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|  | **International Telecommunication Union** |
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| **ITU-T** | **FG-SSC** |
| TELECOMMUNICATIONSTANDARDIZATION SECTOROF ITU | (03/2015)  |
|  | ITU-T Focus Group on Smart Sustainable Cities |
|  | **Key performance indicators related to the sustainability impacts of information and communication technology in smart sustainable cities** |
|  | Focus Group Technical Specifications |



FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating, and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The procedures for establishment of focus groups are defined in Recommendation ITU-T A.7. ITU-T Study Group 5 set up the ITU-T Focus Group on Smart Sustainable Cities (FG-SSC) at its meeting in February 2013. ITU-T Study Group 5 is the parent group of FG-SSC.

Deliverables of focus groups can take the form of technical reports, specifications, etc., and aim to provide material for consideration by the parent group in its standardization activities. Deliverables of focus groups are not ITU-T Recommendations.

|  |
| --- |
| **SERIES OF FG-SSC TECHNICAL REPORTS/SPECIFICATIONS**Technical Report on "Smart sustainable cities: a guide for city leaders"Technical Report on "Master plan for smart sustainable cities" Technical Report on "An overview of smart sustainable cities and the role of information and communication technologies"Technical Report on "Smart sustainable cities: an analysis of definitions"Technical Report on "Smart water management in cities"Technical Report on "Electromagnetic field (EMF) considerations in smart sustainable cities"Technical Specifications on "Overview of key performance indicators in smart sustainable cities"Technical Report on "Information and communication technologies for climate change adaptation in cities"Technical Report on "Cybersecurity, data protection and cyber resilience in smart sustainable cities" Technical Report on "Integrated management for smart sustainable cities" Technical Report on "Key performance indicators definitions for smart sustainable cities"Technical Specifications on "Key performance indicators related to the use of information and communication technology in smart sustainable cities"Technical Specifications on "Key performance indicators related to the sustainability impacts of information and communication technology in smart sustainable cities"Technical Report on "Standardization roadmap for smart sustainable cities"Technical Report on "Setting the stage for stakeholders’ engagement in smart sustainable cities"Technical Report on "Overview of smart sustainable cities infrastructure" Technical Specifications on "Setting the framework for an ICT architecture of a smart sustainable city"Technical Specifications on "Multi-service infrastructure for smart sustainable cities in new-development areas" Technical Report on "Intelligent sustainable buildings for smart sustainable cities" Technical Report on "Anonymization infrastructure and open data in smart sustainable cities"Technical Report on "Standardization activities for smart sustainable cities" |

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**Key performance indicators related to the sustainability impacts of information and communication technology in smart sustainable cities**

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Additional information and materials relating to these Technical Specifications can be found at: [www.itu.int/itu-t/climatechange](http://www.itu.int/itu-t/climatechange). If you would like to provide any additional information, please contact Cristina Bueti (ITU) at tsbsg5@itu.int.

Key performance indicators related to the sustainability impacts of information and communication technology in smart sustainable cities

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Key performance indicators related to the sustainability impacts of information and communication technology in smart sustainable cities

Executive Summary

These Technical Specifications give general guidance to cities and provide for the definition of key performance indicators (KPIs) related to the sustainability impacts of information and communication technology (ICT) in the context of smart sustainable cities (SSCs).

These Technical Specifications are expected to become an ITU-T Recommendation.

Keywords

Cities, information and communication technologies (ICTs), smart sustainable cities (SSCs), sustainability impacts.

Introduction

According to the terms of reference (ToR) of the Focus Group on Smart Sustainable Cities (FG‑SSC), one of the objectives is to:

* Identify or develop a set of key performance indicators (KPIs) to assess how the use of ICTs has an impact on the environmental[[1]](#footnote-1) sustainability of cities.

One of the specific tasks and deliverables of FG-SSC is to:

* Develop a document of KPIs to assess the impact of the use of ICT projects in cities.

This document is one of the deliverables developed by the FG-SSC and defines the KPIs. The series of KPI definitions deliverables include:

* Technical Specifications on overview of key performance indicators in smart sustainable cities [ITU-T L.KPIs-overview].
* Technical Specifications on key performance indicators related to the use of information and communication technology in smart sustainable cities [ITU‑T L.KPIs‑ICT]. This document lists the KPIs focusing on ICT use in SSC.
* Technical Specifications on key performance indicators related to the sustainability impacts of information and communication technology in smart sustainable cities. This document lists the KPIs proposed for ICT impact on sustainability.
* Technical Report on key performance indicators definitions for smart sustainable cities [ITU-T L.KPIs-Supp]. This document provides the information regarding existing KPIs and evaluation index systems of smart cities, KPIs of sustainable cities, etc.

In this document FG-SSC proposes ICT related KPIs in alignment with the definition of SSC while considering the dimensions of such a city. This document is aligned with the framework provided by UN-Habitat in its City Prosperity Index with respect to the categorization of indicators as described in Appendix II and further detailed in [ITU‑T L.KPIs‑overview].

1 Scope

These Technical Specifications form part of a series of Technical Reports and Technical Specifications focusing on key performance indicators (KPIs) for smart sustainable cities (SSCs). It specifically provides the KPIs related to ICT impact on city sustainability in the context of SSC. Evaluating these indicators can help cities as well as their stakeholders understand the extent to which they may be perceived as SSC. These Technical Specifications describe applicability of KPIs, principles, dimensions as well as the definitions of corresponding indicators. To fit into the overall framework of city indicators the present Technical Specifications re-use the categorization of UN-Habitat's City Prosperity Index.

These Technical Specifications can be utilized by:

* Cities and municipal administrations, including the SSC-relevant policy-making organizations, and government sectors, enabling them to develop strategies and understand the progress related to the use of ICT for making cities smarter and more sustainable.
* City inhabitants and their non-profit organizations, enabling them to understand the development and progress of SSC with respect to the impact of ICT.
* Development and operation organizations of SSC, including planning unit, SSC-related producers and service providers, operation and maintenance organizations, helping them fulfill the tasks of sharing information related to the use of ICT and its impact on the sustainability of cities.
* Evaluation agencies and academia, supporting them in selection of relevant KPIs for assessing the contribution from ICT in the development of SSC.

The intention of identifying the KPIs is to establish the criteria to evaluate ICT´s contributions in making cities smarter and more sustainable, and to provide the cities with the means for self‑assessments. It is desirable that cities are able to quantify their achievement according to their goals.

The ICT solutions include ICT goods, networks and services as well as ICT projects. An ICT project is defined as a set of activities that uses mainly ICT goods, networks and services to implement a specific task. At a city level, ICT projects particularly target the deployment of ICT in different parts of society to improve the sustainability performance in SSC. The KPIs can be used to assess the city sustainability before and after the implementation of ICT solutions.

These Technical Specifications list the core indicators that are chosen as applicable to all cities. The goals for moving towards increased smartness and sustainability differs between cities. Thus, based on their stage of economic development or/and population growth etc., the cities can also select appropriate indicators among those listed in Appendix I and/or use new ones.

These Technical Specifications are applicable to both cities and city regions, which could be organized in different ways:

* A single city organized as one or more administrative units, or
* A union of cities in the neighboring area that can share some services.

2 References

[ITU-T L.KPIs-overview] *Technical Specifications on overview of key performance indicators in smart sustainable cities* (2014).

[ITU-T L.KPIs-ICT] *Technical Specifications on key performance indicators related to the use of information and communication technology in smart sustainable cities*.

[ITU-T L.KPIs-Supp] *Technical Report on key performance indicators definitions for smart sustainable cities*.

[ITU-T TR SSC Def] *Technical Report on smart sustainable cities: an analysis of definitions* (2014).

[UN Habitat report] UN Habitat (2013), *State of the World's cities 2012/2013, Prosperity of Cities*.

[ISO 37120] ISO 37120:2014, *Sustainable development and resilience of communities – Indicators for city services and quality of life*.

[OECD KE] Organisation for Economic Co-operation and Development (1996), *The knowledge-based economy*.

3 Definitions

3.1 Terms defined elsewhere

These Technical Specifications use the following terms defined elsewhere:

**3.1.1 city** [ITU-T L.KPIs-overview]: An urban geographical area with one (or several) local government and planning authorities.

**3.1.2 city sustainability** [ITU-T L.KPIs-overview]:The sustainability of smart city is based on four main aspects:

* economic: The ability to generate income and employment for the livelihood of the inhabitants.
* social: The ability to ensure well-being (safety, health, education, etc.) of the citizens can be equally delivered despite differences in class, race or gender.
* environmental: The ability to protect future quality and reproducibility of natural resources.
* governance: The ability to maintain social conditions of stability, democracy, participation, and justice.

**3.1.3 ICT companies** [ITU-T L.KPIs-ICT]: Companies which provide products and/or services with respect to information and communication technologies.

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

**3.1.5 smart sustainable cities** [ITU-T TR SSC Def]: 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 and environmental aspects.

4 Abbreviations and acronyms

These Technical Specifications use the following abbreviations and acronyms:

AIDS Acquired Immune Deficiency Syndrome

GDP Gross Domestic Product

GHG Greenhouse Gas

HIV Human Immunodeficiency Virus infection

HLY Healthy Life Years

ICT Information and Communication Technology

ISO International Organization for Standardization

ITU International Telecommunication Union

KPI Key Performance Indicator

PM10 Particulate Matter up to 10 micrometres in size

PM2.5 Particulate Matter up to 2.5 micrometres in size

QoL Quality of Life

SSC Smart Sustainable City

ToR Terms of Reference

UN-Habitat United Nations Human Settlements Programme

5 General principles for key performance indicators for ICT in a city context

The selection of KPIs is based on the following principles:

* **Comprehensiveness**: The set of indicators should cover all the aspects of SSC. The indicators for evaluation should be aligned to the measured subject, i.e., ICT and its impact on the sustainability of cities. The index system should reflect the level of general development for a certain aspect.
* **Comparability**: The KPIs should be defined in a way that the data can be compared scientifically between different cities according to different phases of urban development, which means the KPIs must be comparable over time and space. It should also be possible to extend and amend the set of KPIs according to the actual stage of development.
* **Availability**: The KPIs should be quantitative and the historic and current data should be either available or easy to collect.
* **Independency**: The KPIs in the same dimension should be independent or almost-orthogonal i.e., overlap of the KPIs should be avoided as much as possible.
* **Simplicity**: The concept of each indicator should be simple and easy to understand. Also the calculation of the associated data should be intuitive and simple.
* **Timeliness**: This is defined as the ability to produce KPIs with respect to emerging issues in SSC construction.

6 Key performance indicators

6.1 Sub-dimensions of KPIs

The sub-dimensions for each dimension are listed in Table 1. These have been tailored from the Table 1 of [ITU-T L.KPIs-overview].

In Table 1, each dimension is identified by the letter Dx. The sub-dimensions are then classified by the label Dx.y where x denotes the dimension and y maps the sub-dimension.

Table 1 – Sub-dimension of KPIs

|  |  |  |  |
| --- | --- | --- | --- |
| Dimension label | Dimension | Sub-dimension label | Sub-dimension |
| D2 | Environmental sustainability | D2.1 | Air quality |
| D2.2 | CO2 emissions |
| D2.3 | Energy |
| D2.5 | Water, soil and noise |
| D3 | Productivity | D3.1 | Capital investment |
| D3.2 | Employment |
| D3.3 | Inflation |
| D3.5 | Savings |
| D3.6 | Export/import |
| D3.7 | Household income/consumption |
| D3.8 | Innovation |
| D4 | Quality of life | D4.1 | Education |
| D4.2 | Health |
| D4.3 | Safety/security public place |
| D5 | Equity and social inclusion | D5.1 | Inequity of income/consumption (Gini coefficient) |
| D5.2 | Social and gender inequity of access to services and infrastructure |
| D5.3 | Openness and public participation |
| D6 | Physical infrastructure | D6.1 | Infrastructure/connection to services – piped water |
| D6.2 | Infrastructure/connection to services – sewage |
| D6.3 | Infrastructure/connection to services – electricity |
| D6.6 | Infrastructure/connection to services – health infrastructure |
| D6.7 | Infrastructure/connection to services – transport |
| NOTE - This list contains only the sub-categories for which indicators are defined in this document. For a total set of sub-categories, refer to [ITU-T L.KPIs-overview]. |

6.2 Key performance indicators for smart sustainable cities

This section defines the core indicators applicable for all cities.

Each indicator is labeled (Ix.y.z), where (i) x denotes the dimension, (ii) y, the sub-dimension, and (iii) z, the indicator.

NOTE – The numbering of indicator Ix,y,z of this document follows that of [ITU-T L.KPIs-ICT].

The indicators listed in Appendix I are proposed as additional indicators for consideration. Cities can select appropriate ones among those, and/or add new indicators, in order to evaluate the sustainability impacts related to the use of ICT.

NOTE – These Technical Specifications contain ICT specific indicators and general indicators[[2]](#footnote-2) which describe the sustainability impacts in the context of smart sustainable cities. Due to the complexity of cites and the wide range of factors that impact citizens´ behaviour, impacts from ICT could in many cases mainly be tracked for specific projects or initiatives. For this reason, the general city level KPIs are defined for areas where ICT could have an impact, though it is not the only change lever. Thus, to understand the ICT impact on the general KPIs, depth analysis is needed based on a broad understanding of the general city development.

NOTE – Although convenience and comfort is an important aspect of SSC, there are no KPIs defined for the sub-dimension D4.4 Convenience and comfort [ITU-T L.KPIs-overview]. However, it is important that ICT projects are designed in a way that is convenient for the intended users. Therefore it is good to combine the use of KPIs with other assessment methods to understand the satisfaction level linked to the use of such projects and how these KPIs develop over time.

NOTE – In this text the *e-service* concept (e.g., e-health and e-governance etc.) is used in an inclusive way and refers to both wired and wireless services that benefit cities and city inhabitants. The mobile wireless services could also be referred to as *m-services* (e.g., m-health, m-banking etc.). These ICT services and goods can be also collectively termed as *Smart services* (e.g., Smart grid, Smart lighting) and *Smart goods* (e.g., Smart meters). In some cases the *Smart service* / *smart goods* concept may be used instead of *e-service* if this terminology is more widely adopted for the referred service or goods.

NOTE – In this document the term *city inhabitant* is used to refer to the people living in the city.

### 6.2.1 Environmental sustainability

This clause lists the core indicators defined for environmental sustainability.

There are 10 indicators in this dimension, covering *air pollution, GHG emissions, renewable energy, energy saving in households, environment perception, quality of water resources, recycling of waste, noise and soil pollution, and green areas etc.*

| Sub-dimension | Indicator | Description |
| --- | --- | --- |
| D2.1 Air quality | I2.1.2 Air pollution intensity | Level of particles and toxic substances. (\*)NOTE – This includes toxic substances and particles such as PM10 and PM2.5. |
| D2.2 CO2 emissions (\*\*) | I2.2.1 GHG emissions | Amount of GHG emissions per capita. (\*)NOTE – It is preferred to distinguish between emissions emerging from industrial (manufacturing, construction), commercial, household, transport, and waste disposal etc. |
| D2.3 Energy | I2.3.1 Use of alternative and renewable energy | Proportion of renewable energy consumed in the city. (\*)NOTE – Renewable energy sources include geothermal, solar thermal, solar voltaic, hydro, wind, and combustible renewable sources and waste (composed of solid biomass, liquid biomass, bio-gas, industrial waste and municipal waste). |
| I2.3.2 Energy saving in households | Energy saving in households compared to a baseline. (\*)NOTE – The baseline may be either a previous measurement or a reference value. NOTE – It would be preferred to distinguish between households with and without smart meters, and with and without home automation systems. |
| D2.5 Water, soil and noise | I2.5.3 Quality of city water resources | Quality of water resources (rivers, lakes etc.). (\*)NOTE – Pollution of water resources includes (but is not limited to) acidity, organic, floatables, alga, chemical substances and bacteria etc. |
| I2.5.4 Recycling of waste | Proportion of waste recycled compared to total collected waste. (\*) |
| I2.5.5 Exposure to noise | Proportion of the city inhabitants with noise levels above international/national exposure limits at home. (\*)NOTE – Noise is measured as sound pressure in accordance with relevant international/national standards. |
| I2.5.6 Soil pollution avoidance | Proportion of soil pollution incidents with successful early warning and emergency detection of heavy metal, chemicals and acid etc. through ICT. |
| I2.5.7 Green areas surface | Proportion of municipal territory allocated to publicly accessible green areas. (\*) |
| I2.5.8 Perception on environmental quality | Proportion of city inhabitants satisfied with the urban environment. (\*) |
| NOTE – Indicators marked by (\*) are not ICT specific indicators but indicators focusing on general city sustainability.NOTE – This sub-dimension marked by (\*\*) looks into the CO2-e/GHG emissions of the city where "-e" is "equivalent" and all other greenhouse gases are converted into CO2. |

### 6.2.2 Productivity

This clause lists the core indicators defined for productivity and economic sustainability.

There are 7 indicators in this dimension, covering *expenditure of ICT to improve industry productivity, service industry employment, saving, city export/import, household ICT expenditures, ICT investment, and ICT related patents etc.*

|  |  |  |
| --- | --- | --- |
| Sub-dimension | Indicator | Description |
| D3.1 Capital investment | I3.1.3 Improvement of industry productivity through ICT | Productivity enhancement in industry through ICT measured as the impact of ICT on value added per person employed.NOTE – This is the contribution from ICT investment.NOTE – Value added per person employed is generally referred to as labour productivity. |
| D3.2 Employment | I3.2.1 Service industry employment | Proportion of employees working in service industry in the city compared with the total employed workforce. (\*) |
| D3.5 Savings | I3.5.1 Saving rate | Proportion of total incomes for each household remaining after deducting consumption and expenditures. (\*) |
| D3.6 Export/import | I3.6.1 Knowledge-intensive export/import | Proportion of export/import of knowledge-intensive goods and services within a city compared to the total industrial export/import. (\*)NOTE – Amount of export/import may be counted among cities, maybe in the same country.NOTE – In some cases data is only available at country level. |
| D3.7 Household income/consumption | I3.7.1 Household ICT expenditures | Proportion of household expenditures related to ICT. |
| D3.8 Innovation | I3.8.2 Investments in ICT innovation | Proportion of private sector expenditures invested in ICT innovation. |
| I3.8.3 ICT related patents  | Number of ICT related patents granted per capita. |
| NOTE – Indicators marked by (\*) are not ICT specific indicators but indicators focusing on general city sustainability. |

### 6.2.3 Quality of life

This clause lists the core indicators defined for Quality of Life (QoL).

There are 3 indicators in this dimension, covering *student ICT availability, inhabitants health statues, and emergency process to improve safety and security.*

| Sub-dimension | Indicator | Description |
| --- | --- | --- |
| D4.1 Education | I4.1.2 Students ICT availability | Proportion of students/pupils with access to ICT capabilities in school.NOTE – ICT capabilities include Internet connectivity, computer labs, ICT modules, digital learning etc. |
| D4.2 Health | I4.2.5 Healthy life years (HLY) | Number of remaining years that a person of a certain age is expected to live without disability. (\*)NOTE – The emphasis is not exclusively on the length of life, as is the case for life expectancy, but also on the quality of life. |
| D4.3 Safety/security public place | I4.3.3 Disaster and emergencies alert accuracy | Proportion of disasters and emergencies with timely alerts. (\*)NOTE – Disasters may be natural or man-made. Emergencies concern incidents like kidnapping and missing people etc. |
| NOTE – Indicators marked by (\*) are not ICT specific indicators but indicators focusing on general city sustainability. |

### 6.2.4 Equity and social inclusion[[3]](#footnote-3)

This clause lists the core indicators defined for equity and social inclusion.

There are 4 indicators in this dimension, covering *income inequity, gender inequity, use of online services and perception on social inclusion etc.*

|  |  |  |
| --- | --- | --- |
| Sub-dimension | Indicator | Description |
| D5.1 Inequity of income/consumption (Gini coefficient) | I5.1.1 Income distribution | Income distribution in accordance with Gini coefficient. (\*) |
| D5.2 Social and gender inequity of access to services and infrastructure | I5.2.1 Gender income disparity | Rate of income disparity between men and women. (\*)NOTE – Income has potential influence on equity of access to services and infrastructure. |
| D5.3 Openness and public participation | I5.3.5 Use of online city services | Proportion of city inhabitants using online public services and facilities (e.g., choice of schools, booking of public sports facilities, library services, etc.).NOTE – This includes bookings, payments etc. |
| I5.3.6 Perception on social inclusion | Proportion of city inhabitants satisfied with the social inclusion. (\*)NOTE – Social inclusion usually refers to members of society feeling valued and important. |
| NOTE – Indicators marked by (\*) are not ICT specific indicators but indicators focusing on general city sustainability. |

### 6.2.5 Physical infrastructure[[4]](#footnote-4)

This clause lists the core indicators defined for the physical infrastructure.

There are 6 indicators in this dimension, covering *piped water, sewage, electricity, health infrastructure, transport and road traffic.*

|  |  |  |
| --- | --- | --- |
| Sub-dimension | Indicator | Description |
| D6.1 Infrastructure /connection to services – piped water | I6.1.4 Leakage in water supply system | Proportion of water leakage in the water supply system. (\*) |
| D6.2 Infrastructure /connection to services – sewage | I6.2.3 Sewage system coverage | Proportion of households connected to the sewage system. (\*) |
| D6.3 Infrastructure /connection to services – electricity | I6.3.2 Reliability of electricity supply system | Proportion of time during which electricity supply system works without outages. (\*) |
| D6.6 Infrastructure /connection to services – health infrastructure | I6.6.1 Availability of sporting facilities | Number of sports training facilities per capita. (\*) |
| D6.7 Infrastructure /connection to services – transport  | I6.7.1 Use of public transport | Proportion of travellers utilizing public transportation compared to overall city population. (\*) |
| I6.7.2 Road traffic efficiency | Freedom from traffic congestion exposure. (\*)NOTE – Traffic congestion is measured in accordance with relevant international/national standards. For example, in terms of average speed of vehicle or average delay. |
| NOTE – Indicators marked by (\*) are not ICT specific indicators but indicators focusing on general city sustainability. |

Appendix I

Additional indicators

The indicators listed in the following table are proposed as additional indicators for consideration. Cities can select appropriate ones among those, and/or add new indicators, to evaluate the contributions of ICT to their SSC goals. Each additional indicator is labeled (Ax.y.z), where (i) x denotes the dimension, (ii) y, the sub-dimension, and (iii) z, the indicator.

| Sub-dimension | Indicator | Description |
| --- | --- | --- |
| D2.2 CO2 emissions (\*\*) | A2.2.1 GHG emissions per sector per capita | GHG emissions per capita per sector including industrial (manufacturing, construction), commercial, household, transport, and waste disposal etc. (\*) |
| D2.3 Energy | A2.3.1 Electricity use for street lighting | Electricity used for street lighting per capita. (\*) |
| D3.2 Employment | A3.2.1 Creative industry employment | Proportion of employees working in start-ups and creative industry in the city compared to the total employed workforce. (\*)NOTE – Creative industries refer to those ones that are based on individual creativity, skill and talent with the potential to create wealth and jobs through developing intellectual property. This includes thirteen sectors: advertising, architecture, the art and antiques market, crafts, design, designer fashion, film, interactive leisure software (i.e., video games), music, the performing arts, publishing, software, and television and radio. |
| D3.3 Inflation | A3.3.1 Inflation rate | A city's inflation rate is based on a projection of its Consumer Price Index, which measures the rise in prices of goods and services. (\*)NOTE – National inflation data may be used.NOTE – A +2% inflation rate is regarded as a target or healthy inflation rate by major international banks. |
| D4.2 Health | A4.2.1 Coverage of health insurance  | Proportion of city inhabitants covered by health insurances. (\*)NOTE – Health insurances may be either private or provided by authorities. |
| D5.3 Openness and public participation | A5.3.2 Interest in online access to cultural resources | On-line visits to cultural resources per capita. |
| D6.1 Infrastructure /connection to services – piped water | A6.1.2 Quality of piped water | Quality of water as supplied to end users. (\*)NOTE – Quality is impacted by both water treatments and distribution systems.  |
| NOTE – Indicators marked by (\*) are not ICT specific indicators but indicators focusing on general city sustainability.NOTE – This sub-dimension marked by (\*\*) looks into the CO2-e/GHG emissions of the city where "-e" is "equivalent" and all other greenhouse gases are converted into CO2. |

Appendix II

UN-Habitat City Prosperity Index

In the Wheel of Prosperity as defined by UN-Habitat, the "spokes" are the five dimensions of prosperity: productivity, infrastructure development, quality of life, equity and social inclusion, and environmental sustainability.



In the "City Prosperity Index" each dimension has its own index and it might be built up by a number of indices. The basic "City Prosperity Index" as reported in a publication consists of the following sub‑indices and indicators:

|  |  |
| --- | --- |
| Dimension | Definition/variables |
| Productivity | The productivity index is measured through the city product, which is composed of the variables capital investment, formal/informal employment, inflation, trade, savings, export/import, and household income/consumption. The city product represents the total output of gods and services (value added) produced by a city´s population during a specific year. |
| Quality of life | The quality of life index is a combination of four sub-indices: education, health, safety/security and public space. The sub-index education includes literacy, primary, secondary and tertiary enrolment. The sub-index health includes life expectancy, under-five mortality rates, HIV/AIDS, morbidity and nutrition variables. |
| Infrastructure development | The infrastructure development index combines two sub-indices: one for infrastructure and another for housing. The infrastructure sub-index includes: connection to services (piped water, sewage, electricity and ICT), waste management, knowledge infrastructure, health infrastructure, transport and road infrastructure. The housing sub-index includes building materials and living space. |
| Environmental sustainability | The environmental sustainability index is made of four sub-indices: air quality (PM10), CO2 emissions, energy and indoor pollution. |
| Equity and social inclusion | The equity and social inclusion index combines statistical measures of inequity of income/consumption (Gini coefficient) and social and gender inequity of access to services and infrastructure. |

Reference

UN Habitat report "State of the World's cities 2012/2013 Prosperity of Cities", table 1.1.3, p. 18.

There is also an extended "City Prosperity Index" with more indicators and a plan to include “Governance” as a sixth dimension. Furthermore, a specific work has been made on Streets as a driver for prosperity.

UN Habitat (2013), *State of the World's Cities 2012/2013, Prosperity of Cities*: <http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=3387>

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[b-FG-SSC infrastructure] FG-SSC deliverable, *Technical Report on overview of smart sustainable cities infrastructure*.

[b-FG-SSC security] FG-SSC deliverable, *Technical Report on cyber-security, data protection and cyber-resilience in smart sustainable cities*.

[b-FG-SSC building] FG-SSC deliverable, *Technical Report on smart sustainable buildings for smart sustainable cities*.

[b-FG-SSC water] FG-SSC deliverable (2014), *Technical Report on smart water management in cities.*

[b-FG-SSC management] FG-SSC deliverable, *Technical Report on* *integrated management for smart sustainable cities*.

[b-FG-SSC stakeholders] FG-SSC deliverable, *Technical Report on* *engaging stakeholders for* *smart sustainable cities*.

[b-ISO TDS 37151.1] ISO TDS 37151.1:2014, *Smart community infrastructures - Principles and requirements for performance metrics*.

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1. The terms of reference of FG-SSC particularly mention environmental sustainability. However, this document tries to have a broader perspective and embraces also indicators that are related to quality of life, social and economic aspects. [↑](#footnote-ref-1)
2. The general indicators are marked (\*). [↑](#footnote-ref-2)
3. In general equity and inclusion in relation to ICT are hard to measure by defining specific indicators. Therefore, in addition to the indicators defined in dimension D5, cities are encouraged to disaggregate and analyse their data with respect to other aspects including gender, age, income and geographic location/area. [↑](#footnote-ref-3)
4. The number of various sensors (per capita) deployed in the city and accessibility to the public administration is very important. [↑](#footnote-ref-4)