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Framework for integration and operation of smart community infrastructures —

Part 1: Recommendations for considering opportunities and challenges from interactions in smart community infrastructures from relevant aspects through the life cycle

Cadre pour l'intégration et l'exploitation des infrastructures communautaires intelligentes —

Partie 1: Recommandations pour la prise en compte des opportunités et des défis découlant des interactions dans les infrastructures communautaires intelligentes, des aspects pertinents tout au long du cycle de vie

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

A list of all parts in the ISO 37155 series can be found on the ISO website.

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.

Introduction

Urban density is likely to increase for the foreseeable future, resulting in further urbanization complexity. From this perspective, a “smart community” approach is an important tool for addressing such urban challenges by integrating different forms of infrastructure in a rational and efficient manner.

An important aspect of a smart community is integrating infrastructures as “a system of systems”. In addition, a smart community has various stakeholders, including users, and each smart community infrastructure has extended scope life cycle (see Figure 1).

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 the specification of smart community infrastructures as a whole, firstly the functions of each subsystem need to be clarified and arranged based on the needs of a smart community. Secondly, the perspectives of various stakeholders and the life cycle of infrastructures need to be considered.

To solve these issues and realize well-functioning smart community infrastructures as a whole, infrastructure development and operation processes are expected to include a common framework, as described in ISO/TR 37152, composed of three elements (see Figure 2):

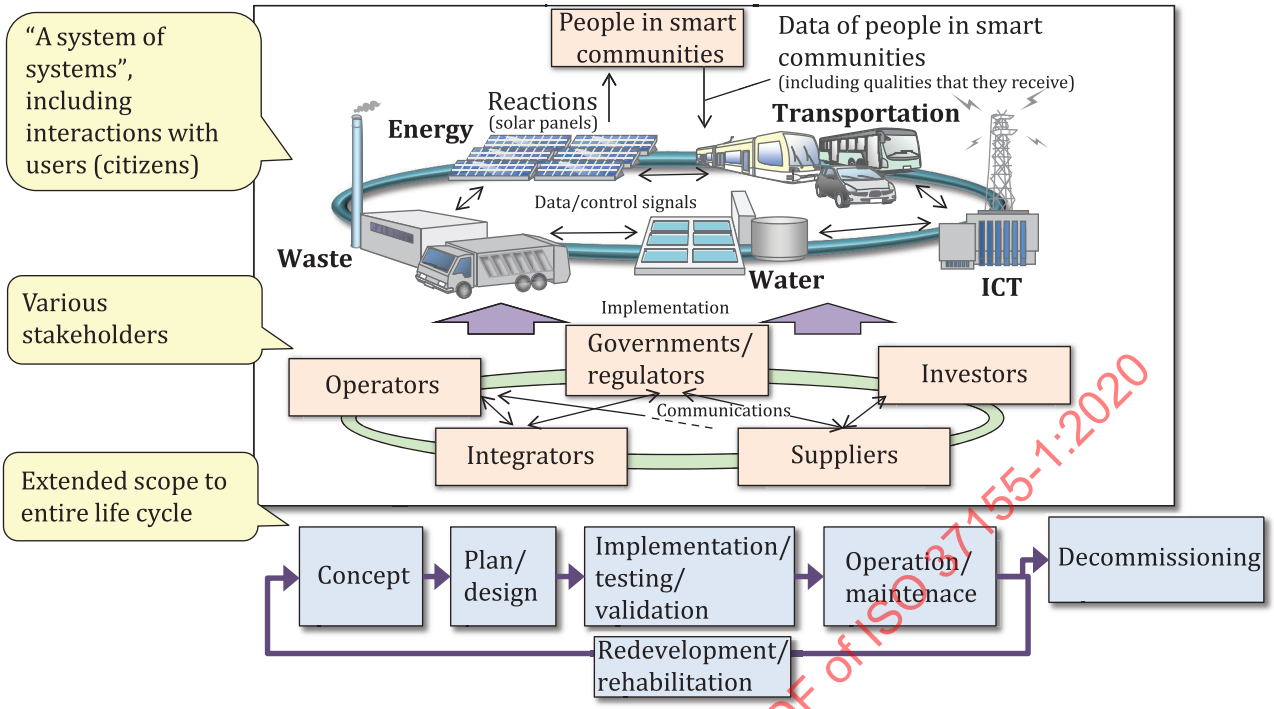
— element (A): allocation of consistent specification requirements to each component of a system and validation of the allocating procedures;

— element (B): specification requirements associated with interaction and adoption of adequate measures into planning and operation;

— element (C): process to facilitate information sharing and communication among stakeholders.

On conducting a study, it was found that all stakeholders will benefit from applying this framework (see Clause 5).

This document provides guidelines for realizing element (B), providing specification requirements to manage interactions and to adopt adequate measures into planning and operation. Parts 2 and 3 in the ISO 37155 series will be about elements (A) and (C), respectively. Should it be required, a guidelines document will be developed to support Parts 1 to 3.



NOTE The infrastructures, stakeholders and life cycle phases pictured in this figure are only examples. Other infrastructures, such as an urban agricultural system, could be included.

Figure 1 — Characteristics of a smart community infrastructure

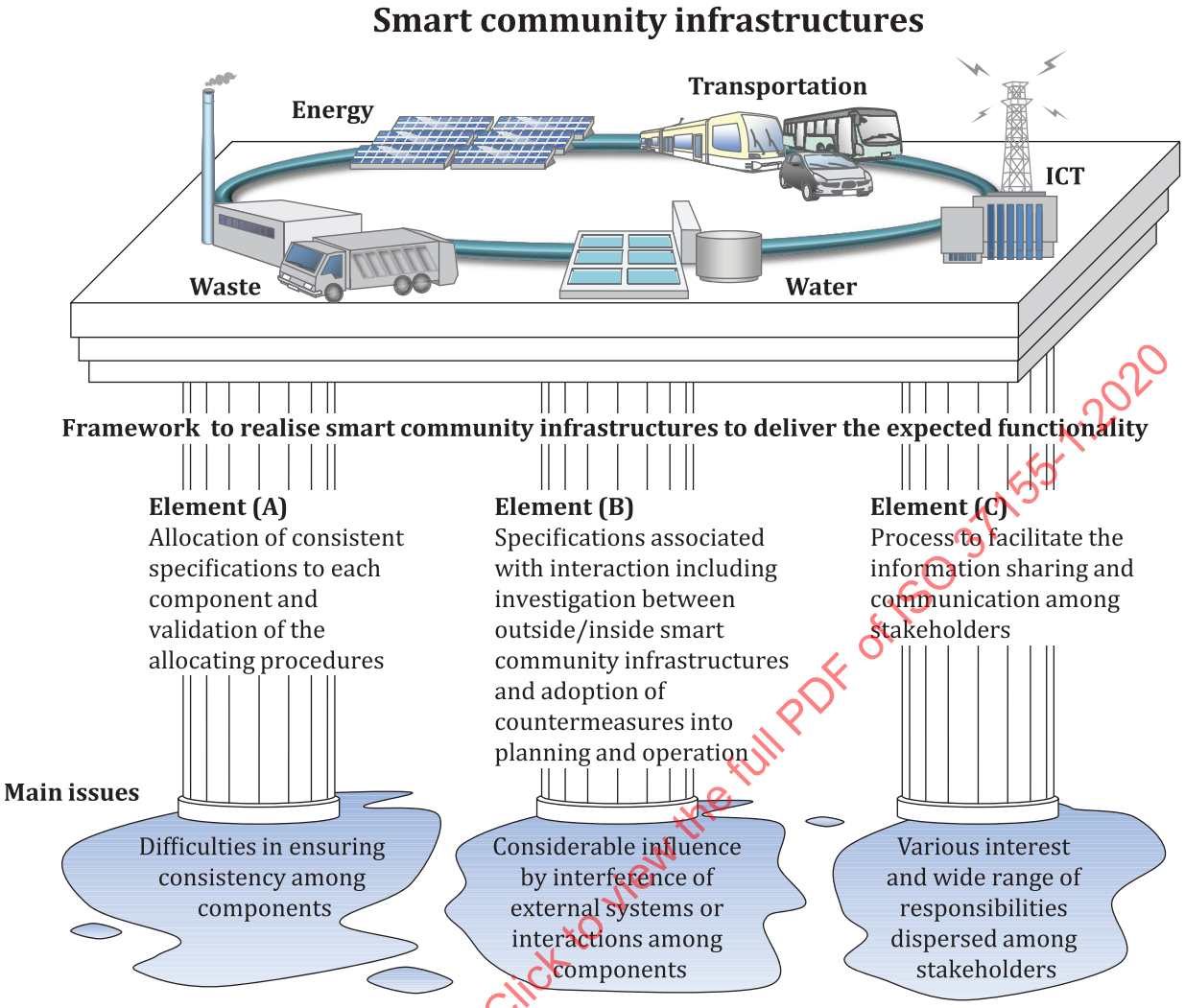


Figure 2 — Three elements of the framework

Framework for integration and operation of smart community infrastructures —

Part 1:
Recommendations for considering opportunities and challenges from interactions in smart community infrastructures from relevant aspects through the life cycle

1 Scope

This document describes a framework (a set of processes and methodologies) for smart community infrastructure interactions (interactions between multiple infrastructures, between infrastructures and stakeholders, and between infrastructures and the external environment) to ensure that such interactions are well identified and managed.

There are two potential use cases for this document. The first is for green field sites, where all the smart community infrastructures can be designed and developed at the same time. This is of value to planners and investors of major new infrastructure developments.

The second builds on the first and will support efficient management of an existing urban area by taking into account the increasing interdependencies of the infrastructures on each other and the way they should be managed as a system of systems. This document will also take into account accelerating technological and environmental changes.

Since this framework is concerned with ensuring the consistency of different systems consisting of smart community infrastructures, the scope does not overlap with any existing work or deliverables that have been or are being developed by existing TCs addressing issues at individual infrastructure level.

NOTE This document describes a management case (not a management system), i.e. specific processes that an organization needs to follow in order to meet specific objectives of this document.

2 Normative references

There are no normative references in this document.

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
risk
effect of uncertainty on objectives

Note 1 to entry: An effect is a deviation from the expected – positive and/or negative.

Note 2 to entry: Objectives can have different aspects (such as financial, health and safety, and environmental goals) and can apply at different levels (such as strategic, organization-wide, project, product and process).

Note 3 to entry: Risk is often characterized by reference to potential events and consequences, or a combination of these.

Note 4 to entry: Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence.

Note 5 to entry: Uncertainty is the state, even partial, of deficiency of information related to understanding or knowledge of an event, its consequences or likelihood.

[SOURCE: ISO 31000:2018, 3.1, modified — Notes to entry revised.]

3.2
verification
confirmation, through the provision of objective evidence, that specified requirements have been fulfilled

Note 1 to entry: The objective evidence needed for a verification can be the result of an inspection or of other forms of determination such as performing alternative calculations or reviewing documents.

Note 2 to entry: The activities carried out for verification are sometimes called a qualification process.

Note 3 to entry: The word "verified" is used to designate the corresponding status.

[SOURCE: ISO 9000:2015, 3.8.12]

3.3
validation
confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled

Note 1 to entry: The objective evidence needed for a validation is the result of a test or other form of determination such as performing alternative calculations or reviewing documents.

Note 2 to entry: The word "validated" is used to designate the corresponding status.

Note 3 to entry: The use conditions for validation can be real or simulated.

[SOURCE: ISO 9000:2015, 3.8.13]

3.4
developer
organization that is responsible for the development and operation of a smart community by organizing *smart community infrastructures* (3.13) in whole or in part

Note 1 to entry: A developer may order *operators* (3.6) to operate and maintain smart community infrastructures.

Note 2 to entry: The roles in 3.4, 3.5, 3.6, 3.10, 3.11 and 3.12 can sometimes be performed by a single organization.

EXAMPLE Private developer, municipality.

3.5
infrastructure owner
organization that owns community infrastructure that is, or could be, smart

Note 1 to entry: An infrastructure owner may order *operators* (3.6) to operate and maintain *smart community infrastructure* (3.13).

Note 2 to entry: The roles in 3.4, 3.5, 3.6, 3.10, 3.11 and 3.12 can sometimes be performed by a single organization.

EXAMPLE Owner of railway tracks, owner of sewage lines, municipality.

3.6
operator
organization that is responsible for operating and maintaining community infrastructure that is, or could be, smart

Note 1 to entry: An operator may order *service providers* (3.7) to supply a part of or the whole *smart community infrastructure(s)* (3.13).

Note 2 to entry: The roles in 3.4, 3.5, 3.6, 3.10, 3.11 and 3.12 can sometimes be performed by a single organization.

Note 3 to entry: Service provider is included in operator. Operator includes service providers.

EXAMPLE Railway operator, power utilities.

3.7
service provider
organization that is responsible for supplying a part of or the whole *smart community infrastructure(s)* (3.13)

EXAMPLE System integrator, component supplier, ICT vendor.

3.8
consultant
organization that consults, advises on or creates solutions, and assists *developers* (3.4), *infrastructure owners* (3.5), *operators* (3.6), *service providers* (3.7), *community authorities* (3.9) or *investors* (3.11) utilizing its expertise, through development, operation and maintenance of *smart community infrastructure* (3.13)

EXAMPLE Civil engineering firm, urban design engineering firm.

3.9
community authority
organization that develops and maintains regulations to ensure safety, quality and other important performances of *smart community infrastructure* (3.13)

EXAMPLE Governmental agency.

3.10
regulator
agency or organization that supervises particular utilities with regards to regulations

Note 1 to entry: The roles in 3.4, 3.5, 3.6, 3.10, 3.11 and 3.12 can sometimes be performed by a single organization.

EXAMPLE Governmental agency.

3.11
investor
organization that invests in development of *smart community infrastructures* (3.13)

Note 1 to entry: The roles in 3.4, 3.5, 3.6, 3.10, 3.11 and 3.12 can sometimes be performed by a single organization.

EXAMPLE Development bank, commercial bank.

3.12
lender
organization that lends to *developers* (3.4), *infrastructure owners* (3.5) and *operators* (3.6) of *smart community infrastructure* (3.13)

Note 1 to entry: The roles in 3.4, 3.5, 3.6, 3.10, 3.11 and 3.12 can sometimes be performed by a single organization.

EXAMPLE Development bank, commercial bank.

3.13
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

3.14
people in smart communities
users or potential users of *smart community infrastructures* (3.13), who should be considered as important stakeholders

4 Understanding of smart community infrastructure layers

4.1 Smart community infrastructure system layer

This is the layer of whole integrated smart community infrastructures, a system of systems, installed (or planned to be installed) in a specific smart community.

4.2 Smart community infrastructure layer

This is the layer of an individual smart community infrastructure. Some examples for the targets of this layer are energy, water, transportation, waste management and ICT infrastructures.

NOTE Smart community infrastructure can be structured using layered functional blocks.

4.3 Smart community sub-infrastructure layer

This is the layer of the layered functional blocks of an individual smart community infrastructure. Some examples in a transportation infrastructure for the targets of this layer are railway, light-rail transit (LRT), public bus, rental bicycles, city roads, bridges and tunnels.

5 Benefits of applying this document

5.1 General

This clause specifies the main benefits that each stakeholder will have through applying this document (see Figure 3).

5.2 General benefits

Application of this document will help stakeholders to:

a) estimate the cost of operation and maintenance in the project planning and budgeting in the initial phase;

b) identify issues and activities through the whole life cycle and take these into account as much as possible in planning and budgeting activities;

c) facilitate the allocation and understanding of responsibility related to the issues and activities among stakeholders;

d) achieve efficient allocation and optimization of energy and material resources, human resources and capital;

e) reduce CO_2 emission and environmental loads, as a result of efficient allocation and optimization of energy and material resources;

f) facilitate coordination and cooperation between stakeholders.

5.3 Benefits for community authorities

Application of this document will help stakeholders to:

a) identify opportunities for synergies and identify risks associated with interactions between multiple smart community infrastructures;

b) ensure safety and security of the community, facilitate developing regulations, which are related to infrastructure and community activities, by utilizing risk information.

5.4 Benefits for investors or lenders

Application of this document will help stakeholders to:

a) decide to invest/loan based on identification of risks at an earlier point;

b) monitor project status to watch for investment/loan control.

5.5 Benefits for developers, infrastructure owners and operators

Application of this document will help stakeholders to:

a) achieve high efficiency and quality for the entire smart community infrastructure;

b) facilitate effective procurement management and efficient project management by preventing rework due to inconsistency or mismatches among components;

c) facilitate accountability for conformity with objectives and needs for infrastructure development;

d) achieve efficient operation and maintenance of smart community infrastructures;

e) facilitate effective risk management by utilizing insurances.

5.6 Benefits for service providers

Application of this document will help stakeholders to:

a) clarify system requirements for the service providers;

b) provide a means for efficient project management as well as accomplishing accountability for how much the system contributes to meeting the objectives and needs of smart community infrastructure development.

5.7 Benefits for people in smart communities

Application of this document will help stakeholders to:

a) facilitate active engagement as an important stakeholder in planning and operating processes through, for example, data sharing and user data acquisition;

b) achieve cost-effective smart community infrastructure financially acceptable for the users;

c) enhance quality of life due to more effective and reliable infrastructure performance as a whole;

d) avoid disruptions to citizens' lives when constructing a smart community infrastructure, which can be achieved by optimized construction plans in which interactions between the construction and citizens are considered.

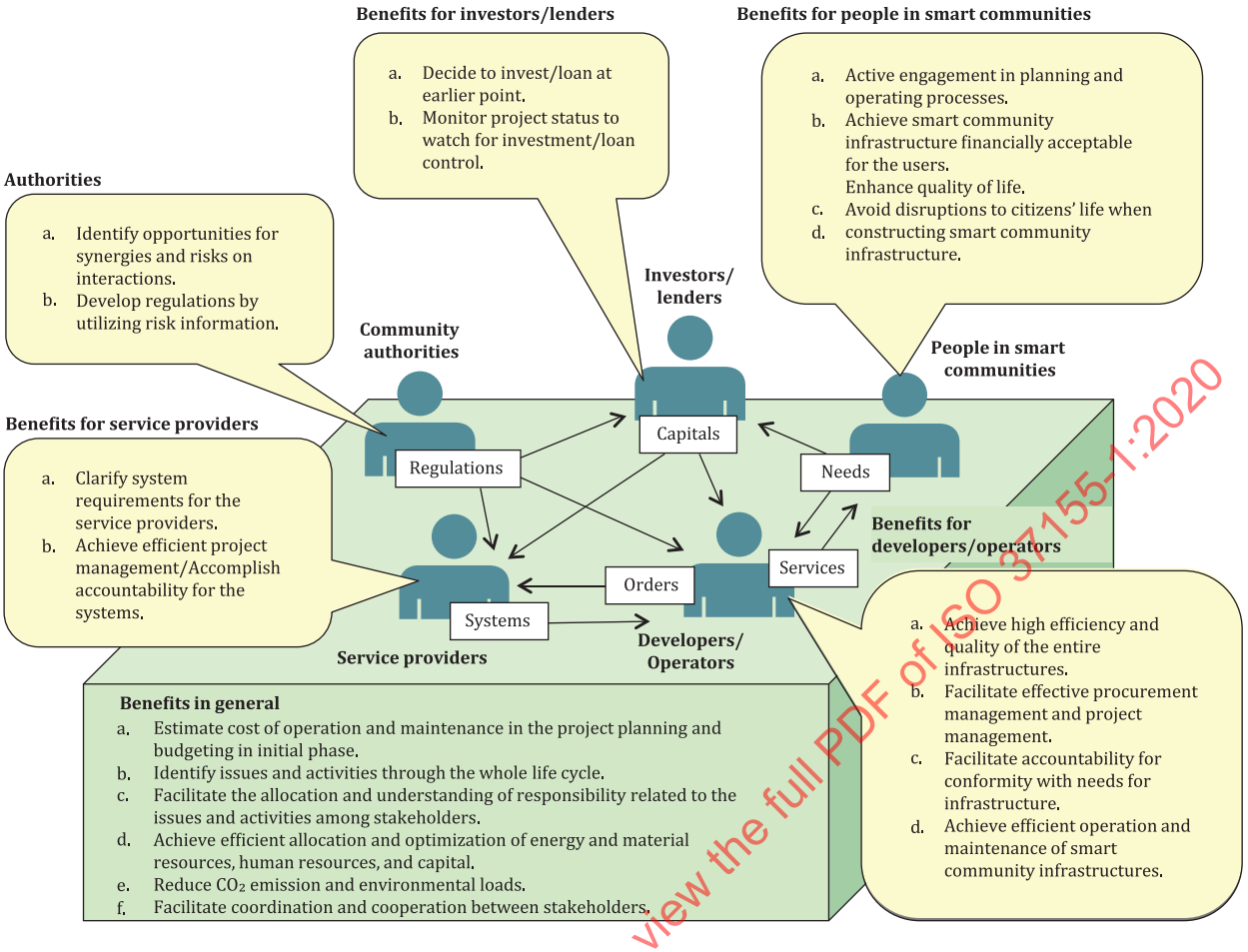


Figure 3 — Benefits of applying this document

6 Life cycle phases of smart community infrastructure

6.1 General

This clause specifies life cycle phases of smart community infrastructure and provides examples of the activities that may be conducted in each phase. The purpose of this clause is to describe each activity, not to define or rule the activities that should be conducted in each phase.

6.2 Initiation (phase 1)

6.2.1 Smart community concept (phase 1-1)

This phase is mainly for developing the smart community concept (see Figure 4 and Figure 5).

In this phase:

a) developers clarify the development background;

b) consultants defining the concept clarify the current state and the needs of the target community (or area) through investigation;

c) developers decide the scope of the project (e.g. needs to be satisfied) and develop the basic concept of the smart community as a whole;

d) developers or consultants advise different stakeholders on potential concepts or conceptual solutions and their impact.

NOTE Citizens can be involved in the development at this phase.

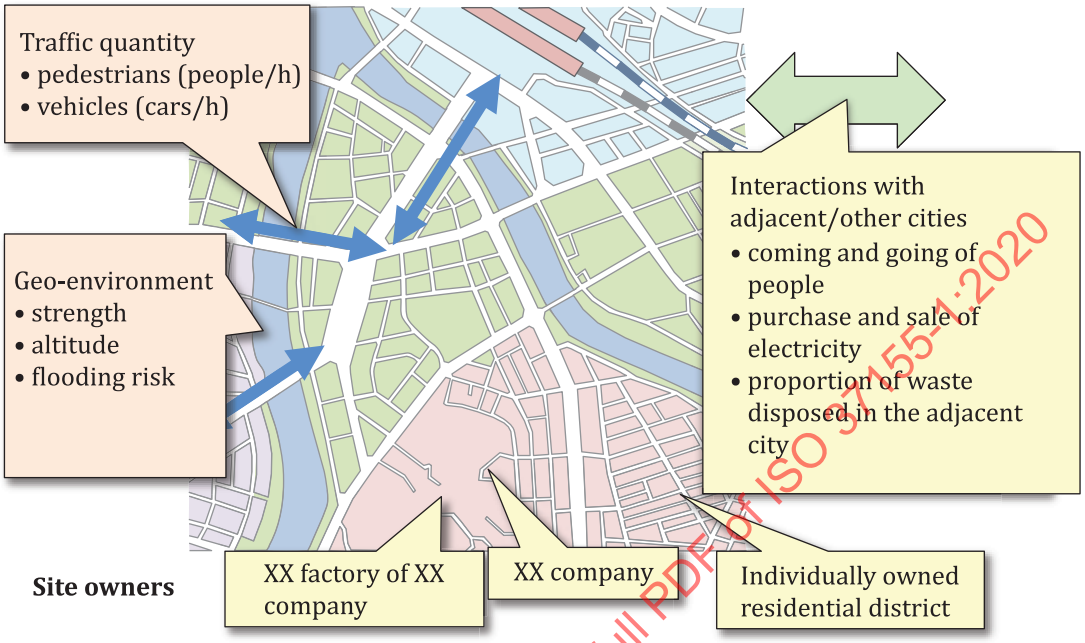


Figure 4 — Clarifying the current state of the target area

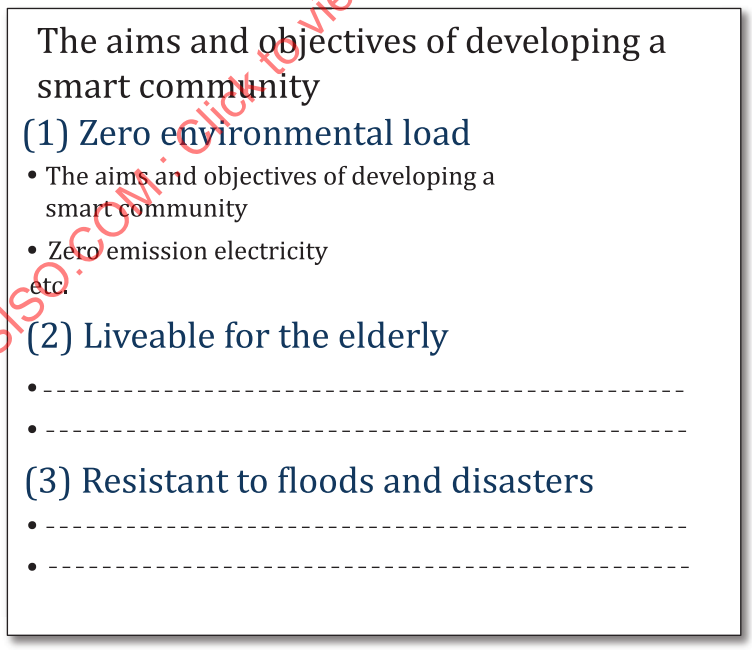


Figure 5 — Example of a smart community concept

6.3 Design of target infrastructures (phase 2)

6.3.1 Basic concept (phase 2-1)

This phase is mainly for developing, in accordance with the smart community concept, the basic concept of a smart community infrastructure (see Figure 6).

In this phase:

a) developers or consultants defining the basic concepts clarify the goals of the infrastructures as a whole and the approaches to achieving them;

b) the consultants develop a list of possible critical risks from the basic concept;

c) the developers or consultants are expected to find synergies between different infrastructure needs and goals and suggest concepts, platforms and solutions that are common or reusable for more than one infrastructure.

NOTE 1 The infrastructure systems are not necessarily decided at this phase.

At some stage in the process, the consultants will need to be selected. The selection criteria should focus on the consultants' qualifications to undertake the project and not the price for their services. Consultants with a proven history on such projects are critical. Quality-based selection methods should be used.

NOTE 2 Citizens can be involved in the development at this phase.

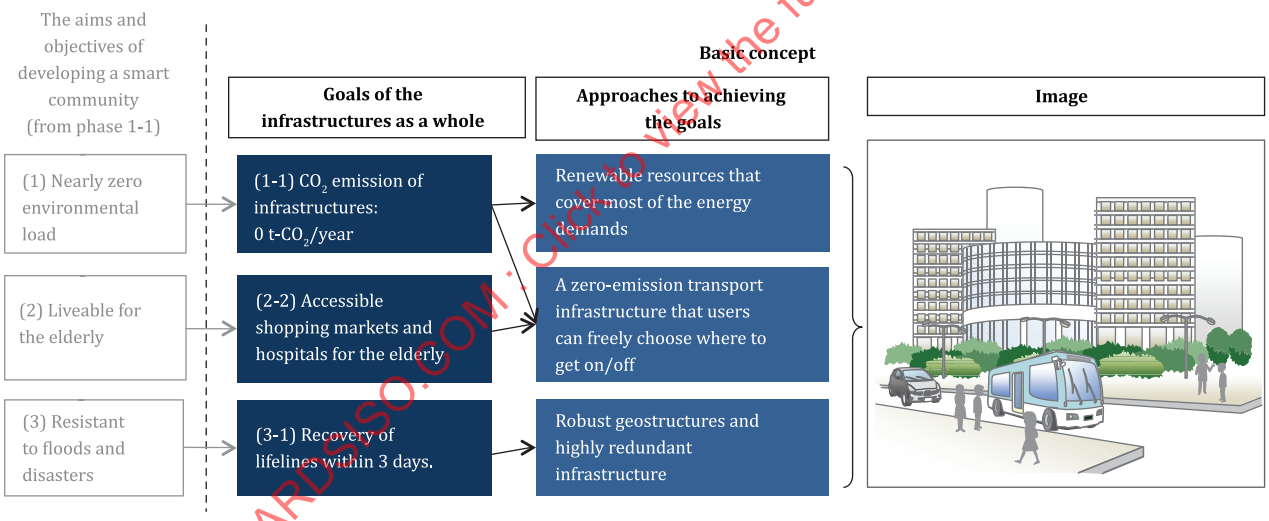


Figure 6 — Example of a basic concept

6.3.2 Basic plan (phase 2-2)

This phase is mainly for developing, in accordance with its basic concept, a basic plan for a smart community infrastructure (see Figure 7).

In this phase:

a) developers and consultants defining the basic plan are expected to find solutions that offer a horizontal approach, i.e. are common or reusable for different infrastructures or enable data exchange or umbrella monitoring and control of different infrastructures;

b) the developers or consultants clarify infrastructure combinations to achieve the basic concept;

c) the developers or consultants clarify fundamental specifications of functions for each infrastructure system;

d) the developers select the infrastructure owner or operator of each infrastructure system (e.g. a private company operates by the PPP scheme);

e) the consultants identify interfaces with external/existent infrastructures and conduct risk assessment related to the interfaces.

NOTE Citizens can be involved in the development at this phase.

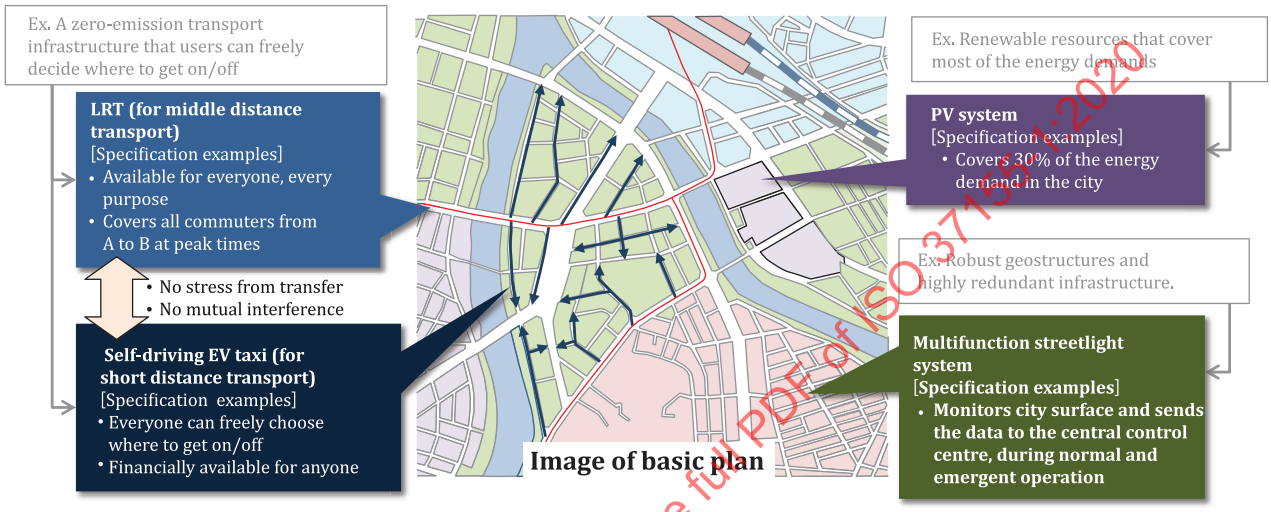


Figure 7 — Example of a basic plan

6.3.3 Fundamental design (phase 2-3)

This phase is mainly for developing, in accordance with its basic plan, a fundamental design for a smart community infrastructure (see Figure 8).

In this phase, consultants developing fundamental design:

a) clarify external (quantified) specifications of each infrastructure system (the system composition is not necessarily clarified);

b) clarify important specifications such as the fee standard and CO_2 emission level of each infrastructure system, or whether it is self-driven or not;

c) present necessary operation and maintenance activities after the building or installation phases so that the planning can include the whole project life cycle cost, or total cost of ownership (TCO);

d) conduct risk assessment according to the fundamental design.

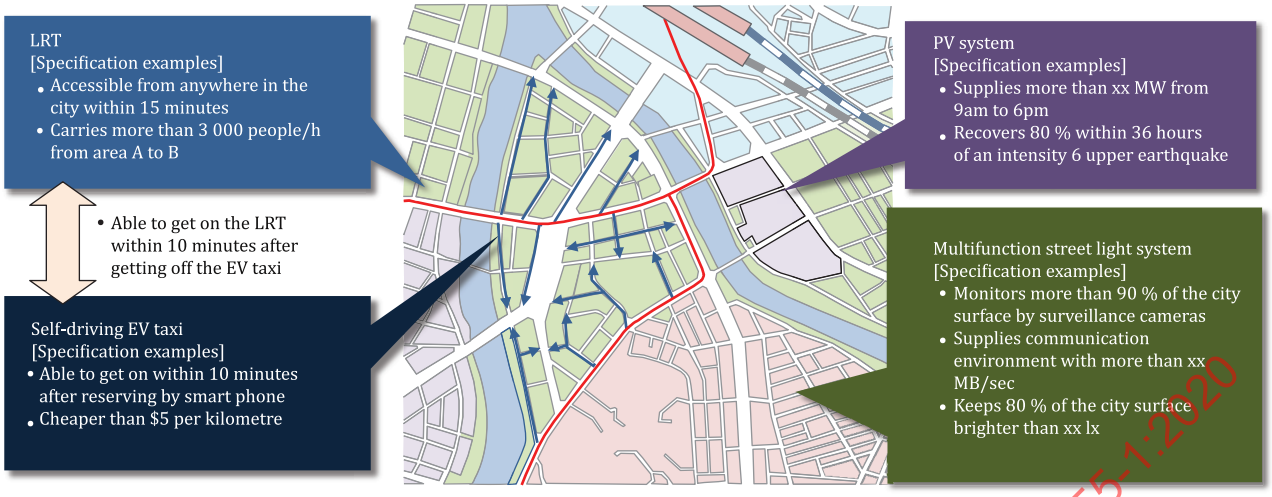


Figure 8 — Example of a fundamental design

6.3.4 Tendering (phase 2-4)

This phase is mainly about deciding the winning bidder.

In this phase, developers conduct bidding, select the winning bidder and complete the order.

NOTE In this phase, developers with support from consultants can select the most appropriate bidding procedure.

This phase is about framing the contract for the delivery of the project. Consideration should be given to the most appropriate procurement model for the specific project, i.e. a selection process for choosing bidders which focus on their qualifications, experience and ability to successfully achieve the project goals, rather than just price.

6.3.5 Implementation design (phase 2-5)

This phase is mainly for developing, in accordance with its fundamental design, an implementation design for a smart community infrastructure (see Figure 9).

In this phase:

a) winning bidders (operators or service providers) clarify implementation designs;

b) consultants developing implementation design conduct risk assessment according to the implementation design.

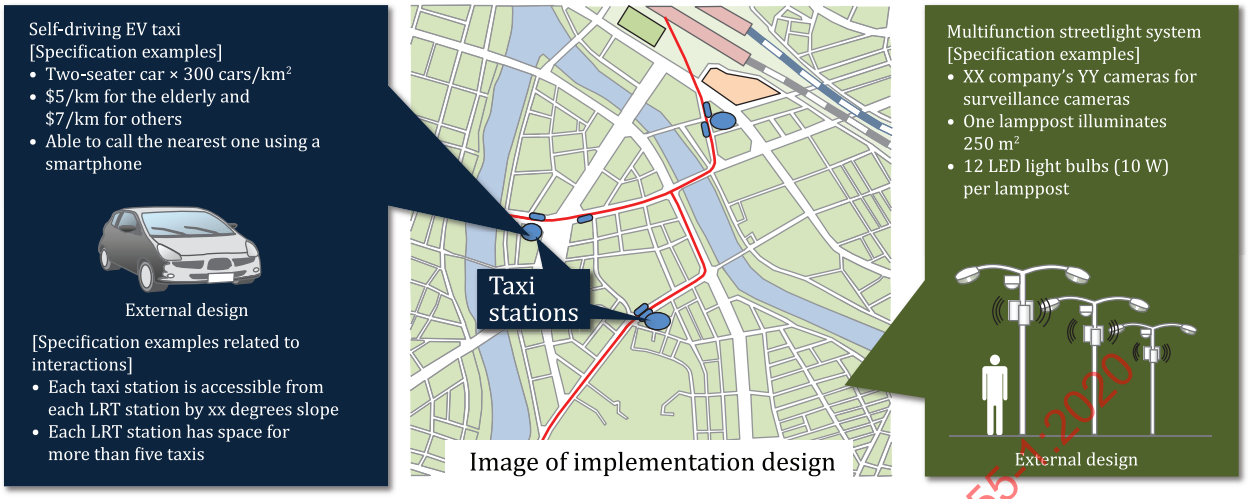


Figure 9 — Example of implementation design

6.4 Construction and assessment (phase 3)

6.4.1 Manufacturing, construction and installation (phase 3-1)

This phase is for manufacturing, construction and installation of a smart community infrastructure in accordance with its implementation design.

In this phase, service providers manufacture smart community infrastructure components and construct and install smart community infrastructure in accordance with the designs.

6.4.2 Individual and combination tests and validation (phase 3-2)

This phase is for individual and combination tests and validation of smart community infrastructure. The target of individual tests is a specific component, a subsystem or a system of a smart community infrastructure. Through individual tests, it is determined whether the component, subsystem or system meets specified requirements. The target of combination tests is the combination of multiple components, subsystems, systems or smart community infrastructures. Through combination tests, it is determined whether these combinations meet specified requirements (see Figure 10).

In this phase:

a) service providers and/or third parties conduct individual tests of infrastructure components and systems, and combination tests of infrastructure systems;

b) developers, infrastructure owners and operators accept or reject, based on the test results, the components, subsystem, systems or smart community infrastructures.

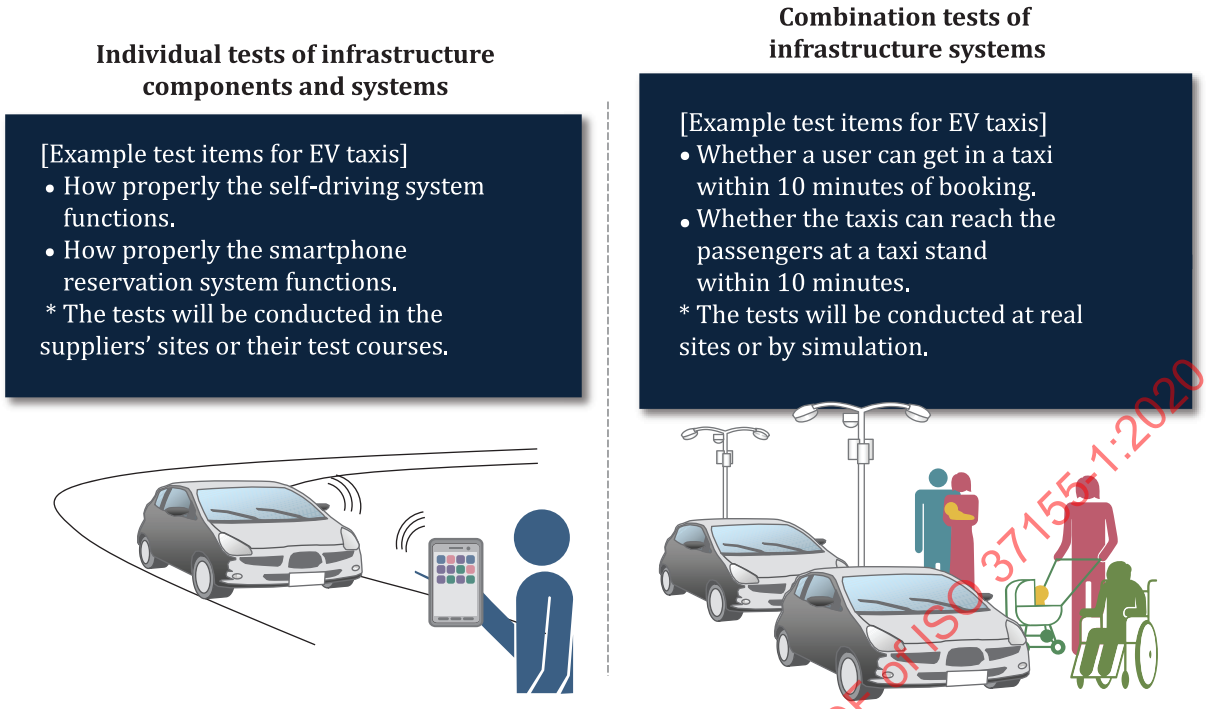


Figure 10 — Example of individual and combination tests and validation

6.4.3 Overall assessment of smart community infrastructures as a whole (phase 3-3)

This phase is for overall assessment of smart community infrastructures as a whole. The purpose of the assessment is to determine whether the design and construction of the smart community infrastructures as a whole has met the goals set as part of the basic concept of smart community infrastructure in phase 2-1 (see Figure 11).

The assessment will be conducted under the direction of the developer, infrastructure owner or operator.

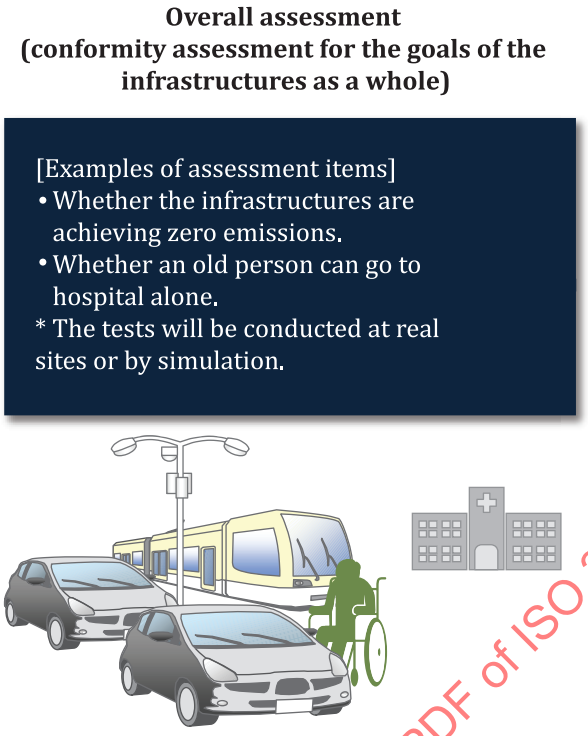


Figure 11 — Example of overall assessment of smart community infrastructure as a whole

6.5 Operation and maintenance (phase 4)

This phase is mainly for the operation and maintenance of a smart community infrastructure.

In this phase, the operator of each infrastructure system:

a) conducts the operation and maintenance according to the plans, which includes, when possible, information gathered from the smart community infrastructure in order to introduce preventive and/or predictive maintenance to lower the cost and increase safety;

b) addresses any new risks that arise (or that are identified) in the operation.

6.6 Redevelopment and rehabilitation (phase 5)

This phase is mainly for developing and implementing a plan for redevelopment or rehabilitation of smart community infrastructure.

In this phase, developers:

a) develop plans, which includes, when possible, information/data gathered from smart infrastructure in order to introduce controlled lifetime extension to reduce cost and increase safety for redevelopment or rehabilitation of smart community infrastructure;

b) conduct redevelopment or rehabilitation of smart community infrastructure in accordance with the plans.

NOTE Adaptation, modification and conversion of smart city infrastructures are included in redevelopment.

6.7 Decommissioning (phase 6)

This phase is mainly for developing and implementing a plan for the decommissioning of a smart community infrastructure.

In this phase, developers:

a) use and analyse data collected from smart infrastructure in order to perform decommissioning in the safest and most cost-efficient way;

b) develop plans for decommissioning of smart community infrastructure;

c) conduct decommissioning of smart community infrastructure in accordance with the plans.

NOTE Citizen involvement (open government) would be effective.

7 Interactions of smart community infrastructure

7.1 General

This clause specifies possible interactions of smart community infrastructure.

7.2 Interactions between infrastructures

a) Exchanges of information/data, energies, substances or signals between target infrastructures, or between target infrastructures and existing infrastructures.

b) Undesirable influence of activities in one infrastructure on other infrastructures.

7.3 Interactions between infrastructures and stakeholders

a) Exchanges of information between the related stakeholders of the infrastructures.

b) Considering impact/influence of changing of human behaviour.

7.4 Interactions with external environment

a) Interactions between target infrastructures and activities of the target community.

b) Interactions between target infrastructures and its surrounding space and/or the surrounding areas of the target community.

c) Long-term economic, demographic, technical and environmental changes in the target community are some of the most important factors that should be considered.

8 General process for managing interactions and related opportunities and challenges

8.1 General

This clause specifies the general process for managing interactions and related opportunities and challenges in order to achieve effective and efficient development, operation and maintenance of smart community infrastructures to ensure interactions between these infrastructures.

8.2 Process overview

The process for managing interactions and related opportunities and challenges should be based on a "V process" as presented in Figure 12.

NOTE In real-life implementation, there might be some overlapping of V processes.

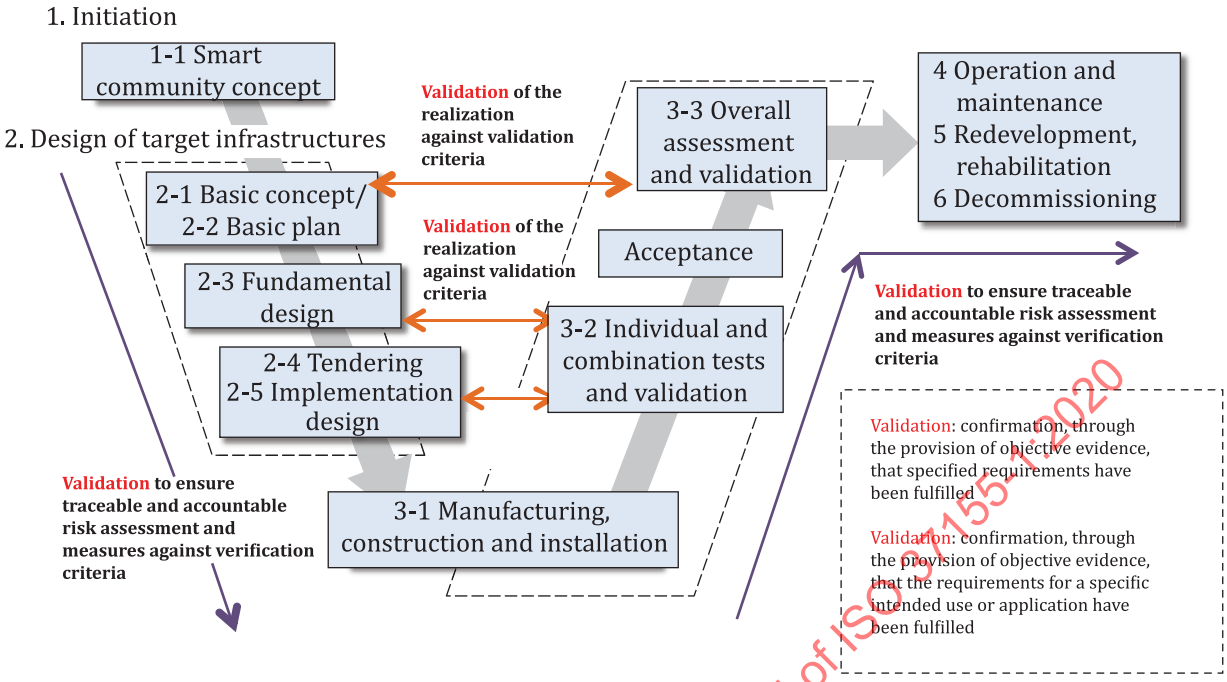


Figure 12 — "V process" for this document

8.3 Action items in "design of target infrastructures" phase (item 2 in Figure 12)

8.3.1 Identification of interactions

Interactions are first identified at the basic concept phase, when integrating the infrastructures in question into existing urban planning mechanisms.

8.3.2 Addressing interactions

Detailed interactions and their opportunities and challenges are identified at the basic plan and the fundamental design phase.

Measures to exploit the opportunities and countermeasures for the challenges are also considered in these phases.

8.3.3 Clarification of the responsibility for the opportunities and challenges

Responsibility regarding interactions and their opportunities and challenges is clarified among the stakeholders of the infrastructures.

8.3.4 Action items in "construction and assessment" phase (item 3 in Figure 12)

8.4 Validation of measures and countermeasures

The implementation of the measures to exploit the opportunities and countermeasures for the challenges will be validated through conformity assessment and site tests.

9 Guidelines for managing interactions

9.1 General

This clause details recommendations to be undertaken throughout each life cycle phase to realize validation and verification in extracting and managing interactions of smart community infrastructure. The scope and application of the recommendations should be assessed and adapted to meet the particular recommendations of the target infrastructure.

Operators, infrastructure owners and service providers should be involved in all activities at each phase.

Case studies, which apply the following recommendations at green field site, are conducted.

9.2 Smart community concept (phase 1-1)

9.2.1 Recommendations for verification and validation

9.2.1.1 When clarifying the current state and needs:

a) external factors (society, economy and regulatory environment) that will affect the smart community should be investigated and clarified;

b) the investigation process and reference data should be clarified and traceable.

9.2.1.2 When developing the basic concepts of smart community as a whole:

a) the connection between external factors (investigation results) and the basic concepts of smart community as a whole should be clarified;

b) the methodology required to continuously understand the state of external factors should be clarified.

9.2.2 Responsibility

Developers that are responsible for the development of the target infrastructure could be responsible for the undertaking of the recommendations in 9.2.1.

9.3 Basic concept (phase 2-1)

9.3.1 Recommendations for verification

9.3.1.1 When developing the basic concept of smart community infrastructures:

a) objectives of the infrastructure as a whole should be clarified.

9.3.1.2 When addressing the risks that can be identified from the basic concept:

a) interactions should be extracted from the external factors;

b) based on the interactions, sufficient scenarios associated with risks should be identified;

c) risks should be sufficiently identified from the scenarios.

9.3.2 Recommendations for validation

When developing the basic concept of smart community infrastructures, addressing the risks that can be identified from the basic concept:

a) achievement criteria for the goals of infrastructures as a whole and their evaluation methods should be clarified;

b) management policies and processes in case of shortfall of the goals should be clarified.

9.3.3 Responsibility

Developers that are responsible for the development of the target infrastructure may be responsible for the undertaking of the recommendations in 9.3.1 and 9.3.2.

9.4 Basic plan (phase 2-2)

9.4.1 Recommendations for verification

9.4.1.1 When developing the basic plan:

a) based on infrastructure basic concepts, functional specifications of infrastructure systems should be clarified;

b) the integration plan between the target and existing infrastructures should be clarified.

9.4.1.2 When addressing the risks that can be identified from the basic plan:

a) interactions described in Clause 7 that can be extracted from the basic plan should be identified;

b) based on the interactions, scenarios that can cause risks should be clarified;

c) from the scenarios, the risks should be identified and assessed;

d) functional specifications for mitigating each risk should be allocated to infrastructure systems.

9.4.2 Recommendations for validation

When developing the basic plan, addressing the risks that can be identified from the basic plan:

a) achievement criteria of functional specifications for each infrastructure system and the methodologies to evaluate the achievement should be clarified;

b) management policies and processes in case of specification shortfall should be clarified.

9.4.3 Responsibility

Developers that are responsible for the development of the target infrastructure may be responsible for the undertaking of the recommendations shown in 9.4.1 and 9.4.2.

9.5 Fundamental design (phase 2-3)

9.5.1 Recommendations for verification

9.5.1.1 When developing the fundamental design

a) external specifications should be set in accordance with the risk assessment conducted in the basic plan;