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Smart community infrastructures — Common framework for development and operation — Ad hoc group report

Infrastructures urbaines intelligentes — Cadre commun pour le développement et les opérations — Rapport du groupe Ad hoc

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Foreword

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The committee responsible for this document is Technical Committee ISO/TC 268, *Sustainable development in communities*, Subcommittee SC 1, *Smart community infrastructures*.

Introduction

In the foreseeable future, urban density is likely to increase, resulting in further urbanization complexity. From this perspective, a "smart community" approach is an important concept to address such urban challenges by integrating different forms of infrastructures in a rational and efficient manner.

An important aspect of a smart community is integrating infrastructures as "a system of systems". Until now it has not been possible to ensure consistency across infrastructure types to meet the requirements for smart community infrastructures as owners have focused on just assembling solutions to each subsystem of infrastructures.

In order to ensure consistency of smart community infrastructures as a whole, first, functions of each subsystem need to be clarified and arranged based on the needs for a smart community, and secondly, the perspectives of various stakeholders and lifecycle of infrastructures need to be considered.

Thus, a new framework is needed to develop a procedure followed by all stakeholders in order to establish an orchestration function of each smart community infrastructure component and to achieve information sharing as well as consensus amongst the stakeholders.

For this purpose, ISO/TC 268/SC 1/AHG 1 "Common framework for development and operation of smart community infrastructures" was established to conduct preliminary studies to develop international standards to formulate a framework which realizes well-functioning smart community infrastructures as a whole, considering their characteristics, i.e. "a system of systems", having various stakeholders, and long lifecycle. These standards will formulate technical procedures for stakeholders to achieve their accountability in developing, operating and maintaining smart community infrastructures as a system of systems. This document presents the results of the study conducted in the AHG. The framework aims to ensure consistency between smart community infrastructures without overlapping with existing work (see Figure 1). It incorporates the metrics as a KPI of the development, operation and maintenance methodology.

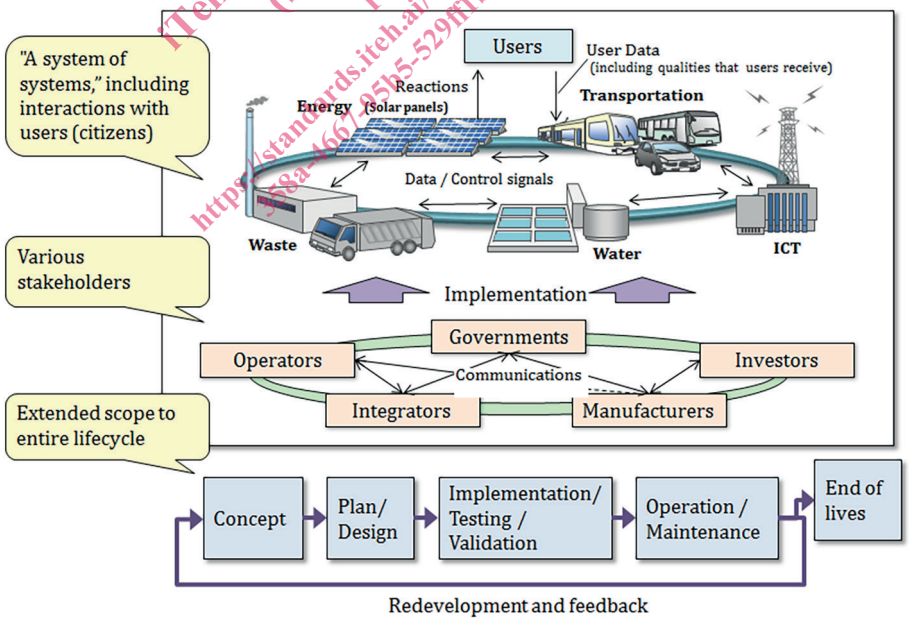

Figure 1 — Scope of the framework

Smart community infrastructures — Common framework for development and operation — Ad hoc group report

1 Scope

This document outlines the basic concept of a common framework for the development and operation of smart community infrastructures. The framework describes the planning, development, operation and maintenance methodology to facilitate the harmonization of each infrastructure as a part of a smart community and ensures that the interactions between multiple infrastructures are well orchestrated.

The framework is applicable to all processes of smart community infrastructures' life cycle (from conceptual design through planning, development, operation, maintenance, redevelopment and feedback). The infrastructures to be covered are energy, water, transportation, waste management, ICT and others.

The framework can be adopted by all relevant stakeholders who are engaged in planning, development and operation of smart community infrastructures, including planners, developers, business operators and suppliers. The framework is intended to cover the processes in which these stakeholders are engaged, such as management, organizational structure, analyses and design methods, and documentations.

2 Possible issues and solutions in developing and operating smart community infrastructures

2.1 Possible issues and solutions

Features of smart community infrastructure can be described as below:

— Smart community infrastructure is infrastructure that has a high level of financial and resource efficiency and convenience for people.

— To achieve the above state, smart community infrastructure

  — has orchestration function to achieve synergy effect of multiple types of infrastructures to improve financial and resource efficiency and convenience for people, and

  — maintains its efficiency in adaptive manners against any changes of city's circumstances including disasters and demographic changes to improve financial and resource efficiency and convenience for people (resiliency / dependability).

NOTE 1 Efficiency means output performance divided by resource input.

NOTE 2 The orchestration function can be implemented by either a centralized approach or a decentralized autonomous approach.

Since smart community infrastructures have the features shown above, they may have three characteristics different from those of conventional infrastructures (see Figure 2). Issues are identified from the characteristics as below. In addition, solutions corresponding to these issues are extracted as elements of the framework.

— Issues due to "a system of systems" and long life cycle:

  — Difficulties in ensuring consistency among components, without which functionality of the whole system of smart community infrastructures cannot occur.

— Considerable influence by interference of external systems or interactions among components onto the quality and performance of smart community infrastructures as a whole.

— Issue due to the participation of many different stakeholders:

— Various interest and wide range of responsibilities dispersed among stakeholders.

In Table 1, specific issues, extracted from the main three issues described above, are summarized along with solutions that will effectively accommodate these issues.

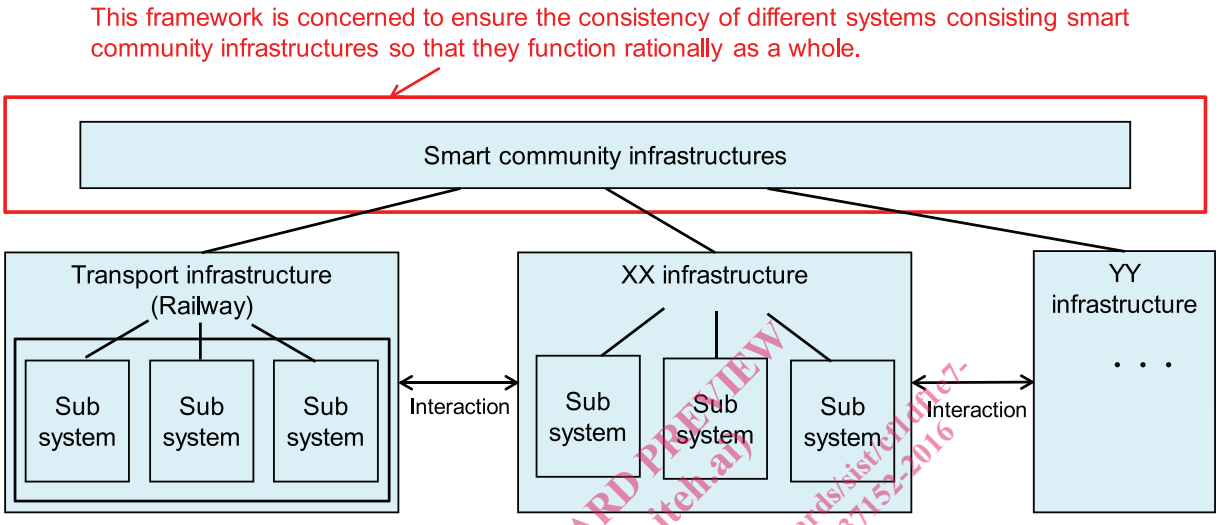

Figure 2 — Characteristics of smart community infrastructures

Table 1 - Possible issues and solutions in developing and operating smart community infrastructures[1] (1 of 2)

Main issues	Specific issues extracted from main issues	Case examples of each specific issue	Solutions (Elements of the framework)
Difficulties in ensuring consistency among components, without which functionality of the whole system of smart community infrastructures cannot occur.	Value added to smart community infrastructures as a whole cannot be shown simply by verifying the performance of each subsystem or component resulting in undervaluation of the appeal integrated infrastructure benefits.	Case example (a) (See 2.2.1.1)	**Element (A)** : Allocation of specifications to each component and validation of the allocating procedures (See 3.2.1).
	Smart community infrastructures may not achieve their target value simply by assembling high performance subsystems / components unless the consistency among the subsystems / components is ensured.	Case example (b) (See 2.2.1.2)	
Considerable influence by interference of external systems or interactions among components onto the quality and performance of smart community infrastructures.	Fluctuation in the parameters of various interactions (in short terms as well as long terms) could curb performance of smart community infrastructures.	Case example (c)～(e) (See 2.2.2.1)	**Element (B) :** Specifications associated with interaction including investigation between outside/inside smart community infrastructures and adopt countermeasures into planning and operation (See 3.2.2).
	Due to limitations in capabilities of external infrastructures, requirements and needs of smart community infrastructures as a whole cannot realised.	Case example (f) (See 2.2.2.2)	

[1] 2.2 and 3.2 of this Technical Report refer to Table 1.

Table 1 - Possible issues and solutions in developing and operating smart community infrastructures[1] (2 of 2)

Main issues	Specific issues extracted from main issues	Case examples of each specific issue	Solutions (Elements of the framework)
Various interest and wide range of responsibilities dispersed among stakeholders.	Stakeholders in different situations make communication complicated.	Case example (g) (See 2.2.3.1)	**Element (C):** Process to facilitate the information sharing and communication among stakeholders (See 3.2.3).
	Many stakeholders of different smart community infrastructures hardly bring efficient information sharing resulting in difficulties in planning and development of smart community infrastructures.	Case example (h) (See 2.2.3.2)	Need comprehensive discussion at the community level, in addition to the elements (A) to (C).

