United Nations ECE/HBP/2015/4

Economic and Social Council

Distr.: General
2 October 2015

Original: English

Economic Commission for Europe

Committee on Housing and Land Management

Seventy-sixth session
Geneva, 14-15 December 2015
Item 6(b) of the provisional agenda
Review of the implementation of the programme of work 2014-2015
Sustainable urban development

The UNECE–ITU Smart Sustainable Cities Indicators

Note by the secretariat

Summary

In 2012, the UNECE Committee on Housing and Land Management decided to include the topic of "smart cities" as one of its priority activities in the Committee's programme of work 2014–2015 (ECE/HBP/173). A project on "United Smart Cities" was launched in May 2014.

In 2014, the Committee, at its seventy-fifth session (ECE/HBP/179), requested the secretariat to prepare a set of smart cities indicators for its consideration and endorsement at its seventy-sixth session.

The Committee secretariat, in cooperation with its partners, including the International Telecommunication Union, the Environment Agency Austria and others, developed a proposal for a set of Smart Sustainable Cities Indicators. The proposed indicators were further discussed with member States and stakeholders through an online consultation and comments received during the consultation were incorporated. This document contains a definition of smart sustainable cities a set of draft indicators, which the Committee is invited to review and endorse.

I. Introduction

1. The topic of smart cities is considered very important among the member States of the UNECE region. In the survey "Challenges and priorities in housing and land management in the UNECE Region" (ECE/HBP/2013/2), respondents from member States ranked the "smart cities initiative, which addresses information, communication and technology in urban planning" second among the activities in the area "sustainable urban development".[1]

2. In 2012, the UNECE Committee on Housing and Land Management (CHLM) decided to include the topic of "smart sustainable cities" as one of its priority activities in the Committee's programme of work 2014–2015 (ECE/HBP/2013/10)[2] under the cluster "Sustainable urban development".

3. Following the Committee's decision, its secretariat conducted a review of existing smart city projects and networks; organized consultations with stakeholders; and, in May 2014, launched a project called "United Smart Cities".[3]

4. At its seventy-fifth session, the Committee requested the secretariat (ECE/HBP/179)4 to prepare a set of Smart City Indicators for its consideration and endorsement at its seventy-sixth session.

5. The Committee secretariat, within the "United Smart Cities" project, in cooperation with the Environment Agency Austria (EAA) and the International Telecommunication Union (ITU) and in consultation with relevant stakeholders and member States[5,] elaborated the Smart Sustainable Cities Indicators.

6. The indicators were developed as a tool to evaluate how smart and sustainable a city is and serve as a starting point to implement concrete actions and measures and improve a city's sustainability level. These indicators have already reflected the content of the Sustainable Development Goals (SDGs), which are to be approved in September 2015 by the United Nations General Assembly. Therefore, the UNECE-ITU Smart Sustainable Cities Indicators will help cities to evaluate their performance against the SDGs.

7. This document provides a definition of smart sustainable cities, describes the objectives and the benefits of using smart cities indicators, informs about the history of the development of the indicators, and explains how the indicators are described. Annex I presents the visual structure of the indicators and Annex II provides the list of the proposed UNECE–ITU Smart Sustainable Cities Indicators.

[1] More information can be found at www.unece.org/fileadmin/DAM/hlm/documents/2013/ece.hbp.2013.02.e.pdf, p.15.
[2] Information is available at www.unece.org/fileadmin/DAM/hlm/documents/2013/ECE_HBP_2013_10.pdf, p.4.
[3] More information is available at www.unece.org/housing/smartcities.html
[4] Information is available at www.unece.org/fileadmin/DAM/hlm/documents/2014/ece.hbp.179.en.pdf
[5]Stakeholder consultations on the indicators included a workshop "Measuring Progress: Achieving Smarter Cities" on 26-27 May 2015 in Lisbon, www.unece.org/index.php?id=38886#/; a workshop on "Smart City Indicators" on 4-5 June 2015 in Rakvere, Estonia, www.unece.org/index.php?id=39554#/; and an expert consultation meeting in Geneva, on 11 May 2015, www.unece.org/index.php?id=39566#/. In addition, consultation with member States was organized by email in July and August 2015.

II. The UNECE-ITU definition of smart sustainable cities

8. The smart sustainable cities definition elaborated by the ITU Focus Group on Smart Sustainable Cities (FG-SSC) reads: "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, cultural[6] and environmental aspects". According to this proposed definition, a city is considered as an "integrated" system. The secretariat is proposing this definition of Smart Sustainable Cities for endorsement by the CHLM.

III. History of the preparation of the Smart Sustainable Cities Indicators

9.. The main objective of the UNECE "United Smart Cities" project[7,] within which the draft Smart Sustainable Cities Indicators (SSCIs) have been elaborated, is to support cities, in particular in developing countries and in countries with economies in transition, to improve their sustainable growth while focusing on a more transparent and efficient use of their resources. Sustainable growth can also be achieved with easier access to new and affordable technologies and will result in better living conditions for citizens. Information on this project's activities and partners is available in Informal Note 5.

10. In May 2015, the secretariat of the CHLM conducted an Expert Consultation on Smart Cities Indicators, in Geneva. During this consultation the ITU informed the UNECE about its work on smart cities indicators. As a result of the discussions between the ITU and the UNECE, a joint set of indicators was established in order to build synergies and ensure a global applicability of the indicators by cities. A joint expert group then worked to unify the two sets of indicators and to provide the version that the CHLM is invited to endorse. Further an online consultation with member States and stakeholders was organized by the UNECE secretariat and received comments during this consultation were incorporated into the draft set of the indicators. Annexes III and IV provide the history of the development of the indicators by the UNECE and the ITU, respectively.

IV. The UNECE–ITU Smart Sustainable Cities Indicators

(a) Objectives of the development and benefits of the indicators

11. The objectives of using the indicators are the following. First, the indicators represent a tool to evaluate the performance of a city so that concrete measures can be recommended and then implemented by the city. Second, they can be used as a tool to monitor cities' progress towards sustainable urban development in the global framework of the Sustainable Development Goals (SDGs). SSCIs cannot be

[6] The UNECE proposed the addition of the word "cultural" to this definition to make it closer to the principles of the Charter on Sustainable Housing and more in line with the Sustainable Development Goals.
[7] More information on the project is available at www.unece.org/housing/smartcities.html

considered a "troubleshooting" instrument but rather a supportive tool that can help cities to grow more sustainably and smartly.

12. These indicators are also expected to be used by the UNECE for its "United Smart Cities" project to draft cities' profiles and support cities in improving their sustainable development.

13. The benefits of using indicators are several. First of all, they can help assess the strengths and weaknesses of a city. By analyzing the performance of a city against the indicators, it is easier to recognize which areas are most critical or in which areas the city is performing well. Second, they can be used to set priorities. Once the strengths and the weaknesses of a city are identified, the indicators can help to prioritize, i.e. to choose the most critical issues for the sustainable growth of the city, and to define measures to address them. Lastly, indicators can also be seen as a good monitoring tool to evaluate the changes in the city's performance over a certain period of time and after several actions have been implemented.

14. The first step in the application of the indicators is an assessment of a defined city - this step can be compared with diagnosing a patient. Many aspects have to be investigated and the city has to be understood in the context of its past development and its surroundings.

(b) Description of the UNECE–ITU Smart Sustainable Cities Indicators

15. The list of the UNECE-ITU SSCIs, a total of 71 indicators, is provided in Annex II.

16. The current set of indicators has been structured according to:

- Area
- Topic, and
- Typology.

17. The areas represent the more generic dimensions which provide a framework for the set of indicators. They correspond to the three pillars of sustainability: economy, environment, and society and culture.

18. The topic indicates a group of specific indicators which describe an area of potential development. Eighteen (18) major topics were identified and each indicator was assigned to one specific topic. Some topics include specific sub-topics which can be considered as keywords that more thoroughly define the nature of the indicators. The topics are:

19. Economy, including the following topics:

- ICT infrastructure
- Innovation
- Employment
- Trade (sub-topics: e-Commerce and export/import)
- Productivity
- Physical infrastructure (sub-topics: piped water, health, electricity, transport, and buildings)

20. Environment, including the following topics:

- Air quality

- Water
- Noise
- Environmental quality
- Biodiversity
- Energy

21. Society, including the following topics:

- Education
- Health
- Safety (sub-topics: disaster relief, emergency, and ICT)
- Housing
- Culture
- Social inclusion

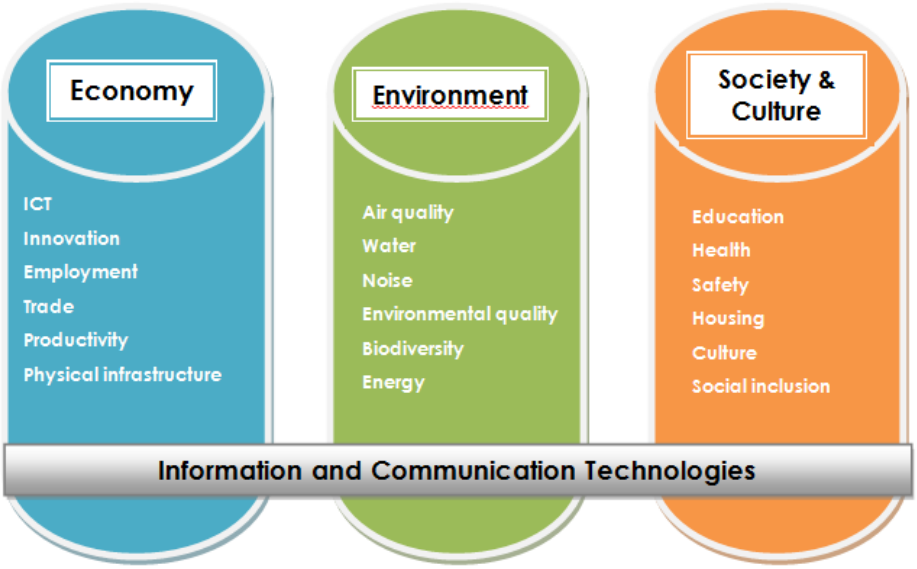
22. The indicator typology indicates the "applicability" of the indicator itself. In total, two indicator types are defined and explained below:

- The core indicators can be used by all cities globally. They will be put in the main body of international standard.
- The additional indicators may be used by some cities according to their economic capacity, population growth, geographic situation, etc. Also, some additional indicators are very "smart" and can be addressed by "smarter" cities. These indicators are optional, especially for self-benchmarking, and will be put in the appendix of international standard which is not normative.

23. Using the area, the topic, and the typology, the indicators are assigned a unit which indicates how they are measured; a definition which informs about what they describe; and a number.

Annex I

The UNECE–ITU Smart Sustainable Cities Indicators: visual representation



Annex II

UNECE-ITU Smart Sustainable Cities Indicators

Area	*Topic*	*No.*	*Indicator*	*Typology*
Economy		1	C1.1.1 Internet access in households	core
		2	A1.1.1 Electronic devices penetration	core
	T1.1 ICT infrastructure	3	A1.1.2 Wireless broadband subscriptions	additional
		4	A1.1.3 Fixed broadband subscriptions	additional
		5	C1.2.1 R&D expenditure	core
	T1.2 Innovation	6	C1.2.2 Patents	core
		7	C1.3.1 Employment trends	core
		8	A1.3.1 Creative industry employment	additional
	T1.3 Employment	9	A1.3.2 Tourism industry employment	additional
		10	C1.4.1 e-Commerce transactions	core
	T1.4 Trade – e-Commerce	11	A1.4.1 Electronic and mobile payment	additional
	T1.4 Trade – export/import	12	A1.4.2 Knowledge-intensive export/import	additional
		13	A1.5.1 Companies providing e-services	additional
		14	A1.5.2 Computing platforms	additional
	T1.5 Productivity	15	A1.5.3 SMEs trends	additional
	T1.6 Physical infrastructure – piped water	16	C1.6.1 Smart water meters	core
		17	A1.6.1 Water system leakages	additional
	T1.6 Physical infrastructure – electricity	18	C1.6.2 Smart electricity meters	core
		19	C1.6.3 Reliability of electricity system	core
	T1.6 Physical infrastructure – health	20	A1.6.2 Sporting infrastructure	additional
	T1.6 Physical infrastructure – transport	21	C1.6.4 Public transport system	core
		22	C1.6.5 Road traffic efficiency	core
		23	C1.6.6 Real-time public transport information	core
		24	C1.6.7 Share of EVs	core
		25	A1.6.3 Traffic monitoring	additional
	T1.6 Physical infrastructure – buildings	26	A1.6.4 Integrated management in public buildings	additional
Environment	T2.1 Air quality	27	C2.1.1 Air pollution	core

Area	*Topic*	*No.*	*Indicator*	*Typology*
		28	A2.1.1 Air pollution monitoring system	additional
		29	C2.1.2 GHG emissions	core
		30	C2.2.1 Quality of water resources	core
		31	A2.2.1 Water saving in households	additional
		32	C2.2.2 Waste water treatment	core
		33	C2.2.3 Household sanitation	core
	T2.2 Water	34	A2.2.2 Drainage system management	additional
		35	C2.3.1 Exposure to noise	core
	T2.3 Noise	36	A2.3.1 Noise monitoring	additional
		37	C2.4.1 EMF consideration	core
		38	C2.4.2 Solid waste treatment	core
	T2.4 Environmental quality	39	C2.4.3 Perception on environmental quality	core
		40	C2.5.1 Green areas and public spaces	core
		41	C2.5.2 Native species monitoring	core
	T2.5 Biodiversity	42	A2.5.1 Protected natural areas	additional
		43	C2.6.1 Renewable energy consumption	core
		44	A2.6.1 Renewable energy generation	additional
	T2.6 Energy	45	A2.6.2 Energy saving in households	additional
Society and Culture		46	C3.1.1 Students' ICT capability	core
		47	C3.1.2 Adult literacy trends	core
		48	C3.1.3 Higher education ratio	core
	T3.1 Education	49	A3.1.1 e-learning systems	additional
		50	C3.2.1 Electronic records	core
		51	C3.2.2 Sharing of medical resources	core
		52	A3.2.1 Adoption of telemedicine	additional
		53	C3.2.3 Life expectancy	core
		54	C3.2.4 Maternal mortality trends	core
		55	A3.2.2 In-patient hospital beds	additional
	T3.2 Health	56	A3.2.3 Health insurance	additional
	T3.3 Safety – disaster relief	57	C3.3.1 Vulnerability assessment	core
		58	C3.3.2 Disaster mitigation plans	core
		59	C3.3.3 Emergency response	core
	T3.3 Safety – emergency	60	A3.3.1 Disaster and emergency alert	additional
		61	C3.3.4 Information security and privacy protection	core
	T3.3 Safety – ICT	62	A3.3.2 Child Online Protection (COP)	additional
	T3.4 Housing	63	C3.4.1 Housing expenditure	core

Area	*Topic*	*No.*	*Indicator*	*Typology*
		64	C3.4.2 Slums reduction	core
		65	C3.5.1 Smart libraries	core
		66	C3.5.2 Culture infrastructure	core
	T3.5 Culture	67	C3.5.1 Protected cultural heritage sites	additional
		68	C3.6.1 Public participation	core
		69	C3.6.2 Gender income equity	core
		70	C3.6.3 Opportunities for people with special needs	core
		71	C3.6.4 Attractiveness for skilled people	core
	T3.6 Social inclusion	72	A3.6.1 Gini coefficient	additional

Annex III

The history of the development of the UNECE Smart Cities Indicators

24. The starting point of the methodological approach to the UNECE Smart Cities Indicators is the Smart City PROFILES that the EAA developed for twelve Austrian cities in 2013.

25. Since many Austrian cities and municipalities were actively pursuing energy-saving and climate strategies, setting examples which could help develop a joint knowledge basis and disseminate best practice models represented a good strategy to support cities in fulfilling this goal. In fact, by obtaining a better understanding of the key factors of urban development with respect to climate and energy issues, Profiles could provide important contributions, since they characterize cities in terms of different areas of activity in urban development. The Smart City PROFILES developed by the EAA were conceived to help Austrian cities and municipalities create smart and sustainable urban strategies and to implement them.

26. The EAA established a set of 21 indicators with the aim of developing city profiles for Austrian cities which gave a full picture of the characteristics and special features of cities and municipalities and could be reproduced by other cities. The indicators focused on climate change mitigation and energy efficiency in five areas of activity in urban development: buildings and settlement structures; transport and mobility; technical infrastructure; economy and population; and policy, administration and governance. From the analysis of the indicators' results, city profiles were drafted. They provided information about relevant sectors of urban activities, including business and economy, demography, strategic urban planning, governance, etc., and especially about the use of energy and resources as well as about the potential for increasing efficiency.

27. The resulting recommendations enabled cities to make better evaluations of their current status and their development, in particular with respect to energy and climate change mitigation, but also to other aspects influencing the quality of life of their citizens, and their competitiveness.

28. Due to the great diversity of the cities in the ECE region, the Austrian Smart Cities PROFILES methodology, as well as the areas considered, was to be revised. Hence, a consortium of partners was established and the existing smart cities initiatives analysed.

29. In order to gather the most relevant indicators to evaluate smart and sustainable cities, the EAA scanned multiple initiatives whose output was the elaboration of indicators on sustainable urban development. They were analysed with regard to their relevance and practicability in low and middle income countries in the UNECE region. The key parameters of this assessment were:

- Name of publisher or organization who developed the indicator set
- Background information
- Addressed topics or indicators
- Data availability

- History of application (reference to cities)
- Sources of information, i.e. website, guidelines, and other literature.

30. In addition to these initiatives, other relevant sources have been analyzed such as: available statistical data at European and global level, i.e. EUROSTAT, Urban Audit, the World Bank, the WHO, the FAO, etc.; thematic maps on several issues, such as likelihood of drought, earthquakes, flooding, precipitations; other methods to assess the quality of urban features, such as perception surveys, checklists, expert judgments, etc.

31. The results of the assessment were summarized in the report "Smart Urban Solutions in the UNECE Region - Preliminary study on a flexible indicator set for smart cities".8

32. From the above-mentioned assessment, ten (10) development fields divided into three (3) dimensions were identified. The three dimensions are: economy, environment, and society and culture. The development fields under the area "economy" are: economic development; and infrastructure and energy. The development fields under the area "environment" are: air, climate change and natural hazards; land and biodiversity; freshwater and oceans; and waste. The development fields under the area "society and culture" are: social issues; governance; health; education; and demography.

33. A preliminary set of top indicators for each development field was also defined. The preliminary set included 59 out of 456 indicators collected, and proposed 4 to 8 indicators per development field. For each indicator a description was provided according to the following parameters:

- Indicator title
- Source: the origin of the indicator
- Development field
- Sub-topic
- Literature: available guidelines and websites
- Relevance: only indicators with high relevance were chosen
- Feasibility (0-10): expert judgment with regard to feasibility
- Implementation: reference to regions where the indicator was already implemented
- Data availability: indication whether or not data is readily available; needs to be collected; is only available for certain regions, etc.
- Comments

[8] Prokop G., Schwarzl. B., Thielen P. (2014): "Smart Urban Solutions in the UNECE Region - Preliminary study on a flexible indicator set for smart cities". Environment Agency Austria (unpublished).

Annex IV

The history of the ITU Smart Sustainable Cities Indicators

34. The International Telecommunication Union (ITU) is the United Nations specialized agency responsible for information and communication technologies (ICTs) and an international standards developing organization (SDO).

35. In February 2013, the ITU established the Focus Group on Smart Sustainable Cities (FG-SSC) to assess the standardization requirements of cities aiming to boost their social, economic and environmental sustainability through the integration of information and communication technologies (ICTs) in their infrastructures and operations. The FG-SSC successfully completed its mandate in May 2015. During its tenure, the FG-SSC developed 21 technical specifications and reports.

36. While acknowledging the potential role of ICTs in addressing urban challenges and providing a better quality of life for its inhabitants, the FG-SSC realized that not every city will have the required level of expertise or a defined set of guidelines for the transition to a SSC.

37. While embarking on the SSC journey, it is important for cities to be able to understand and assess the stage of the transition they are at so that they may take the required steps to progress further. It is also important for urban stakeholders to be able to measure the performance of various SSC ventures once they are initiated. In this regard, the FG-SSC developed a set of international key performance indicators (KPIs) for cities aiming to become SSCs. They provide an ideal measuring system, which assists in monitoring the progress achieved in SSC transitions.

38. The FG-SSC's proposed KPIs are in alignment with the definition of SSCs and the framework provided by UN-Habitat in its City Prosperity Index. The KPIs are divided into six dimensions:

- Information and communication technology
- Environmental sustainability
- Productivity
- Quality of life
- Equity and social inclusion
- Physical infrastructure.

39. These KPIs seek to establish the criteria needed to evaluate ICTs' contributions in making cities smarter and more sustainable, and to provide the cities with the means for self-assessment. By utilizing these indicators, cities, as well as their stakeholders, can also objectively assess the extent to which they may be perceived as SSCs and, accordingly, improve on their SSC initiatives.

40. The KPIs are based on the following principles:

- Comprehensiveness: The set of indicators should cover all the aspects of SSCs. The indicators of evaluation should be aligned to the measured subject, i.e., ICT and its impact on the sustainability of cities.
- Comparability: The KPIs should be defined in a way that 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.

- Availability: The KPIs should be quantitative, and the historic and current data should be either available or easy to collect.
- Independence: 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 for the urban stakeholders. The calculation of the associated data should also be kept intuitive and simple.
- Timeliness: This refers to the ability to produce KPIs with respect to emerging issues in SSC construction.[9]

41. After eight (8) face-to-face meetings and over twenty (20) e-meetings, the ITU-T FG-SSC finalized and approved the following series of Technical Specifications and Reports on SSC KPIs:

- Technical Specifications on the overview of KPIs in SSCs, October 2014.
- Technical Specifications on KPIs related to the use of ICT in SSCs, March 2015.
- Technical Specifications on KPIs related to the sustainability impacts of ICT in SSCs, March 2015.
- Technical Report on KPIs definitions for SSCs, March 2015.

42. The set of indicators of the series of the ITU-T FG-SSC Technical Specifications includes 78 core indicators and 30 additional indicators which cities can select as appropriate. Cities are also encouraged to add new indicators following the above principles for their self-benchmarking.

43. In May 2015, the ITU and the City of Dubai (United Arab Emirates) signed a cooperation agreement in order for Dubai to be the world's first city to access the efficiency and sustainability of its operations using the KPIs developed by the ITU-T FG-SSC. The two-year pilot project will evaluate the feasibility of the indicators with the aim of contributing to their international standardization. Since then, several other cities have requested ITU's assistance to pilot the ITU-T FG-SSC KPIs.

[9] Additional information on ITU indicators and its focus group can be found at www.itu.int/en/ITU-T/focusgroups/ssc/Pages/default.aspx