public health system is a significant barrier to accessing needed health care, including preventive services. Basic health insurance would provide financial risk protection and cover essential healthcare services at an affordable cost and should be counted. Some countries have no universal health insurance and most health insurance is delivered by private insurers. However, in these countries, the public hospitals are free for the poor or offer services at very low cost. Inhabitants covered by this service should also be counted. An improving trend and higher values are considered positive.				
Source(s)	NOTE 1 – Duran.A, Gulati.K, Gunasekar.A, Kumar Gupta. S, Kumar.P, Lahariya.C, Singh. A.R. Public hospital governance in India. [b-Duran] NOTE 2 – Govindaraj.R, Navaratne.K, Cavagnero.E, Seshadri.S. Health Care in Sri Lanka: What Can the Private Health Sector Offer? [b-Govindaraj]				
Methodology	Calculate as: Numerator: number of inhabitants covered by health insurance or a public health system. Denominator: total number of city inhabitants. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	The data may be collected from local health departments or may need to be interpreted from national data.				
SDG reference(s)	SDG target 3.8: Achieve universal health coverage, including financial risk protection, access to quality essential healthcare services and access to safe, effective, quality and affordable essential medicines and vaccines for all.				

Dimension	Society and culture				
Sub-dimension	**Education, health and culture**				
Category	**Health**				
KPI name	**Electronic health records**				
KPI No.	**SC: EH: H: 6A**	**Type:**	**Advanced**	**Type:**	**Smart**
Definition/ Description	Percentage of city inhabitants with electronic health records				
Rationale/ Interpretation/ Benchmarking	Electronic health records (also known as e-health records) refers to a system of collecting patient health records, which are stored digitally so that they can be accessed and shared amongst all relevant health providers. Generally, an e-health record is a single file, which contains the most up to date information on the patient. E-health records may also contain other information such as visits to healthcare providers, immunizations, imaging results, billing information etc. Since e-health records are stored centrally and are more likely up to date, they can be an invaluable source in emergency situations when a patient is unable to communicate. However, some patients may not be in favour of "sharing" records between health providers. In such situations, the healthcare provider should explicitly ask whether the patient would like to share their data with other providers (in life-threatening situations). The relevant data privacy laws also come into play for this indicator. It is also important to note that health records have a minimum retention period (depending on the hospital/clinic), and many patients may not be keen for these records to be kept/shared beyond this specific date.[2] An improving trend and higher values are considered positive.				
Methodology	Calculate as: Numerator: number of city inhabitants with electronic health records. Denominator: total number of city inhabitants. Multiply by 100%.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be obtained through municipal / regional / national health departments.				
SDG reference(s)	SDG target 3.D: Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.				

[2] Retention period begins from the date of last entry of information into the medical record at a specific medical facility. In many countries, keeping medical records beyond the retention period is considered a violation of patient privacy. Hence, medical facilities in most countries are encouraged to destroy the medical records after the retention period is over or hand over the files to the patients themselves. If hospitals/clinics want to continue using these data for research purposes after the retention period, it is essential that all the information is anonymized. Certain records associated with births, cancer treatments and organ transplants are kept indefinitely.

Dimension	Society and culture				
Sub-dimension	**Education, health and culture**				
Category	**Culture**				
KPI name	**Cultural expenditure**				
KPI No.	**SA: EH: C: 1C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Percentage expenditure on cultural heritage.				
Rationale/ Interpretation/ Benchmarking	The city shall report on the total municipal expenditure spent on the preservation, protection and conservation of all cultural and natural heritage as a percentage of the total budget. A city may wish to report by type of heritage (cultural, natural, mixed and World Heritage Centre designation). Expenditures shall include employee costs, construction costs, maintenance costs and subsidies. Expenditures on culture by institutions and residents in a given country are related to economic development since they reflect the allocation of income supporting national and foreign cultural production. Assessing expenditures is also an indirect way of approximating the positive influence of the modern economy on culture as it shows the extent to which society values the amount and quality of the supply offered by this type of economy. Finally, actual expenditures may also serve as an indication of the potential for expansion of the culture sector. An improving trend and higher values are considered positive.				
Source(s)	NOTE – UNESCO: Definitions of various institutions and cultural indicators. Retrieved from <http://unesdoc.unesco.org/images/0019/001910/191061e.pdf>				
Methodology	Calculate as: Numerator: municipal expenditure on preservation, protection and conservation of all cultural and natural heritage (USD). Denominator: total city operating budget (USD). Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected through municipal financial reports. NOTE – Additional resource: <http://www.oregonlaws.org/glossary/definition/cultural_institution>				
SDG reference(s)	SDG target 11.4: Strengthen efforts to protect and safeguard the world's cultural and natural heritage.				

Dimension	Society and culture				
Sub-dimension	**Education, health and culture**				
Category	**Culture**				
KPI name	**Cultural infrastructure**				
KPI No.	**SC: EH: C: 2A**	**Type:**	**Advanced**	**Type:**	**Structural**
Definition/ Description	Number of the cultural institutions per 100 000 inhabitants.				
Rationale/ Interpretation/ Benchmarking	UNESCO states that no development can be sustainable without a strong culture component. Indeed, only a human-centred approach to development based on mutual respect and open dialogue among cultures can lead to lasting, inclusive and equitable results. Yet until recently, culture has been missing from the development equation. UNESCO identifies the following to be part of the "cultural infrastructure": • cultural and natural heritage sites: museums, archaeological and historical places (including archaeological sites and buildings), cultural landscapes, and natural heritage sites; • performance and celebration: venues dedicated to the performing arts and music, festivals, feasts and fairs; • visual arts and crafts: venues dedicated to visual arts; • books and press: libraries and book fairs; • audio-visual and interactive media: media centres and cinemas; and • design and creative services: venues related to fashion, graphic and interior design, landscape design, architectural and advertising services. Cultural infrastructures play a key role in promoting cultural education, empowerment and participation, fostering integration and reducing exclusion and marginalization while improving citizens' quality of life. Cultural infrastructures are also crucial in creating environments conducive to the emergence of dynamic cultural sectors and clusters, as they are a source of cultural, social and economic vitality in areas where they are located. To ensure that culture takes its rightful place in development strategies and processes, UNESCO has adopted a three-pronged approach: it spearheads worldwide advocacy for culture and development, while engaging with the international community to set clear policies and legal frameworks and working on the ground to support governments and local stakeholders to safeguard heritage, strengthen creative industries and encourage cultural pluralism. An improving trend and higher values are considered positive.				
Source(s)	NOTE – UNESCO. Culture for Development Indicators. Retrieved from <http://en.unesco.org/creativity/sites/creativity/files/digital-library/CDIS%20Methodology%20Manual_0.pdf>				
Methodology	Calculate as: Numerator: number of cultural institutions. Denominator: one 100 000th of the city's population.				
Unit	Number/100 000 inhabitants				
Data sources/ Relevant databases	Data can be collected from municipal, regional or national cultural and arts departments. Definitions of various cultural infrastructure: <http://unesdoc.unesco.org/images/0019/001910/191061e.pdf>				
SDG reference(s)	SDG target 11.4: Strengthen efforts to protect and safeguard the world's cultural and natural heritage.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Housing**				
KPI name	**Informal settlements**				
KPI No.	**SC: SH: HO: 1C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Percentage of inhabitants living in slums, informal settlements or inadequate housing.				
Rationale/ Interpretation/ Benchmarking	The term "informal settlements" has been used to refer to unregulated, illegal and unauthorized construction, arising from the conditions and regulations in different countries, including "spontaneous", "unplanned", "unauthorized", "illegal" or "squatter" settlements. The term "informal" may also be used for settlements of refugees or vulnerable people, overcrowded and dilapidated housing in cities, or slums. The United Nations has used the term "informal settlements" to refer to: i) residential areas where a group of housing units has been built on land to which the occupants have no legal claim, or which they occupy illegally; ii) unplanned settlements where housing is not in compliance with current planning and building regulations (unauthorized housing). (UNECE) Informal, slum or inadequate housing are an indicator of precarious circumstances that some citizens may be living under. They are the result of inadequate responses to the demand for housing, infrastructure and community services, which makes the authorities unable to facilitate the legalization process. The city shall report households that lack any one of the following five elements: access to basic water (access to sufficient amount of water for family use, at an affordable price, available to household members without being subject to extreme effort); access to basic sanitation (access to an excreta disposal system, either in the form of a private toilet or a public toilet shared with a reasonable number of people); security of tenure (evidence of documentation to prove secure tenure status or de facto or perceived protection from evictions); durability of housing (permanent and adequate structure in non-hazardous location); sufficient living area (not more than two people sharing the same room). A declining trend and lower values are considered positive.				
Source(s)	NOTE – UNECE. Formalizing the Informal Challenges and Opportunities of Informal Settlements in South-East Europe. Retrieved from <https://unece.org/housing-and-land-management/publications/formalizing-informal-challenges-and-opportunities-informal f>				
Methodology	Calculate as: Numerator: number of people living in slums, informal settlements or inadequate housing Denominator: total number of city inhabitants. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be collected from municipal planning and housing departments. Household surveys and citizen/community-run surveys, such as those developed by Slum Dwellers' International and the Cities Alliance.				
SDG reference(s)	SDG indicator 11.1.1: Proportion of urban population living in slums, informal settlements or inadequate housing.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Housing**				
KPI name	**Housing expenditure**				
KPI No.	**SC: SH: HO: 2A**	**Type:**	**Advanced**	**Type:**	**Structural**
Definition/ Description	Percentage expenditure of income for housing				
Rationale/ Interpretation/ Benchmarking	Housing expenditure includes rent, mortgage, utility services, maintenance, energy efficiency repairs, and other repairs. Housing costs are critical determinants of the living conditions of individuals and households. Concerns about housing affordability are important especially when there is a sharp rise in home prices, rents and energy prices. Housing is one of the largest components of both expenditures and assets of households. As a consequence, higher housing prices can both strain the budget of those households that do not own their main residence and increase households' wealth and financial well-being for those that do. Presenting housing expenditure shows how much income goes to housing services and provides a means to compare such expenditures over time and between countries. (OECD] A declining trend and lower values are considered positive.				
Source(s)	NOTE – OECD. Housing. Retrieved from <http://www.oecdbetterlifeindex.org/topics/housing/>				
Methodology	Calculate as: Numerator: expenditure on housing (USD). Denominator: total household income (USD). Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be obtained through national statistics offices. NOTE – National data available for certain countries at https://stats.oecd.org/				
SDG reference(s)	SDG target: 11.1: By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Social inclusion**				
KPI name	**Gender income equity**				
KPI No.	**SC: SH: SI: 1C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Ratio of average hourly earnings of female to male workers.				
Rationale/ Interpretation/ Benchmarking	This indicator has been defined as unadjusted (e.g., not adjusted according to differences in individual characteristics or other observable characteristics that may explain part of the earnings difference) because it gives an overall picture of gender discrimination and the inequalities in the labour market that explain gender differences in pay. A value of one (1) indicates equality. A trend of closing the income gap is considered positive.				
Source(s)	NOTE – The situation in the EU. Retrieved from <http://ec.europa.eu/justice/gender-equality/gender-pay-gap/situation-europe/index_en.htm>				
Methodology	Calculate as: Numerator: average hourly earnings of female employees (USD). Denominator: average hourly earnings of male employees (USD).				
Unit	Ratio				
Data sources/ Relevant databases	Data can be collected through labour market surveys. Data may need to be interpreted from national statistics.				
SDG reference(s)	SDG indicator 8.5.1: Average hourly earnings of female and male employees, by occupation, age group and persons with disabilities.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Social inclusion**				
KPI name	**Gini coefficient**				
KPI No.	**SC: SH: SI: 2C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Income distribution in accordance with Gini coefficient				
Rationale/ Interpretation/ Benchmarking	Gini coefficient measures income distribution and is used to assess the extent to which income is distributed equally among the population. "The Lorentz curve plots the percentage of total income earned by various portions of the population when the population is ordered by the size of their incomes". (Econometria) Possible outcomes range from zero to one. Zero (0) representing a perfectly equal distribution of income, while one (1) represents one person in the population having access to all income.				
Source(s)	NOTE – Econometria. A general definition of the Lorenz Curve Retrieved from <https://www.jstor.org/stable/1909675?seq=1#page_scan_tab_contents>				
Methodology	Calculate as: Numerator: area between 45-degree line and Lorenz curve. Denominator: entire area below 45 degree line .				
Unit	Number				
Data sources/ Relevant databases	World Bank, OECD: Income distribution database.				
SDG reference(s)	SDG target 10.2: By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Social inclusion**				
KPI name	**Poverty**				
KPI No.	**SC: SH: SI: 3C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Percentage of inhabitants living in poverty.				
Rationale/ Interpretation/ Benchmarking	"Reducing poverty has become an international concern, yet there is no international consensus on guidelines for measuring poverty. In pure economic terms, income poverty is when a family's income fails to meet a federally established threshold that differs across countries. Typically, it is measured with respect to families and not the individual and is adjusted for the number of persons in a family. Economists often seek to identify the families whose economic position (defined as command over resources) falls below a minimal acceptance level. Similarly, the international standard of extreme poverty is set to the possession of less than 1$ a day." (UNESCO) The percentage of the city's population living in poverty is an indicator of social equality and reflects levels of economic and social marginality and/or inclusiveness in a city. Cities should report based on national poverty thresholds which vary for each country/city. A declining trend and lower values are considered positive.				
Source(s)	NOTE – UNESCO. Poverty. Retrieved from <http://www.unesco.org/new/en/social-and-human-sciences/themes/international-migration/glossary/poverty/>				
Methodology	Calculate as: Numerator: number of city inhabitants living below the poverty line. Denominator: total number of city inhabitants. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	National poverty thresholds can be used to determine the poverty level of a city. NOTE – These can be retrieved from the World Bank website: www.worldbank.org				
SDG reference(s)	SDG target 1.1: By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Social inclusion**				
KPI name	**Voter participation**				
KPI No.	**SC: SH: SI: 4C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Percentage of the eligible population that voted during the last municipal election				
Rationale/ Interpretation/ Benchmarking	Voter participation or turnout is defined as the number of votes cast in an election as a proportion of the voting age population – generally the population aged 18 and over – and may serve as an indicator of societal participation. International comparisons of voter participation rates can be affected by differences in legal voting age, the voter registration process, and whether voting is compulsory or not. Voting in municipal elections is one indicator of people's participation in their community's national life. Different types of elections occur in different countries and for different geographical jurisdictions. For some countries, it should be noted, turnout for presidential elections and regional elections may be higher than for national parliamentary elections, perhaps because those elected through these ballots are constitutionally more important for how those countries are run. Equally, relatively frequent elections may reduce turnout. A high voter participation is a sign that a city's political system enjoys a strong degree of participation. Civic engagement and the possibility for a person to express his/her own political view are basic freedom rights of effective democracies. Engaging people in decision-making improves the quality and the inclusiveness of the decisions. It also helps improve on the existing laws and regulations. A high percentage is desirable in a democracy because it increases the chance that the political system reflects the will of a large number of individuals, and that the government enjoys a high degree of legitimacy.				
Source(s)	NOTE 1 – OECD, "Voting", in Society at a Glance 2011: OECD Social Indicators, OECD Publishing, Paris. Retrieved from <http://dx.doi.org/10.1787/soc_glance-2011-29-en> NOTE 2 – How is Life?: Measuring well-being. Retrieved from <http://www.keepeek.com/Digital-Asset-Management/oecd/economics/how-s-life-2015_how_life-2015-en#.WP4PNtryhPY#page87> NOTE 3 – OECD. Civic Engagement. Retrieved from <http://www.oecdbetterlifeindex.org/topics/civic-engagement/>				
Methodology	Calculate as: Numerator: total number of people who voted in the previous administrative city elections. Denominator: total number of eligible voters. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	NOTE 1 – Data about voter participation can be extracted from the international database organised by the Institute for Democratic and Electoral Assistance (IDEA). NOTE 2 – OECD (2011), "Voting", in Society at a Glance 2011: OECD Social Indicators, OECD Publishing, Paris. Retrieved from: <http://dx.doi.org/10.1787/soc_glance-2011-29-en> Data can be collected by local statistics. NOTE 3 – Relevant database is OECD Regional Statistics – see report How's Life? 2015.				
SDG reference(s)	SDG target 16.7: Ensure responsive, inclusive, participatory and representative decision-making at all levels. SDG target 11.3: By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries. SDG indicator 11.3.2: Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Social inclusion**				
KPI name	**Childcare availability**				
KPI No.	**SC: SH: SI: 5A**	**Type:**	**Advanced**	**Type:**	**Structural**
Definition/ Description	Percentage of pre-school age children (0-3) covered by (public and private) day-care centres.				
Rationale/ Interpretation/ Benchmarking	The indicator demonstrates the presence of institutes and facilities for childcare, which can grant a good learning and safe environment for kids. This indicator also highlights the possibility for equal opportunities in the labour force for working women with children as they would not be limited by the lack of childcare facilities.				
Methodology	Calculate as: Numerator: number of day-care spots available for pre-school children. Denominator: total number of pre-school age children. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	NOTE 1 – EUROSTAT. Retrieved from <http://ec.europa.eu/eurostat/cache/metadata/en/ilc_ca_esms.htm> NOTE 2 – OECD Family Database. Retrieved from <www.oecd.org/social/family/database.htm> (see analysis at http://www.oecd.org/els/soc/PF3_2_Enrolment_childcare_preschool.pdf)				
SDG reference(s)	SDG target 4.2: By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education. SDG target 5.5: Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life. SDG target 10.4: Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Safety**				
KPI name	**Natural disaster-related deaths**				
KPI No.	**SC: SH: SA: 1C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Number of natural disaster-related deaths per 100 000 inhabitants.				
Rationale/ Interpretation/ Benchmarking	According to UNISDR, a natural hazard or disaster is a natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. The attractiveness of cities for citizens and investors alike is affected by the frequency and magnitude of natural disasters occurring within a city and a city's ability to respond. The natural disaster-related losses of lives in the past can be indicative of a city's potential future exposure. The city shall report on the number of deaths attributed to natural disasters such as floods, earthquakes, landslide, heat waves, tsunamis, hurricanes, etc. A declining trend and lower values are considered positive.				
Source(s)	NOTE 1 – UNISDR Terminology on Disaster Risk Reduction, 2009. Retrieved from <http://www.unisdr.org/files/7817_UNISDRTerminologyEnglish.pdf>				
Methodology	Calculate as: Numerator: number of annual natural disaster-related deaths. Denominator: oOne 100 000th of the city's population.				
Unit	Number/100 000 inhabitants				
Data sources/ Relevant databases	Data can be collected from municipal emergency services and hospitals.				
SDG reference(s)	SDG indicator 1.5.1 & 13.1.2: Number of deaths, missing persons and persons affected by disaster per 100 000 people.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Safety**				
KPI name	**Disaster-related economic losses**				
KPI No.	**SC: SH: SA: 2C**	**Type:**	**Core**	**Type:**	**Sustainable**
Definition/ Description	Natural disaster-related economic losses as a percentage of the city's GDP.				
Rationale/ Interpretation/ Benchmarking	A city shall report on the "total economic impact that consists of direct economic loss and indirect economic loss. Direct economic loss is the monetary value of total or partial destruction of physical assets existing in the affected area. Direct economic loss is nearly equivalent to physical damage. Indirect economic loss: a decline in economic value added as a consequence of direct economic loss and/or human and environmental impacts. Annotations: Examples of physical assets that are the basis for calculating direct economic loss include homes, schools, hospitals, commercial and governmental buildings, transport, energy, telecommunications infrastructures and other infrastructure; business assets and industrial plants; and production such as crops, livestock and production infrastructure. They may also encompass environmental assets and cultural heritage. Direct economic losses usually happen during the event or within the first few hours after the event and are often assessed soon after the event to estimate recovery cost and claim insurance payments. These are tangible and relatively easy to measure. Indirect economic loss includes microeconomic impacts (e.g., revenue declines owing to business interruption), meso-economic impacts (e.g., revenue declines owing to impacts on natural assets, interruptions to supply chains or temporary unemployment) and macroeconomic impacts (e.g., price increases, increases in government debt, negative impact on stock market prices and decline in GDP). Indirect losses can occur inside or outside of the hazard area and often have a time lag. As a result, they may be intangible or difficult to measure." (UNISDR) A declining trend and lower values are considered positive.				
Source(s)	NOTE – Terminology. Retrieved from <https://www.unisdr.org/we/inform/terminology>				
Methodology	Calculate as: Numerator: total economic losses (last annual reporting period) related to disasters. Denominator: GDP of the city. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	Data can be obtained through governmental economics statistics and insurance statistics.				
SDG reference(s)	SDG indicator 1.5.2: Direct disaster economic loss in relation to global gross domestic product (GDP).				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Safety**				
KPI name	**Resilience plans**				
KPI No.	**SC: SH: SA: 3A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Implementation of risk and vulnerability assessments for disaster mitigation.				
Rationale/ Interpretation/ Benchmarking	A city shall report whether they have implemented risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction (DRR) 2015-2030. The following elements should have been implemented: a) city infrastructures and systems available for resilience; b) risk and vulnerability assessments; c) financial (capital and operation) plans to mitigate address the risks and vulnerabilities; and d) technical systems to implement the plans. Vulnerability to heat, drought, flooding, earthquakes, typhoons, tsunamis and other natural hazards are to be investigated as part of disaster management planning. Cities around the world face a growing number of natural and human-induced disasters and risks. Two global frameworks provide a global landscape for actions to address natural and human-induced disaster, namely the UNFCCC and UNISDR. Under the UNFCCC, countries have agreed to undertake and communicate ambitious actions to address climate change. Relevant information as shared by the countries is available on the UNFCCC website. Under the UNISDR, the Sendai Framework for Disaster Risk Reduction (2015-2030) calls for national governments to adopt and implement national DRR strategies with their own targets, indicators and timeframes. Furthermore, various institutions take actions to support countries in planning and implementing actions to address natural and human disasters.				
Source(s)	NOTE – Sendai Framework for Disaster Risk Reduction. Retrieved from <http://www.unisdr.org/we/coordinate/sendai-framework>				
Methodology	The indicator would involve a summation of qualitative data from various sources on the presence of risk and vulnerability assessments, financial (capital and operating) plans and technical systems for disaster mitigation addressing natural and human induced disasters and risks in the cities. Possible categorization may be plans present and adequate; plans present and inadequate; or plans do not exist. The second option could even be expanded further to provide level of inadequacy.				
Unit	Qualitative				
Data sources/ Relevant databases	NOTE – Data on risk and vulnerability assessments and actions can be derived from the following non-exhaustive list of sources: global datasets on risks and vulnerabilities (e.g., heat, drought, flooding, earthquakes, typhoon and tsunami); the United Nations Framework Convention on Climate Change (http://unfccc.int) for data, policies, plans and strategies to address risks and vulnerabilities associated with climate change; the United Nations Office for Disaster Risk Reduction (http://www.unisdr.org) for disaster risk management policies, plans and strategies; various databases of relevant institutions including: The World Bank, Global Environment Facility, OECD, Asian Development Bank, African Development Bank, Development Bank of Latin America, etc.; and the World Risk Index for data source as well as public private partnerships with reinsurance companies for this data.				
SDG reference(s)	SDG indicator 11.B.1: Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Safety**				
KPI name	**Population living in disaster-prone areas**				
KPI No.	**SC: SH: SA: 4A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Percentage of inhabitants living in a zone subject to natural hazards				
Rationale/ Interpretation/ Benchmarking	"This indicator refers to the percentage of national population living in areas subject to significant risk of death or damage caused by prominent hazards: cyclones, drought, floods, earthquakes, volcanoes and landslides. The indicator can be calculated separately for each relevant prominent hazard. The risk of death in a natural disaster is a function of physical exposure to a hazardous event and vulnerability to the hazard. The indicator measures the risk at sub-national scale by using historical and other data on hazards and on vulnerability. The sub-national risk levels are then aggregated to arrive at national values." [United Nations] "To calculate the percentage of population living in disaster prone areas, thus providing a useful estimate of national vulnerability to cyclones, drought, floods, earthquake, volcanoes and landslides, which combines almost the totality of human and economic loss due to disasters caused by vulnerability to natural hazards. This indicator will contribute to a better understanding of the level of vulnerability in a given country, thus encouraging long-term, sustainable risk reduction programs to prevent disasters, which are a major threat to national development". (UNDESA) A declining trend and lower values are considered positive.				
Source(s)	NOTE – UNDESA. Retrieved from <http://www.un.org/esa/sustdev/natlinfo/indicators/methodology_sheets/natural_hazards/population_hazard_proneareas.pdf>				
Methodology	Calculate as: Numerator: total number of city inhabitants living in areas subject to significant risk of death or damage caused by prominent hazards Denominator: total number of city inhabitants. Multiply by 100.				
Unit	Percentage				
Data sources/ Relevant databases	NOTE – Data availability at the country level varies according to the country. At the international level, data on global hazard frequency and risk and their distribution is available through the Hotspot project implemented by the Centre for Hazards & Risk Research at Columbia University. Data on global disasters is available in the EM-DAT database, maintained by the Centre for Research on the Epidemiology of Disasters (CRED) in Brussels. (UN) It is also important to examine global data sources showing geographical hazard distribution like volcanic maps, fault lines, etc. These can be mapped against national population records at the municipal/territorial/national level. See information at https://www.unisdr.org				
SDG reference(s)	SDG target 1.5: By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.SDG target 11.B: By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels.				

Dimension	Society and culture				
Sub-dimension	**Safety, Housing and Social Inclusion**				
Category	**Safety**				
KPI name	**Emergency Services Response Time**				
KPI No.	**SC: SH: SA: 5A**	**Type:**	**Advanced**	**Type:**	**Structural**
Definition/ Description	Average response time for Emergency Services.				
Rationale/ Interpretation/ Benchmarking	Emergency service response times are an indicator of the effectiveness of these services in responding to emergencies and safeguarding city inhabitants. Emergency services include police, firefighting and ambulance services (including transport and urgent care). This indicator is often interpreted as the average time (in minutes) taken to respond to emergency calls from the initial call to arrival on-site. Lower values are considered positive.				
Methodology	Calculate as: Numerator: Sum of all the minutes from an initial call to the on-site arrival of the emergency service in the year. Denominator: Number of emergency responses in the same year.				
Unit	Minutes				
Data sources/ Relevant databases	Data can be collected from local emergency services.				
SDG reference(s)	SDG target 3.D: Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Safety**				
KPI name	**Police service**				
KPI No.	**SC: SH: SA: 6C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Number of police officers per 100 000 inhabitants.				
Rationale/ Interpretation/ Benchmarking	The number of sworn police officers is an indicator of the overall crime prevention capabilities of a city. The city shall report on the number of sworn law enforcement officers who meet the following criteria: work in an official capacity; have the authority to make arrests; carry identification linking them to their duty; and are paid from governmental funds set aside specifically for payment of sworn law enforcement representatives. Law enforcement agencies shall report the total number of sworn law enforcement officers as of a locally determined date. (ISO 2015) An improving trend and higher values are considered positive based on economic and safety factors.				
Source(s)	NOTE – ISO. Sustainable Development of Communities-Indicators for City Services and Quality of Life. 2015				
Methodology	Calculate as: Numerator: number of full-time police officers (expressed as FTE). Denominator: one 100 000th of the city's population.				
Unit	Number/100 000 inhabitants				
Data sources/ Relevant databases	Data can be collected from police service personnel records.				
SDG reference(s)	SDG target 3.d: Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Safety**				
KPI name	**Fire service**				
KPI No.	**SC: SH: SA: 7C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Number of firefighters per 100 000 inhabitants.				
Rationale/ Interpretation/ Benchmarking	Firefighting services are a fundamental service provided by cities and provide protection of life and property. Firefighters are often the first responders to many other emergencies. The city shall report on the number of full-time firefighters (expressed as FTE) who respond to calls. It shall exclude other administrative and management staff, who are not directly involved in fire suppression, communication and dispatching of services to a fire site. (ISO, 2015) An improving trend and higher values are considered positive based on economic and safety factors.				
Source(s)	NOTE – ISO. Sustainable Development of Communities-Indicators for City Services and Quality of Life. 2015				
Methodology	Calculate as: Numerator: number of full-time firefighters (expressed as FTE). Denominator: one 100 000th of the city's population.				
Unit	Number/100 000 inhabitants				
Data sources/ Relevant databases	Data can be collected from municipal fire service personnel records.				
SDG reference(s)	SDG target 3.d: Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Safety**				
KPI name	**Violent crime rate**				
KPI No.	**SC: SH: SA: 8C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Violent crime rate per 100 000 inhabitants				
Rationale/ Interpretation/ Benchmarking	The number of violent crimes is an indicator of the incidence of serious criminal offences in a city and a lead indicator of feelings associated with personal safety. The number of violent crimes in a city is considered a benchmark measure of the overall level of safety in the city. Violent crimes shall include offences that involve force or the threat of force to a person. Total violent crimes reported shall be calculated as the total sum of the number of murders and non-negligent manslaughters, the number of rapes, the number of robberies and the number of aggravated assaults. For a multiple offence, only the most serious/severe offence shall be counted. (ISO, 2015) A declining trend and lower values are considered positive.				
Source(s)	NOTE – Sustainable development of communities – Indicators for city services and quality of life. ISO 3712:2014				
Methodology	Calculate as: Numerator: number of violent crimes committed. Denominator: one 100 000th of the city's population.				
Unit	Number/100 000 inhabitants				
Data sources/ Relevant databases	Data can be collected from local police departments and departments of justice. UNODC, WHO.				
SDG reference(s)	SDG target 16.1: Significantly reduce all forms of violence and related death rates everywhere. SDG indicator 16.3.1: Proportion of victims of violence in the previous 12 months who reported their victimization to competent authorities or other officially recognized conflict resolution mechanisms.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Safety**				
KPI name	**Traffic fatalities**				
KPI No.	**SC: SH: SA: 9C**	**Type:**	**Core**	**Type:**	**Structural**
Definition/ Description	Traffic fatalities per 100 000 inhabitants.				
Rationale/ Interpretation/ Benchmarking	Road traffic injuries claim more than 1.2 million lives each year and have a huge impact on health development and overall quality of life. They are the leading cause of death among the youth (15 -29 years), and cost governments approximately 3% of overall national GDP. Despite this massive and largely preventable human and economic toll, action to combat this global challenge has been insufficient. The definition of a road traffic fatality for harmonization of surveillance is "any person killed immediately or dying within 30 days as a result of a road traffic injury accident". (WHO, 2015) The choice of 30 days is based on research which shows that most people who die as a result of a crash succumb to their injuries within 30 days of sustaining them. A declining trend should be pursued with lower percentages indicating better road safety.				
Source(s)	NOTE – WHO Global status report on road safety 2018. Retrieved from <https://www.who.int/publications/i/item/9789241565684/>				
Methodology	Calculate as: Numerator: number of traffic fatalities. Denominator: one 100 000th of the city's population.				
Unit	Number/100 000 inhabitants				
Data sources/ Relevant databases	Data can be collected from local transportation and emergency departments and local hospitals. The World Health Organization can also provide adequate data on traffic fatalities.				
SDG reference(s)	SDG indicator 3.6.1: Death rate due to road traffic injuries.				

Dimension	Society and culture				
Sub-dimension	**Safety, housing and social inclusion**				
Category	**Food security**				
KPI name	**Local food production**				
KPI No.	**SC: SH: FS: 1A**	**Type:**	**Advanced**	**Type:**	**Sustainable**
Definition/ Description	Percentage of local food supplied from within 100 km of the urban area.				
Rationale/ Interpretation/ Benchmarking	Food security is a complex concept, and it consists of various dimensions including: • Availability: this refers to the physical availability of food in terms of adequate supply. • Utilization: this refers to consumption of fresh food in sanitary conditions with no negative effects on the well-being or health of an individual. • Access: this refers to the economic means by which fresh food can be acquired in adequate quantities for consumption. • Stability: this refers to adequate intake and availability of food on a regular basis, overcoming any adverse climatic conditions, economic limitations and overriding any possibilities of nutritional deficiencies. (FAO) The Food and Agriculture Organization of the United Nations states that "food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life." (FAO, 1996) Adopting a people-centric approach for local food systems promotes participatory governance at different levels: • Social level: Local procurement is generally focused on wholefood products which are healthier, fresher, more nutritious and tastier because of their seasonality. Also, local procurement provides an opportunity to increase domestic food self-sufficiency, as well as to strengthen communities by increasing the accountability and transparency between consumers and producers. Additionally, local procurement can be an effective option for protecting traditional food cultures and native species. • Economic level: Local procurement supports farmer retention on farmlands, greater income generation at the community level, employment growth and import substitution. Additionally, local food channels, such as farmers' markets, can further stimulate business activity by providing small producers with greater access to consumers. • Environmental level: Local procurement can reduce the negative environmental impacts associated with the transportation of food over long distances as well as the demand on congested infrastructure. Local procurement can also be an effective option for supporting local agriculture and production which, if managed sustainably, can increase the resilience of ecosystems which can be beneficial for mitigating the impacts of extreme weather events. (FAO) A positive trend should be pursued with higher percentages indicating better food security.				
Source(s)	NOTE 1 – FAO. Food Insecurity in the World. Retrieved from <http://www.fao.org/docrep/003/y1500e/y1500e00.htm> NOTE 2 – FAO, Sustainable Local Procurement. Retrieved from <http://www.fao.org/fileadmin/user_upload/nr/sustainability_pathways/docs/SustainableLocalProcurement_Factsheet_ENGLISH.pdf> NOTE 3 – Organic agriculture and food security. Retrieved from <http://www.usc-canada.org/UserFiles/File/organic-agriculture-and-food-security.pdf>				

Dimension	Society and culture
Methodology	Calculate as: Numerator: amount of local food supplied to the city (within 100 km) (tonnes). Denominator: amount of total food supplied to the city (tonnes). Multiply by 100.
Unit	Percentage
Data sources/ Relevant databases	NOTE – FAO: http://www.fao.org/home/en/ Data can be collected from local, regional and national departments related to agriculture and trade.
SDG reference(s)	SDG target 2.C: Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility. SDG target 2.4:By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.

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