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Smart community infrastructures — Maturity model for assessment and improvement

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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

This second edition cancels and replaces the first edition (ISO 37153:2017), which has been technically revised.

The main changes are as follows:

— Annexes B, C, and D replaced Annexes A, B, and C to the first edition.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

The United Nations (UN) sustainable development agenda, "Transforming Our World: The 2030 Agenda for Sustainable Development", adopted in 2015, aims to end poverty, promote prosperity and well-being, while reducing environmental impact by 2030. It includes 17 Sustainable Development Goals (SDGs), of which Goal 11 focuses on "Make cities inclusive, safe, resilient and sustainable". As cities and communities grow, they face challenges in meeting the needs of citizens in an equitable and sustainable way. The demand for community infrastructure(s) such as energy, water, transportation, waste and information and communication technology (ICT) will increase with the growth of urban populations and urbanization. Appropriate development of community infrastructure(s) is crucial to support the operations and activities of communities to overcome urban challenges and make progress towards achieving the SDGs. It also needs to be economically efficient and aims to reduce the environmental impact of urban activities.

For the efficient development of community infrastructure(s) and continuous performance improvement, communities can benefit from a tool that measures the current level of maturity of the community infrastructure(s) relative to the desired future improvements. In this context, a maturity model is widely recognized as an efficient and effective tool. This model describes the necessary practices and processes at each level to achieve the desired level of performance in a reliable and sustainable manner. For example, the capability maturity model (CMM) presented in the ISO/IEC 15504 series provides this function in software development. Documents such as ISO 18091 and ISO 37101 also promote a CMM-like framework for local governments or communities.

This document provides the basis, requirements and guidance for assessment and improvement of community infrastructure(s) using a community infrastructure maturity model (CIMM). The CIMM assesses the level of performance, process and interoperability of the community infrastructure(s) as well as its contribution to the community. It also helps stakeholders set improvement targets to guide investment by identifying gaps in the current level of community infrastructure.

The CIMM can be expressed conceptually as a series of levels, each building on the previous one as shown in Figure 1. See Clauses 4 and 5 for more information.

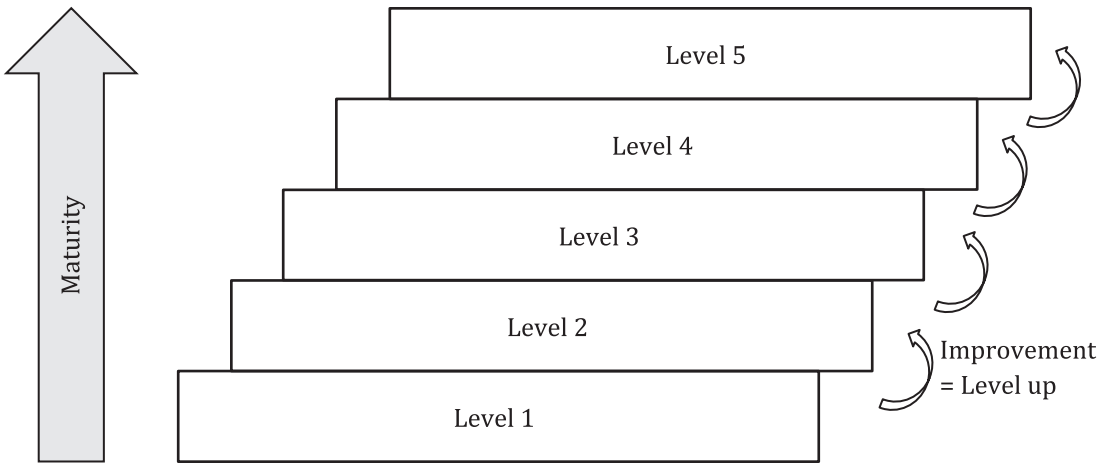

Figure 1 — Conceptual expression of CIMM

Decisions are made on the basis of a systematic overall picture of the characteristics of the community infrastructure in order to promote continuous improvement. The CIMM is a systematic assessment framework that includes the five reference levels of maturity for each of the community infrastructure characteristics.

An assessment using the CIMM can be used to compare different communities, but can also be used to compare the current and future state of infrastructure in a single community by defining the object and scope of the assessment. For example, see Annex A for an overview of the "Plan-Do-Check-Action (PDCA)" cycle for developing community infrastructure(s), where this document is particularly helpful in the "Plan"

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and “Check” phases. This document can help users assess current levels of performance, process and interoperability, and to monitor progress towards achieving desired improvements.

More specifically, this document supports the following stakeholders:

- citizens:
  - to improve their quality of life;
  - to make community infrastructure accessible for a wide range of people, regardless of their individual language, disability, etc.;
- owners of community infrastructure:
  - to identify which performance characteristics of the infrastructure should be prioritized;
  - to identify what technical performance aspects should be prioritized for improvement;
- suppliers of community infrastructure:
  - to determine which community infrastructure products meet the specified requirements;
  - to identify a direction for the development of future community infrastructure products and services;
- operators of community infrastructure:
  - to determine the current level of performance of the community infrastructure they operate;
  - to determine the appropriate processes to improve performance;
- investors:
  - to determine which types of infrastructure investment will best achieve the desired level of performance;
- city planners or government decision makers:
  - to assess city planning and identify infrastructure priorities;
- all stakeholders:
  - to ensure that investment in community infrastructure 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 community resilience.

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Smart community infrastructures — Maturity model for assessment and improvement

1 Scope

This document provides the basis, requirements and guidance for assessing the level of performance, process and interoperability of community infrastructure(s) as well as its contribution to the community using a CIMM. It also helps stakeholders set targets for improvement that will guide investment by identifying gaps in the current level of community infrastructure.

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;

c) all types of communities, regardless of geographical location, size, economic structure, or stage of economic development;

d) all applicable stages of the infrastructure life cycle (e.g. planning, design, construction, operation and decommissioning).

NOTE The use of natural systems, such as green infrastructure, is considered a 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 37151, *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 terminology databases for use in standardization at the following addresses:

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

— IEC Electropedia: available at https://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 within the scope of the maturity model used

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3.3
impact
change to the economy, environment and other community issues, either adverse or beneficial, resulting from community infrastructure(s)

3.4
achievement criteria table
ACT
table populated with predefined requirements for characteristics to be achieved at each maturity level, as specified in the community infrastructure maturity model (CIMM)

3.5
community infrastructure maturity model
CIMM
maturity model applied to community infrastructure, which defines maturity levels in order to assess the level of maturity of 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 the services so exchanged 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 — 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 many, but not all, contexts, a community has a defined geographical boundary.

Note 2 to entry: A city is a type of community.

[SOURCE: ISO 37100:2016, 3.2.2]

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3.10
community infrastructure
system of facilities, equipment and services that support the operations and activities of communities

Note 1 to entry: Such community infrastructures include, but are not limited to, energy, water, transportation, waste and information and communication technologies (ICT).

[SOURCE: ISO 37100:2016, 3.6.1]

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

[SOURCE: ISO 37151:2024, 3.3]

3.12
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 82:2019, 3.2]

3.13
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]

3.14
metric
defined measurement method and the measurement scale

[SOURCE: ISO 37100:2016, 3.5.2]

3.15
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 for the development of a methodology to assess the performance, process and interoperability of community infrastructure(s) and their contribution to community-wide priorities in relation to five maturity levels based on the CIMM. This methodology is also used to identify improvement points for the levels.

For this purpose, an achievement criteria table (ACT) shall be developed and utilized.

Clause 4 provides an overview of the whole methodology, including definitions and requirements. Clause 5 specifies how to develop the ACT. Clause 6 specifies how to utilize the table for assessment and improvement.

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4.2 Achievement criteria table

The ACT comprises:

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

— objectives justifying the inclusion of each characteristic;

— five levels of maturity for each characteristic;

— descriptions or definitions of the criteria for the characteristics that define each level.

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

Table 1 outlines the basic structure of an ACT. Note that this basic structure can be customized to meet the needs of each assessment. An example of a customized ACT structure for the assessment of community infrastructure(s) is provided in Annex C. Annex D then provides an example of an assessment trial using the ACT structure from Annex C.

Table 1 — Basic structure of an ACT

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.
…	…	…	…	…	…	…

Key

"CH1": characteristic 1.

"CH2": characteristic 2.

"CH3": characteristic 3.

"Def.": definition. Represents a description of the criteria for the characteristics to be met at each level of the CIMM. These definitions can be expressed in 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).

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

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

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

A contribution assessment can be useful as an assessment tool for government decision-makers and development agencies.

Table 2 outlines the conceptual relationship between the two assessment aspects. It is a modified version of ISO 37151:2024, Table 1.

NOTE 1 For details of the relationship between community issues and community infrastructure performance, see ISO 37151:2024, 5.3.

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