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Smart community infrastructures — Maturity model for assessment and improvement

Infrastructures communautaires intelligentes — Modèle de maturité pour l'évaluation et l'amélioration

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Foreword

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This document was prepared by Technical Committee ISO/TC 268, *Sustainable cities and communities*, Subcommittee SC 1, *Smart community infrastructures*.

Introduction

The United Nations (UN) sustainable development agenda, "Transforming Our World: The 2030 Agenda for Sustainable Development", was adopted by world leaders in New York in September 2015. Through 17 Sustainable Development Goals (SDGs) and 169 targets, this agenda aims to end poverty and promote prosperity and well-being by 2030, while reducing the adverse impact of human activities on the environment. The UN SDGs address cities directly through Goal 11, which aims to "Make cities inclusive, safe, resilient and sustainable".

According to the SDGs, cities and communities are well positioned as "hubs for idea, commerce, culture, science, productivity, [and] social development." At the same time, cities, which are growing rapidly in many parts of the world, are facing a number of challenges in meeting the needs of their citizens in an equitable and sustainable way.

As urban populations grow, the demand for community infrastructures such as energy, water, transportation, waste, and information and communications technology (ICT) will also continue to grow in the coming decades, driven by major trends such as population growth and increased urbanization. According to the report "Infrastructure 2030" by the Organization for Economic Cooperation and Development (OECD), total cumulative infrastructure investment requirements — for new and improvements to existing community infrastructure — will be approximately $53 trillion (USD) over the next two decades (2010 to 2030).

The appropriate development of community infrastructure is fundamental to supporting the operations and activities of communities, while helping communities overcome urban challenges and make progress in supporting all 17 of the SDGs. It can also play an important role in helping communities overcome urban challenges. In addition to providing a high quality of service to support a decent standard of living for all city residents, community infrastructure should also be economically efficient and endeavour to reduce the environmental impact of urban activity.

In order for communities to develop community infrastructure efficiently, and in a manner that will enable continual improvements in all aspects of performance, it is helpful to have a tool to gauge the current level of maturity of community infrastructure relative to desired future improvements. For such a process, a maturity model is widely recognized as an efficient and effective tool. A maturity model describes the practices and processes needed at each level to reliably and sustainably achieve a corresponding level of desired performance. For example, the capability maturity model (CMM) as presented in the ISO/IEC 15504 series performs this function in the field of software development. Documents such as ISO 18091 and ISO 37101 also promote a CMM-like framework for local governments or communities.

This document describes a community infrastructure maturity model (CIMM) and a standardized approach for the assessment and improvement using the CIMM. The CIMM aids all stakeholders to understand the level of performance, process and interoperability of community infrastructure and their contribution to the community, helps them in setting targets for improvement that will guide investments and helps them to identify gaps in current levels of community infrastructure.

The CIMM can be expressed conceptually as a series of levels, each of which builds off the levels shown in Figure 1. The details are described in Clauses 4 and 5.

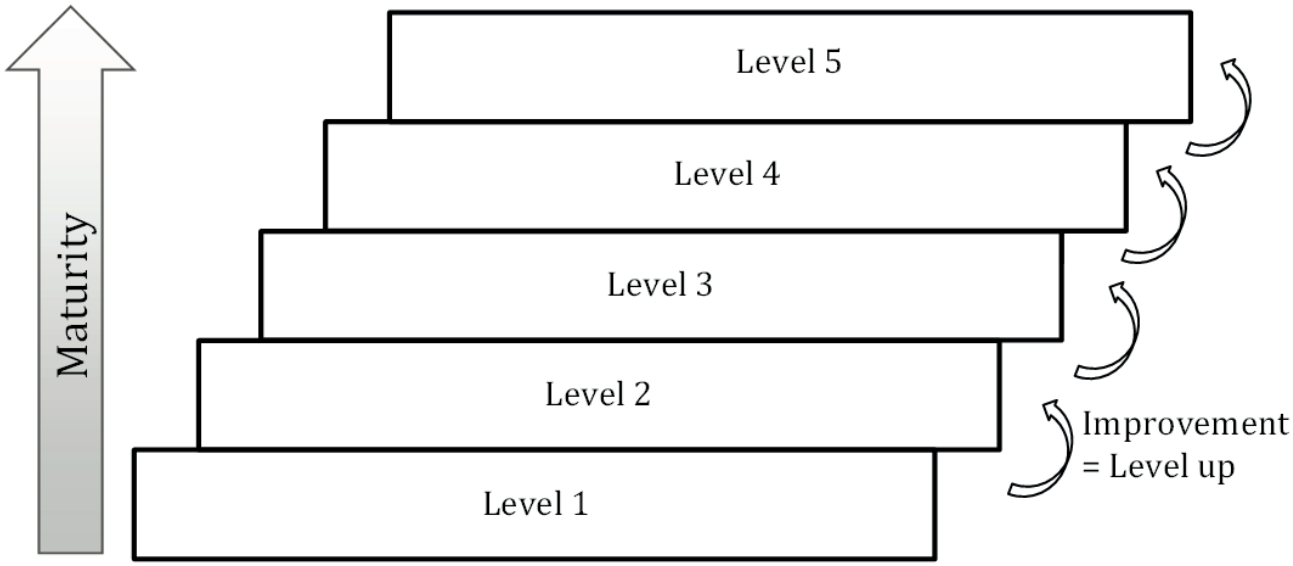

Figure 1 — Conceptual expression of community infrastructure maturity model (CIMM)

To promote continual improvements, it is important to make decisions based on a systematic overall picture of the characteristics of community infrastructure. Therefore, this document provides a systematic framework for assessment, the CIMM, which includes the five reference levels of maturity in each of the characteristics of the community infrastructure.

An assessment using the CIMM could be used to compare different communities but can also be used to make a comparison between the current and future states of infrastructure in a single community by defining the object and scope of the assessment. For example, in the "Plan-Do-Check-Action (PDCA)" cycle of development of community infrastructure, this document could be particularly helpful in the "Plan" and "Check" phases, helping users to assess the current performance, process and interoperability, and to check progress toward achieving desired improvements.

More specifically, this document supports the following stakeholders:

— citizens
  — to improve their quality of life;
— owners of community infrastructure
  — to identify which performance characteristics of the infrastructure should be prioritized;
  — to identify what technical performance aspects should be given priority for improvement;
— suppliers of community infrastructure
  — to determine which community infrastructure products will meet the specified requirements;
  — to identify directions for the development of future community infrastructure products and services;
— operators of community infrastructure
  — to determine the current performance of the community infrastructure they operate;

- to determine the appropriate performance improvement processes;

— investors

- to determine which types of infrastructure investments will best meet the desired level of performance;

— city planners or government decision makers

- to assess city planning and identify which infrastructure to prioritize;

— all stakeholders

- to ensure investment in community infrastructure that maximizes performance and minimizes life-cycle costs;
- to promote the harmonization of the needs of residents, community managers and the environment;
- to promote the sustainable development and resilience of communities.

Smart community infrastructures — Maturity model for assessment and improvement

1 Scope

This document provides the basis, requirements and guidance for a maturity model for the assessment of technical performance, process and interoperability of community infrastructure(s) as well as its contribution to the community, and guidance for future improvements.

This document is applicable to

a) all types of community infrastructure, including, but not limited to, energy, water, transportation, waste and ICT,

b) single types of community infrastructure or multiple types of community infrastructure, and

c) all types of communities, regardless of geographical locations, size, economic structure, stage of economic development, and

d) all applicable stages of infrastructure life cycle (e.g. planning/design, construction, operation, decommission).

NOTE Utilization of natural systems, such as green infrastructure, is also considered as one type of infrastructure.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/TS 37151:2015, *Smart community infrastructures – Principles and requirements for performance metrics*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
maturity model
model derived from one or more specified assessment model(s), that identifies the set of phased development or progress levels showing the assessment categories for community infrastructure(s)

3.2
maturity level
point on an ordinal scale of community infrastructure maturity that characterizes the maturity of the community infrastructure assessed in the scope of the maturity model used

3.3
impact
change to the economy, environment and other community issues, whether adverse or beneficial, resulting from community infrastructures

3.4
achievement criteria table
table populated with predefined requirements for characteristics to be achieved at the levels, which consists of sets of characteristics and their maturity levels derived from CIMM

3.5
community infrastructure maturity model
CIMM
maturity model applied to community infrastructure, which provides common maturity level definitions to assess the community infrastructure

3.6
performance
measurable result

Note 1 to entry: Performance can relate to either quantitative or qualitative findings.

Note 2 to entry: Performance can relate to the management of activities, processes, products (including strategies, programmers, projects, plans and services), systems or organizations.

[SOURCE: ISO 37101:2016, 3.29]

3.7
process
series of actions or events taking place in a defined manner leading to the accomplishment of an expected result

Note 1 to entry: "Defined" in this context does not necessarily mean documented. A defined process includes, but is not limited to, adaptive means.

[SOURCE: ISO/IEC 15944-1:2011, 3.53, modified — Note 1 to entry has been added.]

3.8
interoperability
ability of systems to provide services to and accept services from other systems and to use these services to enable them to operate effectively together

Note 1 to entry: "Systems" in this context means community infrastructures.

Note 2 to entry: "Services" in this context includes information such as data and knowledge.

[SOURCE: ISO 21007-1:2005, 2.30, modified — the definition has been slightly revised and Notes 1 and 2 to entry have been added.]

3.9
community
group of people with an arrangement of responsibilities, activities and relationships

Note 1 to entry: In the context of this document, a community shares geographic areas.

3.10
community infrastructure
systems of facilities, equipment and services that supports the operations and activities of a community

Note 1 to entry: Community infrastructure includes, but is not limited to, energy, water, transportation, waste and information and communication technologies (ICT).

3.11
smart community infrastructure
community infrastructure with enhanced technological performance that is designed, operated and maintained to contribute to sustainable development and the resilience of the community

[SOURCE: ISO/TS 37151:2015, 3.3]

3.12
sustainability
state of the global system, including environmental, social and economic aspects, in which the needs of the present are met without compromising the ability of future generations to meet their own needs

Note 1 to entry: The environmental, social and economic aspects interact, are interdependent and are often referred to as the three dimensions of sustainability.

Note 2 to entry: Sustainability is the goal of sustainable development (3.13).

[SOURCE: ISO Guide 82:2014, 3.1]

3.13
sustainable development
development that meets the environmental, social and economic needs of the present without compromising the ability of future generations to meet their own needs

Note 1 to entry: Derived from the Brundtland Report.

[SOURCE: ISO Guide 82:2014, 3.2]

3.14
life cycle
consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal

[SOURCE: ISO 14044:2006, 3.1]

3.15
metric
defined measurement method and the measurement scale

[SOURCE: ISO/IEC 14598-1:1999, 4.20, modified — Note 1 and Note 2 to entry have been removed.]

3.16
characteristic
distinguishing feature

[SOURCE: ISO 17566:2011, 2.2]

4 Basis of community infrastructure maturity model

4.1 Outline

This document provides requirements and guidance on a methodology to assess the performance, process and interoperability of community infrastructures and their contribution to community-wide priorities on five levels based on the community infrastructure maturity model (CIMM), and to identify improvement points for the levels.

For the assessment and improvement, an achievement criteria table shall be developed and utilized.

Clause 4 provides an overview of the entire methodology, including definitions and requirements. Clause 5 describes how to develop the achievement criteria table. Clause 6 describes how to utilize the table for assessment and improvement.

4.2 Achievement criteria table

The achievement criteria table of target community infrastructure(s) comprises

— characteristics to assess the performance, process and interoperability of community infrastructure(s) or their contribution to the community;

— objectives justifying the inclusion of each characteristic;

— five levels of characteristics;

— descriptions or definitions of criteria for those characteristics which define each level.

The CIMM provides reference levels of maturity of the community infrastructure(s). See 4.5 and 5.4.3 for details.

Table 1 outlines the basic structure of an achievement criteria table. Annex C provides examples of the achievement criteria table (ACT) for community infrastructure.

Table 1 — Basic structure of an achievement criteria table

Characteristics	Objectives	Level				
		1	2	3	4	5
CH1	Objective of CH1	Def.	Def.	Def.	Def.	Def.
CH2	Objective of CH2	Def.	Def.	Def.	Def.	Def.
CH3	Objective of CH3	Def.	Def.	Def.	Def.	Def.
...	...	...	...	...	...	...

NOTE 1 “CH1”, “CH2” and “CH3” represent the characteristics.

NOTE 2 “Def.”(“definition”) represents a description of the criteria for the characteristics to be met at each level of the maturity model. These definitions can be expressed by quantitative, qualitative or descriptive measures.

4.3 Assessment aspects of the community infrastructure

This document provides two aspects for the assessment of the community infrastructure(s) as shown below.

— Technical assessment: assessment of performance, process and interoperability of community infrastructure(s) (e.g. capacity of a power generation plant):

— Contribution assessment: assessment of the contribution of community infrastructure(s) to community-wide priorities (e.g. the unemployment rate of a community affected by a road-building project).

A technical assessment could be a useful aid as an assessment tool for operators, supervisory authorities and community infrastructure vendors.

Contribution assessment could be a useful aid as an assessment tool for government decision makers and development agencies.

Table 2 outlines the conceptual relationship of the two assessment aspects.

NOTE 1 For details on relating community issues to community infrastructure performances, see ISO/TS 37151:2015, 5.3.

NOTE 2 Annex A provides a more detailed description of the difference between technical assessment and contribution assessment.

NOTE 3 Community issues are the challenges that the community faces. Obviously, the issues and their priorities vary between different communities.