ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Series Y

Supplement 32
(01/2016)

SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS
AND NEXT-GENERATION NETWORKS

ITU-T Y.4000 series – Smart sustainable cities – A guide for city leaders

ITU-T Y-series Recommendations – Supplement 32

Supplement 32 to ITU-T Y-series Recommendations

ITU-T Y.4000 series – Smart sustainable cities – A guide for city leaders

Summary

Supplement 32 to the ITU-T Y-series Recommendations is intended for city decision makers and strategists, whose decisions have a significant impact on the way their city functions and its future development trajectory. Accordingly, this high level policy document helps identify practical steps based on which urban decision makers can envisage and build a smart sustainable city (SSC).

History

Edition	Recommendation	Approval	Study Group	Unique ID[*]
1.0	ITU-T Y Suppl. 32	2016-01-26	20	11.1002/1000/12758

Keywords

City leaders, decision making, smart sustainable cities, SSC, SSC transformation.

---

[*] 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

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

Compliance with this publication is voluntary. However, the publication may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the publication is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the publication is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this publication may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the publication development process.

As of the date of approval of this publication, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this publication. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

Table of Contents

Introduction

Modern cities have experienced unprecedented socio-economic growth and environmental crises since the latter half of the 20th century and the beginning of the 21st century. In 2014, there were 28 mega cities, home to 453 million people. With 54% of the world's population living in urban areas, cities are confronted with contemporary problems, including rapid urbanization, rising pollution levels and an ever increasing rural to urban migration, all of which have exerted pressure on ageing city infrastructure. Projections indicate that the percentage of the global population living in cities is expected to rise to 66% by 2050 [b-WHD]. Globally, cities also account for 75-80% of a country's GDP and are considered the main engines of global economic growth [b-UNEP]. On the flip side, cities also produce 50% of the global waste [b-CB] along with 60% of the global greenhouse gas (GHG) emissions [b-CCCM].

As a result, there is increasing pressure on existing natural resources such as water, land and fossil fuels [b-Naphde]. Additionally, there are growing concerns regarding existing transportation infrastructure, provision of adequate healthcare, access to education and overall safety for the growing population of urban residents [b-ERSC].

Supplement 32 to ITU-T Y-series Recommendations

ITU-T Y.4000 series – Smart sustainable cities – A guide for city leaders

1 Scope

This Supplement is intended for city decision makers and strategists, whose decisions have a significant impact on the way their city functions and its future development trajectory. Accordingly, this high level policy document helps identify practical steps based on which urban decision makers can envisage and build a smart sustainable city (SSC).

2 References

None.

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

EMF   Electromagnetic Field

ICT   Information and Communication Technology

IoT   Internet of Things

KPI   Key Performance Indicator

SDG   Sustainable Development Goal

SSC   Smart Sustainable City

SWOT   Strengths, Weaknesses, Opportunities and Threats

5 Conventions

None.

6 Smart sustainable cities: the urban future we want

In light of the facts outlined in the introduction, urban planners are faced with daunting questions as to whether to promote cities as drivers of economic growth or pay heed to issues such as increasing population, resource overuse and dependence in cities. Understanding this dilemma, ITU's Focus Group on Smart Sustainable Cities (FG-SSC) set the path for cities to become smart and sustainable. Smart sustainable cities (SSC) is a concept developed by the FG-SSC which intends to leverage the potential of information and communication technology (ICT) in urban governance systems to create cities which are not only economically and socially advanced but are also designed to achieve environmental sustainability.

This Supplement is intended for city decision makers and strategists, whose decisions have a significant impact on the way their city functions and its future development trajectory. Accordingly, this high level policy document helps identify practical steps based on which urban decision makers can envisage and build a smart sustainable city.

## 7   Starting your SSC journey

For cities wishing to go the SSC way, each city has to start from a different baseline for their transition to becoming a smart sustainable city. However, it is important to understand that SSC means embracing a journey and cannot be considered the final destination.

Through its research work on SSC, ITU intends to assist city decision makers (including municipal and government representatives) by re-defining the way in which the city's infrastructure is built, services are offered, citizens are engaged and systems linked, with the aim of transforming cities into more sustainable, smart, resilient and robust living environments.

Realizing that the establishment of SSC is a long term process and cannot be achieved overnight, it is essential that a series of generic steps are defined that would not only allow for comparability but would also promote sustainable development along with each city being able to quantify improvements over time.

In keeping with this way of thinking, the ITU has developed some basic steps for SSC transformation. Each of the steps described in this document are required when making the transition to a smart sustainable city. These steps can help formulate an action strategy oriented to: (i) consensus building among varied stakeholders, (ii) governance mechanisms, (iii) citizen engagement, (iv) ICT infrastructure, (iv) monitoring mechanisms and (v) learning among SSC stakeholders.

Figure 1 gives an overview of the steps to becoming a smart sustainable city (SSC).
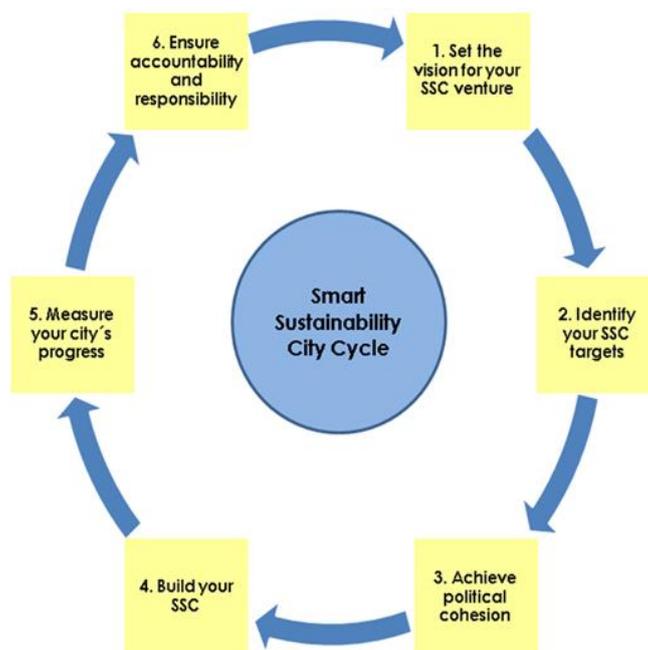
Figure 1 – SSC 6-step transition cycle

(Adapted from [b-ICLEI])

Step 1 – Set the vision for your SSC venture

Local government should increasingly take on a more central role in such development initiatives. They should assist in identifying a specific SSC vision and in assessing the city's existing situation

in order to establish the relevance and feasibility of becoming a smart sustainable city. This step includes the following aspects:

a) Identifying an SSC vision that is in line with the city's identity, political priorities and long-term development strategy;

b) Gathering relevant data on the status of ICT infrastructure and its usage at the city-level, including the status of the city in regards to the widely used ITU-T Recommendations and Technical Reports;

c) Identifying the SSC stakeholders;

d) Identifying the existing governance and organisational mechanisms that would allow an efficient and effective management of SSC solutions;

e) Identifying mechanisms for multi-stakeholder involvement, citizen engagement, communication and information sharing throughout the SSC process.

This step can be facilitated through a basic SSC strengths, weaknesses, opportunities and threats (SWOT) analysis for each city. This will assist in framing a city specific strategy and goals.

Step 2 – Identify your SSC targets

Local government should work in close collaboration with the various SSC stakeholders to design the overall master plan for the SSC's implementation. This should include broad agreement on objectives, priorities, initiatives and actions needed in the short, medium and long term. Consideration should be accorded to setting measurable SSC targets and timeframes for their achievement. This step involves, among others, the identification of SSC targets in regards to:

a) Developing SSC infrastructure and an integrated platform for example using Internet of things (IoT);

b) Identifying and developing SSC services;

c) Defining SSC key performance indicators (KPIs);

d) Educating the stakeholders on the advantages of SSC.

Step 3 – Achieve political commitment

Engagement with political leadership is imperative. Local governments should obtain the necessary political approval and backing to ensure that the SSC strategic programme is pursued. This includes the adoption of the SSC programme/targets through consensus. This will provide the basis for an agreed document that has widespread support and will serve as a reference for the strategic planning by the local authority.

Step 4 – Build your SSC

Using the political backing gained in Step 3 and support from other SSC stakeholders, local governments should lead the way to actually initiating the establishment of their smart sustainable city. For this step, the existing traditional infrastructure may be significantly improved on by integrating the required ICT applications for the upgrade to SSC. The stakeholders may also choose to build a new infrastructure from scratch.

For either of the aforementioned scenarios, the following features are pertinent:

a) Making of a feasible master plan for your SSC journey;

b) Conforming to appropriate construction models (e.g., public-private partnerships in various SSC programmes);

c) Ensuring long term services via good operation and maintenance after the infrastructure is in place.

Step 5 – Measure your city progress

The fifth step consists of monitoring and evaluating a work programme required to achieve the targets. This stage involves close coordination and collaboration among SSC stakeholders, as well as an assessment on the basis of relevant key performance indicators (KPIs). The ITU has developed a useful set of KPIs for SSC, which can be utilized for this specific step. These KPIs form an excellent baseline for city decision makers, as they map their city's progress of their overall SSC journey.

Step 6 – Ensure accountability and responsibility

The last step is focused on evaluating, reporting and learning from the SSC process and related experiences. This involves an assessment of the implementation of the work programme and an analysis of reflections about strengths and shortcomings. Such an evaluation contributes to informing the decision making process of the local council, as well as to informing the preparation of future baseline reviews to deepen SSC master plans, among others.

Better decisions are reached if they emerge out of a process of knowledge sharing and dialogue between stakeholders. The reflective process of evaluation will feed into a process of continuous learning, which in turn will influence and inform the development of the future vision and strategy for SSC.

Cities must be capable of applying lessons learned and instituting best practices concerning SSC. Consequently, cities must be accountable for continuous improvement to strengthen the effectiveness of future SSC strategies. To do this, city leaders must be flexible and able to adapt to the dynamic, evolving and complex nature of SSC and be able to continuously update the vision as required.

8 Cities are our best future

While sustainability challenges of cities are significant, urban areas also hold the key to achieving many global sustainability goals. Cities are home to the majority of humanity and sustainable development cannot be achieved without significantly transforming the way we build and manage our urban spaces.

The infusion of ICT into key processes is pertinent to achieving sustainability. ICTs can assist with the establishment of SSCs through innovation and redesign of existing processes. This can include new applications, technologies and systems for smart energy, smart transportation, smart buildings, smart water management and smart government.

As ICTs provide an integrated strategic approach to sustainability in SSC, they are key enablers of urban development, making ICT integration also vital to the achievement of the post-2015 sustainable development goals (SDGs).

Cities do not have the option to continue functioning as they have done in the past. Hence city decision makers have to see the writing on the wall and decide on a maintainable urban process, which promotes economic progress as well as environmental protection. Here, the SSC vision not only provides the benefit for sustained economic growth but also ensures a high quality of life for the citizens along with environmental sustainability.

Appendix I

Overview of the Focus Group on Smart Sustainable Cities

The Focus Group on Smart Sustainable Cities (FG-SSC) was established in February 2013 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. FG-SSC acts as an open platform for smart-city stakeholders such as municipalities; academic and research institutes; non-governmental organizations (NGOs) and ICT organizations, industry forums and consortia, to exchange knowledge in the interests of identifying the standardized frameworks needed to support the integration of ICT services in smart cities.

FG-SSC held eight physical meetings and over 70 virtual meetings from May 2013 to May 2015.

The development of its documents was overseen primarily by FG-SSC Working Groups (WGs), including: WG1 on the ICT Role and Roadmap for Smart Sustainable Cities; WG2 on Smart Sustainable Cities Infrastructure; WG3 on Key Performance Indicators (KPIs), and Metrics for Smart Sustainable Cities and WG4 on Policy and Positioning (communications, liaisons, and members).

FG-SSC finalized the following Technical Reports and Specifications:

1. Technical Report on Smart sustainable cities: a guide for city leaders
2. Technical Report on Master plan for smart sustainable cities
3. Technical Report on An overview of smart sustainable cities and the role of information and communication technologies
4. Technical Report on Smart sustainable cities: an analysis of definitions
5. Technical Report on Smart water management in cities
6. Technical Report on Electromagnetic field (EMF) considerations in smart sustainable cities
7. Technical Specifications on Overview of key performance indicators in smart sustainable cities
8. Technical Report on Information and communication technologies for climate change adaptation in cities
9. Technical Report on Cybersecurity, data protection and cyber resilience in smart sustainable cities
10. Technical Report on Integrated management for smart sustainable cities
11. Technical Report on Key performance indicators definitions for smart sustainable cities
12. Technical Specifications on Key performance indicators related to the use of information and communication technology in smart sustainable cities
13. Technical Specifications on Key performance indicators related to the sustainability impacts of information and communication technology in smart sustainable cities
14. Technical Report on Standardization roadmap for smart sustainable cities
15. Technical Report on Setting the stage for stakeholders' engagement in smart sustainable cities
16. Technical Report on Overview of smart sustainable cities infrastructure
17. Technical Specifications on Setting the framework for an ICT architecture of a smart sustainable city

18. Technical Specifications on Multi-service infrastructure for smart sustainable cities in new-development areas

19. Technical Report on Intelligent sustainable buildings for smart sustainable cities

20. Technical Report on Anonymization infrastructure and open data in smart sustainable cities

21. Technical Report on Standardization activities for smart sustainable cities

For additional information, please visit the FG-SSC website at http://www.itu.int/go/fgssc.

Bibliography

[b-CB]   United Nations Environment Programme: *Cities and Buildings*.
                https://www.google.fr/?gfe_rd=cr,ssl&ei=HWJhV4j0MorCaIXQq-
                gG#q=Cities+and+Buildings.+United+Nations+Environment+Programme

[b-CCCM]   UN-Habitat, *Cities and Climate Change Mitigation*.
                http://unhabitat.org/urban-themes/climate-change/

[b-ERSC]   Evolution Roadmaps for Smart Cities: *Determining Viable Paths*.
                https://www.researchgate.net/publication/236648383_Evolution_Roadmaps_for_Smart_Cities_Determining_Viabl
                e_Paths

[b-FG-SSC]   Focus Group on Smart Sustainable Cities (FG-SSC), ITU, 2015. http://www.itu.int/go/fgssc

[b-ICLEI]   Sustainability Cycle, ICLEI (2014),
                http://www.sustainablecities.eu/pathways/integratedmanagement/sustainability-cycle/

[b-Leonidas]   Anthopoulos, Leonidas, Fitsilis, Panos: *Evolution Roadmaps for Smart Cities:
                Determining Viable Paths. Proceedings of the European Conference on
                e-governance*.

[b-Naphde]   Naphde. M, Banavar. G, Harrison. C, Paraszczak. J. (2011), *Smarter Cities and
                Their Innovation Challenges*.
                http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=5875937&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpl
                s%2Fabs_all.jsp%3Farnumber%3D5875937

[b-UNEP]   United Nations Environment Programme: *How can Cities decouple economic
                growth from resource use and its environmental impacts and find a balance
                between social, environmental and economic goals?* www.unep.org/pdf/GI-REC_4pager.pdf

[b-WHD]   UN-Habitat, World Habitat Day: *Voice from Slums*. http://unhabitat.org/whd-2014/.

[b-WUP]   World Urbanization Prospects: Revision 2014, United Nations.
                https://esa.un.org/unpd/wup/Publications/Files/WUP2014-Highlights.pdf

SERIES OF ITU-T RECOMMENDATIONS

Series A   Organization of the work of ITU-T

Series D   General tariff principles

Series E   Overall network operation, telephone service, service operation and human factors

Series F   Non-telephone telecommunication services

Series G   Transmission systems and media, digital systems and networks

Series H   Audiovisual and multimedia systems

Series I   Integrated services digital network

Series J   Cable networks and transmission of television, sound programme and other multimedia signals

Series K   Protection against interference

Series L   Environment and ICTs, climate change, e-waste, energy efficiency; construction, installation and protection of cables and other elements of outside plant

Series M   Telecommunication management, including TMN and network maintenance

Series N   Maintenance: international sound programme and television transmission circuits

Series O   Specifications of measuring equipment

Series P   Terminals and subjective and objective assessment methods

Series Q   Switching and signalling

Series R   Telegraph transmission

Series S   Telegraph services terminal equipment

Series T   Terminals for telematic services

Series U   Telegraph switching

Series V   Data communication over the telephone network

Series X   Data networks, open system communications and security

Series Y   Global information infrastructure, Internet protocol aspects, next-generation networks, Internet of Things and smart cities

Series Z   Languages and general software aspects for telecommunication systems