D5.7 Standardisation Roadmap for NbS

Work Package	WP 5 - CLEVER Solutions – From Innovation to Market
Dissemination Level	Public
Lead Partner	TECNALIA
Due Date	2023 May
Submission Date	2023 July

Deliverable No.	D5.7 Standardisation Roadmap for NbS
Work Package	WP 5 - CLEVER Solutions – From Innovation to Market
Dissemination Level	Public
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Date	2023 July 31st
File Name	D5_7 Standardisation roadmap
Status	Final
Revision	1
Reviewed by (if applicable)	Aguirre Such, Adriana; Cantergiani; Carolina; TECNALIA Heyder, Monika; Roca Vallejo; Roger; ICLEI

This document has been prepared in the framework of the European project Clever Cities. This project has received funding from the European Union's Horizon 2020 innovation action programme under grant agreement no. 776604.

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Acronym tables

Acronym	Explanation
GBI	Blue Green Infrastructure
CCA	Climate Change Adaptation
CWA	CEN Workshop Agreement
DRR	Disaster Risk Reduction
EN	European Standards
EU	European Union
IEC	International Electrotechnical Commission
IUCN	International Union for Conservation of Nature
NbS	Nature based Solutions
NWPI	New Working Proposal Item
RESIN	Climate Resilient Cities and Infrastructures
SDOs	Standard Developing Bodies
SF-SSCC	Sector Forum on Smart and Sustainable Cities and Communities
SMR	Smart Mature Resilience
SUDs	Sustainable Urban Drainage Systems
TC	Technical committee
TG	Task Group

Acronym	Explanation
TR	Technical Reports
TS	Technical Spacifications
UNEP	United Nations Environment Assembly (UNEP/EA
UN SDGs	United Nations Sustainable Development Goals
WG	Working Group

NbS standardisation bodies and their acronym

EUROPEAN		
	AFNOR	Association française de normalisation
	ASI	Austrian Standards International – Standardisation and Innovation
	BSI	British Standards Institution
	DIN	Deutsches Institut für Normung
	CEN	European Committee for Standardisation
	CENELEC	European Electrotechnical Committee for Standardisation
	ETSI	European Telecommunications Standards Institute
	NEN	Royal Netherlands Standardisation Institute
	UNE	Asociación Española de Normalización
	UNI	Ente Italiano di Normazione
	VDI	The Association of German Engineers

INTERNATIONAL		
	ANSI	American National Standards Institute
	ASTM	American Society for Testing and Materials
	IEEE SA	Institute of Electrical and Electronics Engineers Standards Association
	JIS	Japanese Industrial Standards
	JSA	Japanese Standards Association Group
	SABS	South African Bureau of Standards
	ISO	International Organization for Standardization
	ITU	Telecommunication Standariazation Sector

Executive summary

Nature-based Solutions (NbS) application in urban regeneration processes is increasing since these solutions are becoming crucial in the context of the climate change adaptation and mitigation agenda. Yet, due to the novelty of the approach, NbS application is in its early stages, and therefore, its related standarisation processes are starting to emerge and become key for NbS implementation. The NbS standardisation can ensure consistent and comparable implementation, monitoring, and evaluation across different projects and regions, enabling effective knowledge sharing, scaling up, and maximizing their benefits for biodiversity conservation and sustainable development. The main gaps regarding NbS standarisation are related to the lack of formal coordination around it. It is also related to the fact that the few already NbS developed standards do not account the climate change perspective. In the CLEVER Cities project (CLEVER), an analysis of the NbS standardisation process was developed, which main tasks were as follow:

1. Analysis of needs, demands, gaps, and barriers to define standardisable elements that respond to the collected needs. From the selected needs, only the standarisable ones were chosen and prioritized. The hybrid methodology also included reviewing the results obtained through a questionnaire distributed in the NetworkNature Semester.
2. Review of existing standards related to NbS and categorising them. The main goal of this part of the process was to review the existing standards, both formal and informal.
3. Proposition of a NbS standardisation Roadmap, based on cross-referencing the revised needs and demands mapping with the review of existing standards.

Key findings reveal the need for diverse standards related to different thematic spheres to better understand, and apply them from a holistic perspective (Terminology, Technical References, and Standards, protocols for assessing effectiveness, NbS monitoring and evaluation strategy, NbS planning processes, policy, and governance processes). Clear and consistent definitions are needed, through terminology harmonisation, to improve collaboration, policy development, and scientific research for NbS. Another important conclusion is related to the need for technical references and standards, improved planning processes, business and finance opportunities, monitoring and evaluation strategies, and assessment methodologies in the context of NbS.

The CLEVER Cities project has enabled the knowledge interaction among experts to create a unified approach based on mutual agreement. The standardisation efforts undertaken by CLEVER would not be meaningful without interaction with formal standard developing bodies (SDOs) to ensure the adoption of project outputs.

1. Introduction

The current climate crisis and its multiple and ever more common manifestations and consequences call for the urgent need for action at all levels. Urban settlements account for over 70% of the EU population and this figure is rising. Thus, in an increasingly urbanised world, there is a need to reconsider not only the forms of urban growth, but also the ways to regenerate existing city. In this context, the incorporation of Nature-based Solutions (NbS) in urban regeneration practices is essential to climate change mitigation and adaptation in urban areas.

However, the introduction of NbS is not yet a common or particularly mainstream practice. Moreover, as they are incorporated into policies and projects, there is a growing demand for clarity in their concepts and their form of application (IUCN, 2020).

The CLEVER Cities project (hereafter CLEVER) aims to promote NbS in urban areas. To achieve this, the project proposes creating a NbS Standardisation Roadmap that considers the most appropriate ways to develop, implement or influence standard setting for NbS and encourages active engagement in relevant standardisation processes. To develop this Roadmap, CLEVER Cities has conducted two main activities: (1) the analysis of the current needs & demands, barriers, and gaps around NbS, which main output is the NbS landscape, and (2) the mapping of existing and under-development standards in relation to NbS. The cross-analysis of these two main activities has allowed to identify gaps in the needs and available rules, guidelines or characteristics for activities or their results. This forms the basis for the NbS Standardisation Roadmap to support NbS uptake, replication and upscaling.

Establishing links with standard developing bodies (SDOs) and associated partners is crucial for successfully implementing or influencing standards and maximizing the deployment of the CLEVER Standardisation Roadmap. International and Euroepan standardisation processes require, when developing norms, the consensus of multiple stakeholders from different countries and cannot be achieved by an individual or a few individuals alone[1]. Therefore, CLEVER is actively working to establish relations with various working groups or technical committees on European level such as the CEN/CENELEC/ETSI Sector Forum Smart and CEN TC/465 Sustainable Cities and Communities. It is important to note that the standardisation priorities established by CEN TC/467 includes standardisation of NbS, and all efforts must be coordinated accordingly[2].

As mentioned aboved, this work is divided into three parts to achieve its objectives:

1. The first part involves identifying the **needs and demands related to NbS**, with the aim of defining standardisable elements that respond to these needs and prioritising them. It includes reviewing the results obtained through a questionnaire distributed in the NetworkNature Semester.
2. The second part focuses on **reviewing existing standards** related to NbS and categorising them.
3. The third part proposes a **Standardisation Roadmap** based on cross-referencing the revised needs and demands mapping with the review of existing standards.

[1] The development of CWA/IWA (CEN Workshop Agreement/ISO Workshop Agreement) typically involves consensus-building among a limited number of individuals. Nonetheless, CWA/IWA documents are recognised as preliminary standards

[2] At the time of writing, the work carried out under the CLEVER-Cities project serves as the foundation for Tecnalia's involvement in the working group established by UNI and UNI within the scope of TC465. The group's objective is to promote the standardisation of nature-based solutions (NbS). This work also constitutes Tecnalia's contribution as an expert in the NetworkNature NbS Standardisation Semester.

1.1. Standardisation definition and relevance

A standard is defined as an element or process that serves as a reference, as a pattern or model, to measure or assess, or to describe what is considered to be the "*best way of doing something*" (ISO, 2022) and standardisation refers to the process of developing and implementing a set of agreed-upon guidelines, principles, or specifications for products, services, or processes (see the official ISO/IEC definition in the box below). For instance, the process of creating a wardrobe can serve as an analogy for the application of standards across various domains, such as the manufacture of products (e.g., food safety standards), the management and optimization of processes (e.g., quality management standards), the delivery of services (e.g., health and safety standards), and the sourcing and distribution of materials (ISO, 2022).

Standard definition (ISO/IEC Guide 2:2004)

A document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines orcharacteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

NOTE1 In particular, the activity consists of the processes of formulating, issuing and implementing standards

NOTE 2 Important benefits of standardisation are improvement of the suitability of products, processes and services for their intended purposes, prevention of barriers to trade and facilitation of technological cooperation

The benefits of standardisation are numerous, and organisations such as the International Union for Conservation of Nature (IUCN, 2019) have outlined some of these advantages.

Standardisation brings together a range of different stakeholders to create a unified approach based on mutual agreement. Standards can be particularly useful when regulation is not yet in place, as it provides a clear set of guidelines to follow. This results in greater confidence, as standardisation establishes a clear and consistent framework for developing and assessing the quality of products, services, or processes. Particularly emerging fields, such as NbS, where there may be a lack of established norms and procedures may profit.

Additionally, standardisation supports innovation by providing a clear framework for developing new products or services. It can help to identify areas for improvement and ensure that new innovations are compatible with existing systems (see Figure 1).

When it comes to NbS specifically, we think standardisation is particularly important. As noted by organisations such as IUCN, standardisation establishes a necessary connection between societal needs, research and the market (see Figure 1 Standardisation). This is because it provides a clear framework for assessing the quality of NbS, making it easier for businesses to understand what they are buying and how it can be used. Standardisation can also support the uptake of NbS by providing a clear framework for assessing their effectiveness and promoting best practices. This is important because NbS have the potential to transform the way we address a range of environmental challenges, from climate change to biodiversity loss. Furthermore, standardisation can facilitate the integration of NbS into urban policy by ensuring their inclusion in strategic planning and decision-making processes. This helps to prioritize the

use of NbS in a manner that aligns with broader sustainability objectives and acknowledges their significance.

Another important attribute to standardisation is the consolidation of high-quality products, services, processes, and others. By establishing clear guidelines and principles, standardisation ensures that NbS are developed and implemented to a consistent standard, which is essential for their long-term success.

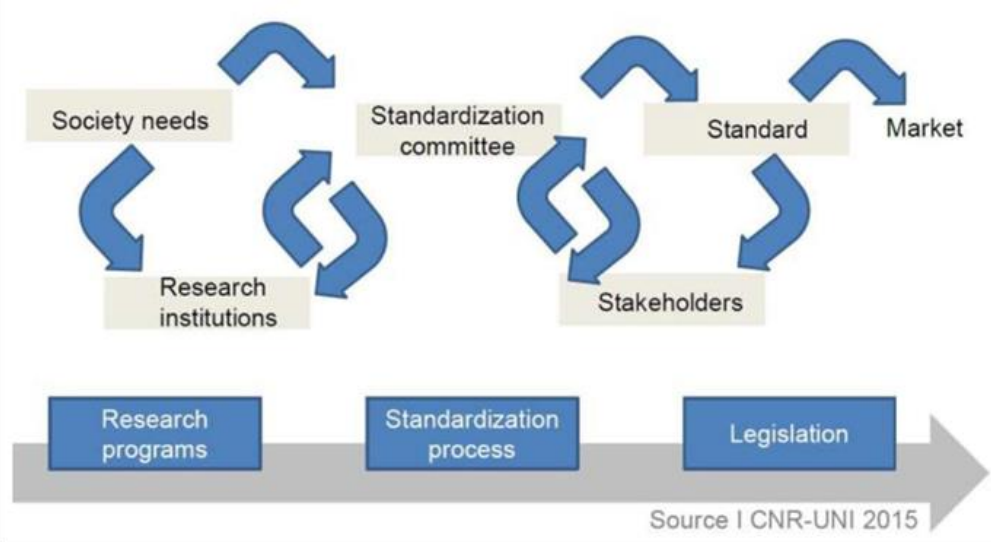


Figure 1 Standardisation process: from: society needs to market.
Source: ICNR-UNI 2015

1.2. What is the current stage of the standardisation process for NbS?

European standardisation in NbS is in its early stages, however special attention is being paid to it currently. Numerous events have been held focusing on standardisation in NbS such as CEN-CENELEC-ETSI Sector Forum on Smart Cities and Communities (SF-SCC, 31st of March 2021), CEN/TC 465 Smart Cities and Communities (16th December 2021), Standardisation for NbS NetworkNature Semester Theme activities e.g. session during Task Forces Cluster Meeting(17th January 2022) or Standards for Climate: uptake of nature-based solutions in urban and rural areas (23rd May 2022). As a result of this on-going discussion process a New Working Proposal Item (NWPI) has been established to address NbS vocabulary within the CEN/TC 465.

European and international bodies are supporting standardisation in NbS. At the European level, according to the EU Biodiversity Strategy for 2030 "*the Commission will develop in 2021 methods, criteria and standards to describe the essential features of biodiversity, its services, values, and sustainable use*" (EC, 2020:18). In this sense, it is important to note that SDOs (International, European, and National) are working on some standards related to NbS and, are launching specific working groups in NbS (see ***¡Error! No se encuentra el origen de la referencia.***). Usually NbS standardisation has been addressed by different working groups dedicated to different topics or they have been produced at a national level since different technological solutions may be subject to different expert working groups.

Additionally, different administrations at the international, European, and national levels have been actively involved in standardisation efforts. For instance, organisations like IUCN have developed the NbS Global

Standard, along with guidelines, handbooks, and other resources to support the planning, implementation, and utilization of NbS. These initiatives serve as a foundation for potential standardisation processes (referred to as Informal standardisation).

Likewise we may build on results provided by the public funded projects under Horizon 2020 in adjacent fields of research:

- RESIN - Climate Resilient Cities and Infrastructures (EU Grant agreement ID: 653522) and
- SMR- Smart Mature Resilience (EU Grant agreement ID: 653569).

The SMR project, in its Deliverable D6.1 *Existing standards and standardisation activities report*[3], gathered knowledge about relevant existing Smart City standards regarding potential missing standards (including aspects such as Resilience and Smart Cities or Critical Infrastructures, Social Dynamics, and Climate Change). This analysis will serve as the initial step towards reviewing and potentially revising the current standards in NbS.

The RESIN project in Deliverable 5.1/2.2*: Standardisation in urban climate*[4] developed standardised informal approaches to help cities develop their adaptation strategies and strengthen their resilience. First, a survey was carried out to identify the use and needs of standards for Climate Change Adaptation (CCA). Secondly, the RESIN project worked in three standardisation lines: Standardisation of vulnerability assessment (in a tool for impact and vulnerability analysis IVAVIA), Standardisation of the decision-making process (in a decision support tool, E-Guide), and Standardisation of adaptation measures. In the latter an inventory was made of available standards for adaptation measures, considering six categories: I 'Flood protection: dry- and wetproofing', II) 'Permanent flood measures'), III) 'SuDS/infiltration techniques', IV) 'Cool materials', V) 'Energy systems and cooling' and VI 'Green infrastructure'. On the other hand, identifying this last as the highest priority category, the project worked on the detection (interviewing key stakeholders) of needs in *Green roofs*, *Temporary flood barriers*, and *Swales*.

Recently, the NetworkNature project project addressed quality and standardisation, led by Dóra Almássy, as the NbS quality expert, and Efren Feliu, as standardisation expert. From April to September 2022 the third NetworkNature semester 'Nature-based solutions and Standards' aimed to understand how the quality of NbS is measured, reported, and monitored and to contribute to the knowledge of standardisation in NbS by raising awareness. The work developed in the third NetworkNature semester was in turn supported by CLEVER. The results obtained by the questionnaire and the workshop NetworkNature semester have fed into the work presented in this deliverable.

In conclusion, until now, standardisation has been promoted in areas closely related to the NbS, such as biodiversity or resilience and adaptation to climate change, which constitute an important input for the development of a roadmap on NbS. Nevertheless, notable advancements have been made in the realm of non-formal standardisation, specifically within the field of NbS, which warrant significant attention.

[3] Smart Mature Resilience D6.1 Existing standards and standarisation activities report
[4] RESIN D5.1 Standardisation in urban climate adaptation

2. NbS Landscape. Review of needs and demands

2.1. State of the art on needs, demands, barriers and gaps

Despite the growing interest in NbS, few analyses of NbS knowledge gaps, barriers, and potential opportunities have been found, probably as a result of the relatively early stage of the topic.

Among the academic literature, "*Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers, and opportunities for action*" (Kabisch et alt, 2016) stands out. The article, based on the results of an inter/transdisciplinary workshop (research, municipalities, policy, and society experts), highlights:

- *four main **knowledge gaps***
  - *the effectiveness of NbS*
  - *the relationship between NbS and society*
  - *design of NbS*
  - *implementation aspects*
- five main groups of **barriers**
  - *fear of the unknown*
  - *the disconnect between short-term actions and long-term goals*
  - *the discontinuity between short-term actions*
  - *long-term plans, sectoral silos, and the paradigm of growth* (Kabisch, et alt, 2016)
- two **opportunities** facilitating action for NbS
  - *valorising and exploiting the existing tacit and expert knowledge of policymakers, policy advisors, urban citizens, researchers, and urban planners*
  - *the establishment and utilization of collaborative governance approaches NbS in cities*"

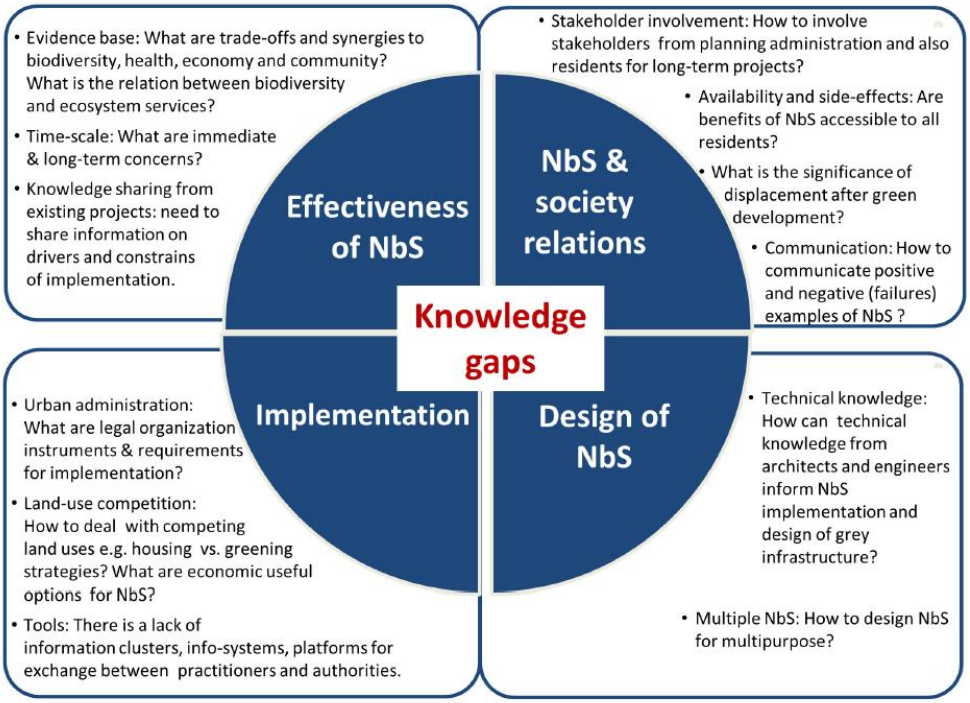


Figure 2. Knowledge gaps in relation to the four analysed dimensions addressing Nature-based Solutions (NbS) by: Kabisch et al (2016)

In conclusion, this work points to three **needs** related to NbS*: "(i) produce stronger evidence on nature-based solutions for climate change adaptation and mitigation and raise awareness by increasing implementation; (ii) adapt for governance challenges in implementing nature-based solutions by using reflexive approaches, which implies bringing together new networks of society, nature-based solution ambassadors, and practitioners; (iii) consider socio-environmental justice and social cohesion when implementing nature-based solutions by using integrated governance approaches that take into account an integrative and transdisciplinary participation of diverse actors"* (Kabisch et al., 2016).

In addition, the work carried out by NetworkNature for defining an *EU NbS Research & Innovation Road Map* must be highlighted. A draft of the first results about the detection of NbS knowledge gaps was presented in December 2021 and is available on the NetworkNature web (Nature-based solutions knowledge gaps). This work aims to help identify future research and innovation lines in NbS, as a result of the compilation of 171 knowledge gaps in a database, collected through a desk study and online consultation.

The result of the desk study enabled identifying mainly 11 knowledge gaps (see Table 1), with an emphasis on two main gaps: 1) *Cost analysis and performance of NbS: science-based assessments of benefits and cost at different* and 2) *Synergies and trade-offs between different goals and impacts of NbS to identify NbS that maximize synergies*. Three of the groups were noted through expert surveys*: Missing Knowledge/data, Implementation gap, and Capacity and awareness gap.*

Table 1. Network Nature Knowledge gaps - desk study results. Source: NetworkNature (2021) Presentation of the Draft EU NbS Research & Innovation Road Map

Knowledge gaps
Cost analysis, and performance of NbS: science-based assessments of benefits and cost at different scales (geo and time) (comparison with grey infrastructure)
Synergies and trade-offs between different goals and impacts of NbS to identify NbS that maximize synergies
More evidence on long-term effects of NbS (performance, profitability, Ecosystem Service delivery, management adaptation...)
Impact of climate change on the resilience of ecosystems to better plan future NbS in the long term
Synergies and trade-offs in combining NbS with grey infrastructure in designing hybrid solutions
Development of adequate indicators of the effectiveness of NbS: more standardised and tools for systemic evaluations
Engaging stakeholders in the co-design and assessment of NbS to enhance acceptability
Managing and optimizing NbS for biodiversity benefits and provision of ES (resilience and efficiency of systems, functionality, genetic diversity...)
Lack of sufficient technical references, design standards and guidelines + knowledge, and evidence base
Inclusive governance: how to involve local stakeholders and citizens
Equal access to benefits of NbS: how do different groups use or interact with NbS

Table 2. Network Nature Knowledge gaps – expert survey results. Source: NetworkNature (2021) Presentation of the Draft EU NbS Research & Innovation Road Map

	Knowledge gaps
Missing Knowledge/data	Context-specific synergies and trade-offs between ES
	Role of biodiversity
	Environmental justice and social cohesion
	Evidence of NbS benefits
	Lack of standardised methods for measuring NbS performance
	Financing & sustainability of NbS
	NbS in absence of suitable native species
	Specific topics (related to e.g. offshore windfarms or solid hydraulic functionality)
Implementation gap	Operational knowledge at local and landscape-scale
	Transposition of NbS in legislative frameworks, legislative support for bottom-up initiatives
	Lack of awareness of existing tools/Resources
Capacity and awareness gap	Appropriation of NbS at the national and local policy scale
	Awareness of NbS and acceptability by citizens

While needs are only detected through the first sutdy, albeit in a very general terms, both of them identify knowledge gaps related to 1) the effectiveness of NbS and assessment (considering synergies, benefits, impacts, and cost-effectiveness), 2) the design of NbS (technical references, design standards, and evicence-based guidelines) 3) Implementation aspects, 4) Relationship between NbS and society (inclusive governance, stakeholders engagement, awareness rising).

Table 3. Comparison between the knowledge gaps identified in NetworkNature (2021) and Kabisch et al (2016)

NetworkNature (2021)			Kabisch et alt (2016)
Missing Knowledge / data	Context-specific synergies and trade-offs between ES	• *Synergies and trade-offs between different goals and impacts of NbS to identify NbS that maximize synergies* • *Synergies and trade-off in combining NbS with grey infrastructure in designing hybrid solutions* • *Impact of climate change on the resilience of ecosystems to better plan future NbS in the long term*	***Effectiveness of NbS***
	Evidence of NbS benefits	• *Cost-effectiveness, and performance of NbS: science-based assessments of benefits and cost at different scales (geo and time) (comparison with grey infrastructure)*	
	Role of biodiversity	• *Managing and optimizing NbS for biodiversity benefits and provision of ES (resilience and efficiency of systems, functionality, genetic diversity...)*	
	Environmental justice and social cohesion	• *Equal access to benefits of NbS: how do different groups use or interact with NbS*	
	Lack of standardised methods for measuring NbS performance	n/a	
	Financing & sustainability of NbS	n/a	
	NbS in absence of suitable native species	n/a	n/a
	Specific topics (related to e.g. offshore windfarms or solid hydraulic functionality)	n/a	n/a
Implementation gap	Operational knowledge at local and landscape-scale	*More evidence on long-term effects of NbS (performance, profitability, Ecosystem Service (ES) delivery, management adaptation...*	***Implementation aspects***
	Transposition of NbS in legislative frameworks, legislative support for bottom-up initiatives	n/a	
	Lack of awareness of existing tools/Resources	*Lack of sufficient technical references, design standards and guidelines + knowledge, and evidence base*	***Design of NbS***
Capacity and awareness gap	Appropriation of NbS at national and local policy scale	n/a	***Relationship between NbS and society***
	Awareness of NbS and acceptability by citizens	*Engaging stakeholders in the co-design and assessment of NbS to enhance acceptability* *Inclusive governance: how to involve local stakeholders and citizens*	

Both studies contribute with compelling and valuable methodology and results. However, a more specific and updated analysis for mapping standardisable needs is required. While the article by Kabisch et al. (2016) provides an overview of the needs, barriers, and gaps of the NbS, more than five years have passed since its publication, and the definition of standardisable elements or processes requires more detail. Additionally, NetworkNature's work looks for knowledge gaps that are at a point prior to standardisation. Given that NetworkNature Knowledge gaps consider both the lack of knowledge or data and the lack of knowledge in implementation, it is proposed to cross-check them with the research results in future stages.

2.2. Methodology

The following body of work has two goals: to define standardisable elements or processes that respond to the main needs and demands in the NbS field, and to prioritise them.

For the first objective, the detection of current needs, demands, gaps, and barriers is proposed in order to define the possible elements or standardisable processes to respond to them. Among the few analyses carried out to date on this topic, three methodology types stand out: 1) those based on expert consultation (e.g. in Kabisch et al., 2016), 2) those based on literature analysis (publications, articles, or projects), and 3) hybrid methodologies –(both methodologies mixed) (e.g. NetworkNature, 2021).

In this case, a hybrid methodology is followed:

1. The development of a first desk-work analysis based on recent publications from the Publication Office of the Euopean Uniion and projects (see **¡Error! No se encuentra el origen de la referencia.** in 2.2.1 Desk analysis).
2. A subsequent review through a questionnaire in the context of the **NetworkNature Semester** is proposed (see 1.2.3. NetworkNature Questionnaire).

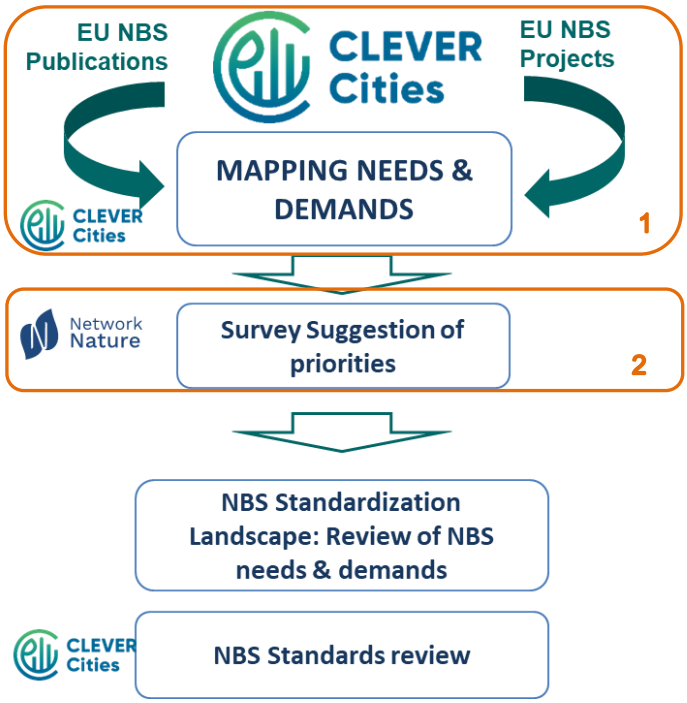


Figure 3. Methodological scheme

2.2.1. Desk analysis

To find the main needs, demands, barriers, and gaps of the NbS, a systematic methodology has been implemented. This consists of:

1) establishing an analysis framework to facilitate the definition of standardisable elements/ processes (see 1.1. Analysis matrix).

2) defining a set of documents representing the most recent advances and work on NbS.

3) executing a systematic search in the analysed texts for the main search terms: Needs, demands, barriers, and gaps.

4) classifying them according to the analysis matrix, evaluating their matches for consolidation purposes, and detecting and defining the possible standardisable elements/ or processes that respond to the detected and defined needs, as well as the barriers and gaps related to them.

5) Finally, distinguishing between those needs and demandsthat represent a prerequisite or require an advance in knowledge (more related to the "Knowledge Gaps" analysed by NetworkNature) before a possible standardisable element or process.

i) Needs & Demands Framework: analysis matrix

a) What could be standardised?

The first step for identifying standarisable needs is to establish what standard types can be developed. Depending on the standards' nature and aim, five main categories have been determined[5]

1. **Terminology,** focusing on the development of agreed definitions that make the NbS' concepts linked, accessible, and facilitate their adoption, communication, and use.

2. **Process of NbS:** co-design, co-creation, financing, innovation, management, monitoring, etc.

3. **NbS Performance & Impact assessment (including co-benefits) and related KPIs:** Standards that deal with NbS environmental, economic, and social performance, as well as quantifiable benefits & trade-offs. These can be related to effectiveness measurement, data gathering, performance monitoring, and assessment

4. **NbS architectur**e: construction and installation technical specifications of different NbS types.
5. **Technology for NbS monitoring and/or maintenance:** These can describe the use of their maintenance for assessment purposes.

b) CLEVER Framework

Within the CLEVER project framework, the CLEVER exchanges developed by ICLEI Europe, have been structured from large thematic groups. On the one hand, these groups have provided a structure to analyse the needs detected by the cities, and issues pointed out by the experts. On the other hand, they were reviewed to become the basis of the gathering structure of the Lessons Learned shown in

Table 4.

[5] Other categories may be established, but based on CLEVER Cities work these five categories have been prioritized.

Table 4. CLEVER Lessons Learned structure

Thematic group		Categories
	NbS TECHNICAL DESIGN & IMPLEMENTATION	NbS Technical set-up
		NbS Design
		NbS Performance & Monitoring
	NbS PLANNING	Planning tools, instruments, and methods
		Integrated Management System
		Expectation management
	POLICY & GOVERNANCE	Policymaking
		Collaborative governance approaches
		Citizen involvement in decision-making processes
	NbS FINANCING & ECONOMIC ACTIVITIES	Financing and funding strategies
		Public procurement and tendering
		Economic development strategy
	COMMUNICATION & AWARENESS-RAISING	Communication strategy
		Awareness-raising

c) Needs & Demands Framework

Crossing both frameworks, the one established by CLEVER and the one resulting from analysing the standardisable elements, we obtain the evaluation matrix to detect the standardisable needs and the possible barriers related to them.

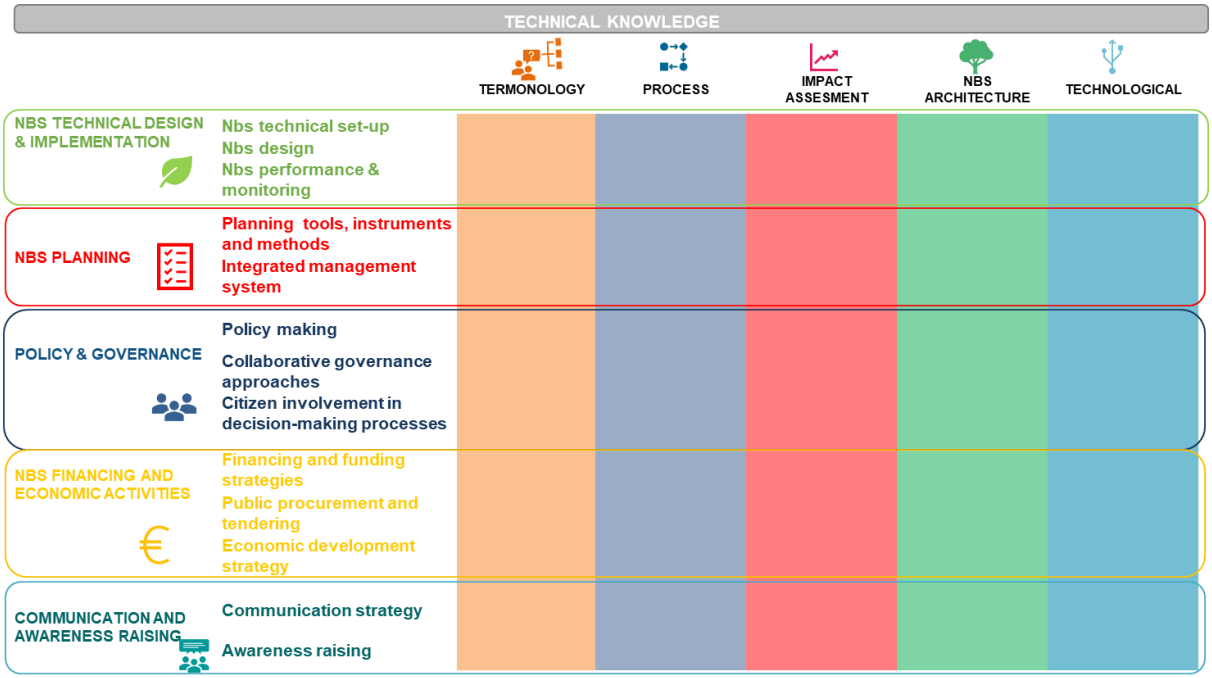


Figure 4. Analysis matrix

ii) Documents analysed

a) NbS Publications

Although the EU has been working on projects related to the introduction of nature in the city and its benefits since the 1980s, the identification of current unmet needs and demands leads us to evaluate only the most recent projects and publications. The last 5 years, from 2016 to the present, have been determined as the study time frame, including the entire period of the H2020 projects, and the relevant publications on NbS published by the EU (mainly in 2020). In addition, IUCN has developed publications on NbS specially related to standardisation. The list of publications can be seen in Annex I.

b) NbS Relevant Projects

Throughout the five-year evaluation period, seven EC calls related to the NbS have been launched, addressing a variety of topics and sectors:

- New governance, business, financing models, and economic, impact assessment tools for sustainable cities with Nature- bases Solutions (urban naturing) (SCC-03-2016)
- Operationalising Insurance Value of ecosystems (SC5-09-2016)
- Demonstrating innovative Nature-based Solutions in cities (SCC- 02-2016- 2017)
- Large-scale demonstrators on Nature-based Solutions for hydro-meteorological risk reduction (Sc5-08-2017).
- International cooperation on sustainable urbanisation: NbS for restoration and rehabilitation of urban ecosystems (Sc5-13-2018-2019)

- Visionary and integrated solutions to improve well-being and health in cities (SC5 14-2019)
- Inter-relations between climate change, biodiversity, and ecosystem services (LC-CLA- 06- 2019)

26 NbS projects (including CLEVER Cities, see Anex II) proposed in the seven calls mentioned above, as well as two *Multi-stakeholders dialogue platforms for NbS,* launched in this time period, have been analysed.The primary sources for the analysis have been the EU portal and the available deliverables of each project[6].

Throughout CLEVER, needs and barriers at have been defined. In addition, the needs and interests of CLEVER and the expertise available within the consortium have been worked on within the CLEVER Exchange Working Sheet "Needs and Expertise" Living Document. Besides that, within WP1, *Deliverable 1.1: Guiding Framework for CLEVER Cities Activities*, includes the analysis of "*Barriers and success factors for effectively co-creating nature-based solutions for urban regeneration"* and *Deliverable 1.2. Multi-level policy framework for sustainable urban development and nature-based solutions*, that includes gaps and opportunities in EU and international policies.

2.2.2. NetworkNature Survey

As mentioned in the introduction, a questionnaire was completed, within the third NetworkNature Semester framework, 'Nature-based Solutions and Standards'. The first part of the questionnaire, executed by Dora Almassy, was based on the desk review in order to *identify a list of potential features and characteristics of high-quality NbS*. This first part of the survey covered qualitative aspects such as methods for measuring, reporting, and monitoring NbS quality. The second part was based on the "Needs, Demands, Barriers, and Gaps mapping" of identified NbS in CLEVER (see 1.4. Standardisable NbS Needs & Demands) with two main goals:

1. Check, compare, and complete the result of the analysis derived from the bibliography.
2. Prioritise the standardisable elements/processes resulting from the process according to a) their necessity and b) their feasibility.

This part of the questionnaire consisted of six questions, grouped in three blocks:

- The first three questions were aimed at reviewing whether any standardisable needs were missing and whether identified standardisable elements/processes should be included in another thematic or standardisation category.
- The next two questions were focused on the prioritisation of the identified standardisable elements/processes.
- The last question established the link with the analysis of the quality of the NbS, developed in the first part of the questionnaire.

The survey was available online (in the NetworkNature platform) from the end of May to the end of June. 38 responses were obtained, the responders mainly work on European NbS projects. The results were presented at the ***NetworkNature workshop: The way towards high quality NbS and standards: What we learned so far*** held on 26th July 2022. The results are included in Chapter 1.5 Review and prioritising.

[6] In nine of them, which were scheduled to start in 2020, no available deliverables have been found.

2.3. Needs & demands vs gap & barriers

2.3.1. Knowledge requirements

In addition to specific needs related directly to standardisable elements, needs, demands, gaps, and barriers, others have been detected regarding **knowledge** and **prerequisites** necessary to respond to those more specific needs.

i) Generating better knowledge:

The main gap identified related to NbS knowledge is the lack of a deep understanding of NbS itself, and the complex processes of natural systems, concretely supported by advancing knowledge: (a) **on specific needs of a place**, (b) **on risks and threats, and how to deal with them**, and (c) about **what counts as nature**, what is valued and why this varies between individuals and communities, and how this can be considered in the development of future NbS (related to 3.5.1. Effectiveness cost/ benefits).

In addition to these, there is a need to improve knowledge (f) **on specialised technical issues**:

- General, such as on aquatic ecosystems and water resources, on natural ecosystems, or on the development of NbS in South America and Africa.
- Specific: how floods arise and enforce the spatial planning rules, how to assess services from brownfield and industrial areas, community gardens, or natural and semi-natural green and blue spaces, or how to analyse and consider the risk of NbS contributing to the introduction and spread of invasive alien species.

In this context, knowledge and research gaps are particularly identified in 1) the identification of the types of NbS available, 2) the development of specific guidance, 3) the development of methods to assess the impacts and benefits of NbS (related to 3.5.1. Effectiveness cost/ benefits), and 4) the lack of support for discussion and exchange events.

The main **barriers** are 1) lack of operational knowledge and experience with NbS, 2) lack of ready-to-use scientific results, concepts, and technologies (technical inadequacy), 3) lack of knowledge of performance, 4) lack of multidisciplinary/inclusive discussions of NbS, and 5) the advent of COVID-19, which has relegated the development of knowledge from other fields.

ii) Addressing prerequisites

Several **prerequisites** are identified**:**

a) **consideration of ecological scale**, the analysis points to 1) the need to broaden the vision of the scope in which NbS and Blue and Green Infrastructure (BGI) are planned and developed to consider functional areas that favour their resilience, coherence, connectivity and increase positive impacts on the conservation status of habitats and species, and 2) plan the connection of small and fragmented NbS to green corridors to maximise their impact on biodiversity and other environmental goods.

b) **establishment of clear objectives and conservation measures**, (1) that also consider protected areas and non-intervention areas (protected areas), both terrestrial and marine, (2) that are more spatially coherent across the national scale and corresponding monitoring systems with

measurable indicators, (3) that improve their definition in specific, measurable, comprehensive and realistic objectives for Natura 2000 sites that can be monitored and evaluated.

c) **greater investmentments in the development of knowledge** hubs, resource centres, and a digital knowledge platform is noted.

d) **specific issues,** such as (1) describing current and past land/sea use and cultural contexts to inform the NbS, and (2) studying the effect of the urban conditions on the selected plants and at the same time offers the possibility to understand the impact, are identified.

2.3.2. NbS Technical Design and Implementation

The main **needs** identified in the NbS technical design and implementation are: **expansion and consolidation of the knowledge and use of the NbS, improvement of the technical design,** and **improvement of monitoring and evaluation of NbS.**

i) Extension d and consolidation of the knowledge and use of the NbS

One of the key points made in many documents, which goes beyond this category, is the **need** to (a) **make the key concepts of the NbS accessible**. It is essential to facilitate their development and adoption, by ensuring that the concepts are clearly understood, communicated, and implemented (IUCN, 2016). This is related to the need to (b) **extend and expand technical knowledge and information** on new techniques and their benefits.

The lack of **NbS typologies** and **the lack of technical knowledge and/or qualified labour for design** are considered **gaps**. Both can be related to these needs and to those of improving the technical design, discussed below.

ii) Improvement of technical design

In the analysed documents and projects, including CLEVER, it is proposed to **improve the technical design** of the NbS, taking into account: (a) **principles of good design** of specific spaces (such as improved planning of urban green spaces) and technical solutions and support, (b) **aesthetic criteria** to improve their acceptance by citizens and their social and health benefits and (c) **safety, durable and resilient** to extreme events **criteria**.

Directly related to this need, the **main gaps** identified are the lack of (1) technical (cultural, formal, and informal) knowledge and/or qualified labour for installation and monitoring (due to the lack of practical experience to implement NbS); (2) sufficient technical references and design standards, and (3) guidelines for the change from old systems (grey infrastructure) to new NbS systems. In addition to these, there are specific gaps related to specific NbS, such as the lack of structural capacity of buildings to support the weight of green infrastructure.

Besides these gaps, numerous **barriers** are identified such as (1) over-regulation, (2) difficulty in prioritising between different stakeholder interests and ambitions, (3) the existence of negative experiences, (4) mistrust due to the novelty of the technique and lack of reference, (5) complexity in the construction phase and (6) technical barriers related to infrastructural challenges.

iii) Improvement of monitoring and evaluation of the NbS

One of the primary **needs** identified in the framework of NbS DESIGN & IMPLEMENTATION is to improve monitoring and evaluation of the NbS, including improvements to the impact assessment, choosing appropriate indicator selection and data, and making monitoring more accessible and applicable.

First of all, the analysis indicates the need to (a) **consider/include in the impact assessment** of the NbS and in the monitoring plan: 1) the coordination of systematic evaluation and frequent monitoring of the network of NbS at the EU level, reaching a protocol for monitoring and exchange of information on already implemented NbS projects, 2) traditional and scientific knowledge, focusing on the social need(s) that the NbS seek to address, and on the three dimensions of sustainability, 3) real-time and long-term monitoring (including the lifecycle of the NbS) and evidence on effects, 4) monitoring of other types of applied solutions, 5) maintenance of monitoring system sensors and 6) clear evaluation of NbS performance based on evidence measuring intangible values, looking for better indicators for sustainability and social outcomes. [related to (b) Choosing appropriate indicator selection and data].

Secondly, it stresses the need to (b) **choose appropriate indicators**, indicators selection, and data that, on the one hand, **ensures:** 1) comparability between cases, 2) harmonisation of assessment methodology, 3) the nature of the data, and 3) assessment of the links between "categories" (nature, people). That, on the other hand, enables to **assess**: 1) the social (property value, use, perception, health, etc.), economic and environmental impact, 2) the net effectiveness and multiple short- and long-term cost-benefits (environmental, socio-cultural, and economic) and risks (including possible negative consequences) of NbS for CCA and Disaster Risk Reduction (DRR), 3) synergies between health and climate, energy, food, bioeconomy, agriculture, biodiversity and ecosystem services, 4) benefits of NbS compared to grey solutions and synergies between different NbS and/or with grey infrastructure, 5) the relationship between overall or typical NbS provision, 4) the spatial and temporal scales, 6) the impacts of NbS in terms of transitions in rural and urban areas, 7) the contribution of NbS to carbon neutrality by 2050 (to the reduction of energy costs and carbon emissions) and to the success of climate action and risk reduction, and 8) the implications of the COVID-19 pandemic on some of the assessment methodologies.

Lastly, the analysis considers the need (c) to make **monitoring more accessible** and applicable, by reducing the price of monitoring resources through technological advances.

Directly related to the demand to improve monitoring and evaluation, the main shortcomings identified are 1) the lack of monitoring and sharing information about the already implemented NbS projects, 2) the lack of a clear assessment of NbS results or a commonly accepted and easy to apply monitoring framework, of robust results across approaches and 3) the existence of gaps in the evidence base and its presentation (not given in an understandable and "ready to apply" format for policymakers and the general public).

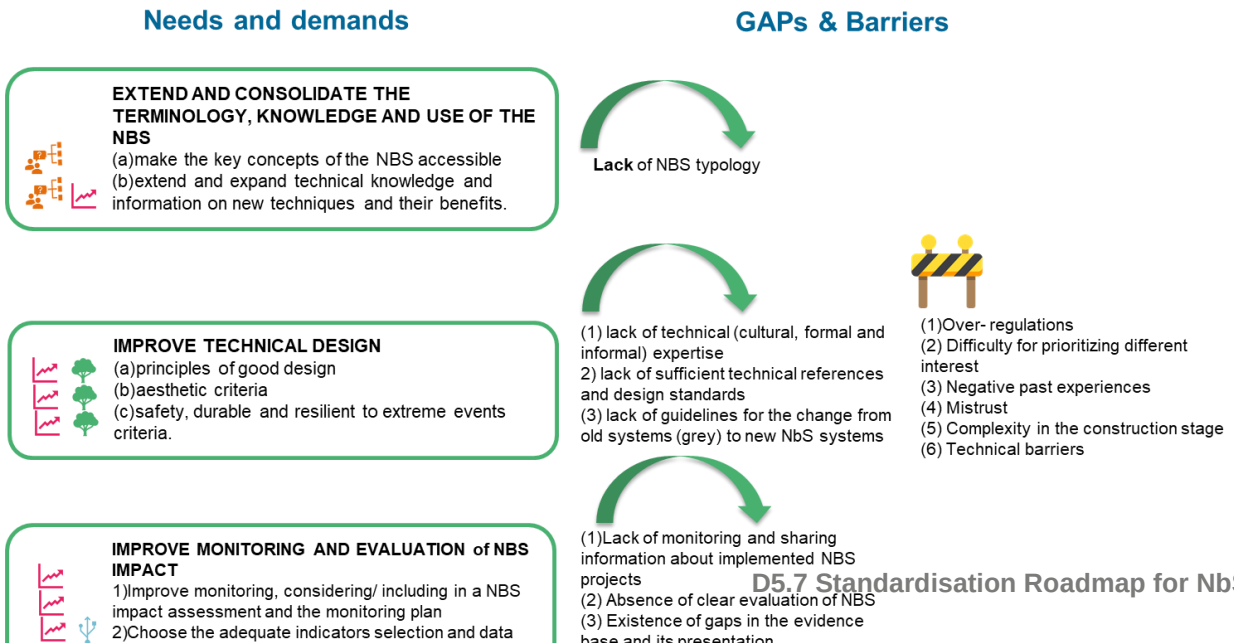


Figure 5. Needs and demands vers gaps and barriers in NbS Technical Design and Implementation group, related to the standardisation categories

2.3.3. NbS Planning

The needs detected regarding NbS Planning are (1) encouraging **upscaling or replication processes** and (2) **improving planning** by the incorporation of an integrated approach.

i. Encourage upscaling/replication processes

The analysis identifies the **demand** to transform knowledge practices and technologies to become applicable on a larger scale, and flexible enough to adapt to the specific needs of each case and the NbS market. These points need to develop a method to manage uncertainties related to the application, scaling up, and replication of NbSs, considering the definition: a) of the **scale for the design and implementation of NbS** to have the greatest possible impact on social needs and global challenges (problem-solving in the scale of the intervention), b) **of multi-scale NbS networks and schemes** (individual large-scale NbS and/or combination of multiple NbS in strategies), and c) **of a continuous scaling up to** (inter)national scale.

However, some **barriers** are found, which may make it difficult to respond to this need. These are 1) uncertainties related to the implementation, scaling up, and replication of NbS, problems in the scale of intervention, 2) lack of regulatory standards on technical solutions for NbS and their implementation, and 3) lack of maturity of some NbS market.

ii. Improving planning

Furthermore, there is a need to improve planning, especially considering two key issues: (a) the **integrated approach** and (b) the **adaptive vision**.

On the one hand, to respond to this improvement, there is a specific **need** to (a) **develop a more coordinated and integrated approach to planning and maintenance of the NbS**. In order to do this, it is proposed to: (1) establish a coordinated approach to the design and implementation of the NbS/BGI at EU and Member State level (using spatial data to map, select, assess and manage priority areas and ensure functional connectivity), (2) improve planning tools by integrating and considering NbS (dealing with how NbS contributes to the delivery or creation of overarching sustainability objectives and more developed understanding of the economic, social, political and cultural NbS dimensions), 3) build on ambitious selection programmes to increase the potential benefits on human health and well-being and consider mitigation capacity in terms of both air quality and urban heat island effect, 4) develop more effective long-term strategies, improving the connection between short-term actions and how they relate to long-term

plans and objectives, addressing the risks and their interaction (with multiple drivers and cascading tipping points related to sustaining and enhancing ecosystem services provision and ecosystem degradation).

Against these demands **some gaps** are revealed, such as 1) lack of NbS consideration in the planning and design phase of projects, 2) lack of response to challenges in using evidence and dealing with uncertainty, 3) lack of relationship between NbS and societal needs, 4) lack of careful planning and management of the work and lack of planning tools, 5) lack of the perspectives, interests, the expertise, and knowledge of various experts and citizen groups in a holistic planning approach (city objectives and policies, stakeholder views and expected benefits of the NbS have to be aligned with spatial plans, business models and funding mechanisms and delivery and maintenance mechanism) and 6) lack of integration and consideration of the NbS as part of the urban regeneration strategy.

Additionally, **barriers** are identified as: 1) reluctance to support novel/new approaches and to change traditional practices, 2) short-term pressures and disconnection/discontinuity between short-term actions and their relationship or accumulation with long-term plans and objectives (NbS are often long-term), and 3) problems in the operation, maintenance, and uptake of NbS and lack of consideration of future infrastructure maintenance needs.

Also, it is necessary to develop (b) **an adaptative efficient design organisation and programme management**: 1) based on monitoring and evaluation knowledge, and recognising uncertainty, 2) that optimises biodiversity benefits, and 3) that considers organisational resources for the delivery of multifunctional NbS.

Nonetheless, some **gaps** are observed in this line such as 1) the existence of organisational, logistical, and production problems (such as the lack of efficient organisation of programme design and management), 2)as well as the lack of prioritisation. On the other hand, it is pointed to the existence of barriers such as: 1) difficulty in allocating resources and in finding qualified suppliers, 2) difficulty in managing multiple risks and insecurity in the outcome of the project, 3) problems in identifying the legal ownership of the areas, and 4) lack of community support.

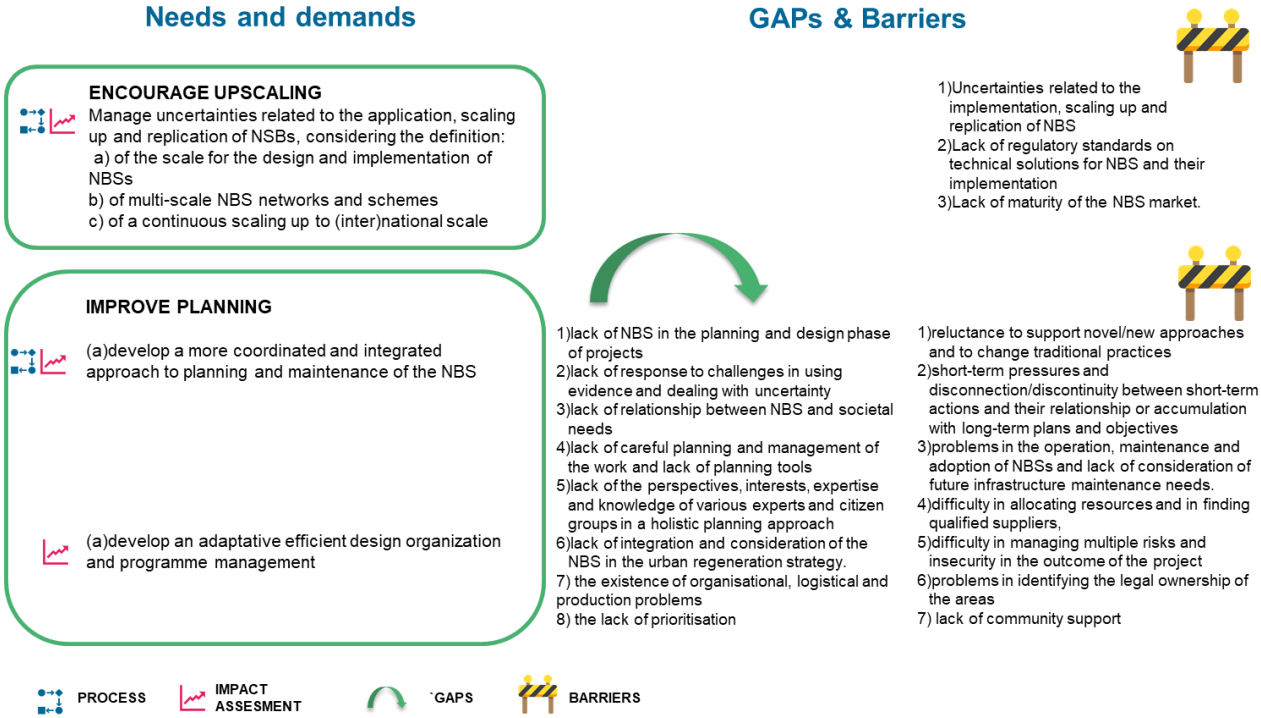


Figure 6 Needs and Demands vers gaps and barriers in NbS Planning group, related to the standardisation categories.

2.3.4. NbS Policy and Governance

The main **needs** identified in NbS Policy and Governance are related to (1) changing policymaking & regulatory framework, (2) improving governance, (3) improving co-design and engagement processes, and (4) developing policies that favour social inclusion.

i) Change policy making & regulatory framework

One of the main **needs** within the NbS Policy and Governance thematic group is to promote changes in the (a) policy-making framework and (b) regulatory framework.

Promoting (a) **changes in policymaking** at the state and municipal level relates to **integrating and mainstreaming** NbS for CCA and DRR: 1) into land use and sectoral policies (identifying gaps, barriers, synergies, and opportunities), 2) at multiple scales (upscaling), to connect individual NbS measures across regions and broader sectors, and 3) to reconcile trade-offs between biodiversity benefits and human well-being. Furtehrmore, at the European level, there is a need to broaden the range of perspectives brought to EC policy-making processes to complement those with technical expertise and to reflect more on the links between biodiversity, nature, and people.

As main **gaps** in this area, the analysis has identified the lack of 1) the necessary strength of NbS policies to lead to action, 2) use of climate science in policymaking (linked to the need to include climate change in policy design criteria),3) coherence among policies (Somarakis et al., 2019) and fragmented governance arrangements (Trémolet, 2019) at both EU and global levels (a problem for collaboration, synergies, and degree of joint funding across multiple agendas), and 4) implementation of NbS support policies in practice at EU level, largely due to their non-binding nature (Davis et al., 2018).

All these changes in policymaking must lead to (b) **promote changes in the regulatory framework**, which include **requirements** for the incorporation of BGI and the monitoring of its implementation in different sectoral legislations.

However, this need facesmany **gaps**, such as 1) the lack of mandatory requirements (EU, national or local) for including or designing NbS and BGI and monitoring their implementation in current multilateral agreements or conventions (Trémolet, 2019), and 2) legal uncertainty due to the lack of specific or inappropriate legislation on NbS because of inflexible rules and regulations. Andsome barriers such as limitations set, in some cases, by environmental and heritage protection laws, building regulations, and planning permissions.

ii) Improve governance

Another **need** is the improvement of governance in different aspects: (a) such as strengthening political leadership, (b) strengthening collaborative governance, (c) improving the composition of stakeholder groups, (d) improving horizontal coordination, and (e) improving vertical coordination.

One of the issues identified as necessary to improve governance is (a) **the strengthening of political leadership and political and technical representatives** to defend the role of the NbS. This faces multiple gaps such as (1) the lack of institutional legitimacy to support NbS projects and (2) the lack of commitment from public authorities. These are partly due to barriers like (1) short timeframes of action and decision-

making cycles (due to election campaign periods), (2) frequent changes in the local authority or other governing administration (political uncertainty due to political cycles, which implies changing priorities) and associated changes in political mindsets, and (3) diverging views of the problem and solutions.

Another key is (b) **strengthening collaborative governance**. Therefore, various projects and publications remark the need to (1) establish appropriate governance structures, to include multiple actors and their interests, and to adopt long-term agreements that take into account changing needs, (2) consult all stakeholders and involve them in the planning, implementation and monitoring processes, supporting empowerment, innovation and mobilisation of multi-stakeholder participation (identification and capacity building of all stakeholders), 3) identify ways to involve external experts and technical perspective as concrete steps within the design process (urban planners, landscape architects, urban designers, park managers, social policy experts and economists), 4) promote trust and understanding between the different actors and private partners, identifying both possible synergies and conflicts between the various economic interests, 5) develop together with affected stakeholders strategies to mitigate trade-offs (agree on them) and share costs and benefits in a transparent and equitable process, and 6) build bridges between researchers and municipalities to increase opportunities to study NbS from ecological and biophysical interventions, and thus, fill the corresponding knowledge **gaps**.

This, nevertheless, is confronted with several identified **gaps** such as a lack: 1) of integration of NbS with multidisciplinary actors from the early stages of project planning, design, and implementation, 2) of institutional capacity and expertise, especially in management (lack of cross-cutting knowledge among senior staff), 3) of the flexibility of decision-making structures, and 4) of agreement between the different objectives and interests of individuals and institutions, and between the institutions' departments. At the same time, there are several barriers such as: 1) ambiguity of roles, responsibilities, and ownership, and 2) resistance to change both in the way problems are addressed and in formal and informal institutional arrangements.

The third key is (**c) finding the best composition of stakeholder groups**; 1) reflecting their diversity in the composition of NbS governance entities, 2) carefully considering the design, framing, and development of programmes to incorporate young people's perspectives, and 3) exploring and leveraging the involvement of new change agents in the design and implementation of NbS (e.g. religious groups and places of worship, insurance companies, business associations, and the health sector).

The fourth key point identified is (d) **the improvement of horizontal coordination**, considering the promotion of partnerships and interdepartmental cooperation for communication and collaboration in cross-functional NbS, as well as informal means/spaces for communication between departments.

Against this, some gaps are pointed out, such as the lack of coordination and communication between departments in the municipality in decision-making (silos). Added as barriers to these gaps are 1) the complexity of these relationships, 2) the lack of common objectives, 3) limited resources (significant budget cuts), 4) bureaucracy and unfavourable legal frameworks.

Last but not least, the need to (e) **improve vertical coordination**, favouring the coordination of policies and institutions at all administrative levels is revealed. Regarding this need important barriers are pointed out as 1) the disconnection of governance between different levels (local, national, European), 2) inter-institutional fragmentation and lack of coordination between agencies and institutions; and 3) interaction/dependency at the municipal level, and possible tensions in coordination between local, regional and national governments when they have different political ambitions and the legal responsibilities between governance and management of the NbS are separated.

iii) Improve co-design & engagement processes

Another major **need** identified in NbS Policy & Governance group is the improvement of both (a) co-design and (b) engagement processes.

For (a) **improving co-design processes**, that involves different stakeholders to improve the social acceptability of these solutions and better address potential conflicts, it points to the need to (1) use such co-production processes sparingly, being aware of their limitations, 2) to explore the tensions and relative success of existing institutional models of co-design and co-production for the implementation of NbS, and 3) to introduce new approaches that bring together multiple and novel 'change agents' to enable the development of pathways for mainstreaming NbS and ensuring just transitions.

For (b) **improving participation and engagement processes**, it is important (1) to improve their design and delivery to encourage more active participation in decision-making, especially in the early stages of the project, (2) to empower local actors to advocate for the NbS in their neighbourhood or city, and (3) to develop methods and tools for engagement. In addition to these, some specific issues are identified, such as the need to take gender identities into account when introducing consultations and to apply the principle of free, prior, and informed consent in the design and implementation of the NbS, when indigenous peoples are affected.

About this demand some **gaps** are identified such as a lack 1) of empowerment of local stakeholders, 2) of appreciation of the importance of public consultations and 3) of public understanding of BGI.

And some **barriers** such as 1) apathy and lack of social participation, 2) constant interaction with the municipality and little culture and experience of participation, work sharing, and partnership between the municipality and residents, and 3) top-down service delivery and care.

iv) Develop policies that favour social inclusion

Finally, the NbS Policy and Governance group indicate the relevance of the **demand** to develop policies that favour social inclusion while ensuring social equity and the maintenance of the BGI (addressing potential planning deficiencies). On the one hand, (a) **ensuring that new NbS do not contribute to green gentrification** and ensuring that those most likely to be affected by changes in land and rental values are included in the design of new developments and are given some stake in the resulting outcomes. On the other hand, (**b) improving social cohesion through strategies that encourage the participation of vulnerable populations** and reduce isolation and anti-social behaviour (e.g. by organising information forums or workshops for socially disadvantaged citizens).

This need encounters significant **barriers**, such as 1) gentrification and green gentrification, 2) the lack of social equity and fairness in planning favoured by the domination of planning processes by those with higher incomes, 3) the lack of consideration of the interests of some groups because of their socio-economic and cultural background, such as women and minorities.

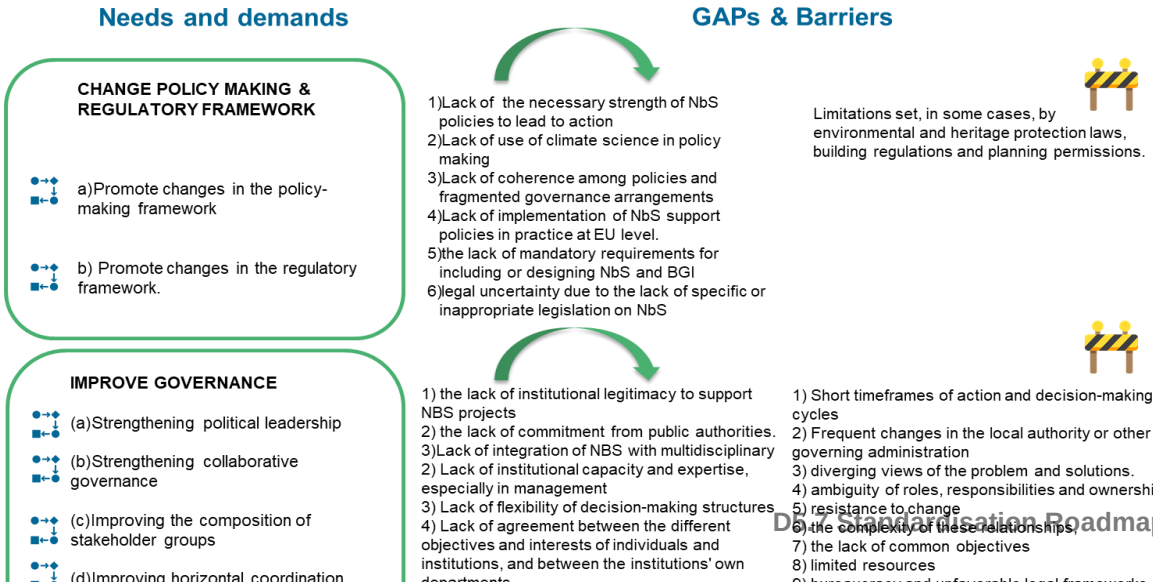


Figure 7. Needs and Demands vers gaps and barriers in NbS Policy and Governance group, related to the standardisation categories

The primary demands identified in the 3.5. NbS Financing and Economic Activities group are structured in three main blocks: (1) **assessing cost-benefit effectiveness**, (2) **ensuring and improving funding**, and (3) **developing alternative business and financial models and opportunities**.

i. Integrate cost/ benefits effectiveness

One of the main **needs** found by different publications and projects in the field of NbS financing is to integrate (into design, planning, and decision-making) the assessment of the cost/benefit effectiveness of NbS: (a) considering, over the life cycle of the project**, the potential costs, benefits and trade-offs of NbS at its site and in the wider landscape**, (b) carefully considering **the relationship with "net loss" or "net gain" strategies**, (c) promoting **monetised quantification of the nature and scale of the benefits of NbS**, and (d) working to detect **who bears the costs and who enjoys the benefits of these investments.**

However, the **lack** of knowledge or tools to facilitate the implementation of cost-effective measures or forms of investment is identified as a gap. Moreover, the bad perception of ecological services valuation and the difficulty in establishing who benefits and who pays are acknowledged as barriers.

ii. Ensure and improve funding

As the lack of consistent demand inhibits investment and the development of expertise in the provision of NbS services, there is a need to secure and improve both (a) **public funding**, by facilitating access to public funds, and (b) **private funding**.

Ensuring public funding by increasing strategic investments at the EU level and improving the funding allocated to NbS in all relevant policies and funding instruments (sufficient funding to integrate and mainstream NbS for CCA and DRR) is considered essential.

This need, nevertheless, faces significant **obstacles** such as: 1) difficulties in accessing funding and resources, very limited and unstable at all levels (European, national, local) affected by budgetary constraints under austerity, 2) lack of awareness of access to funding or lack of knowledge on how to access funding, 3) challenges in public procurement that inhibit innovation and may lead to the continued application of grey solutions, 4) slow public tendering processes, and 5) time lag between economic investment, perceived benefits (mostly public goods) and political impact (which underestimates their benefits).

The analysis identifies the **demand** to promote **private financing** (markets). To this end, it stresses the importance of 1) reducing perceived reputational risk (risk aversion as default), 2) making the economic value of NbS more visible or transparent through natural capital accounting, 3) facilitating the use and understanding of how evidence (monitoring results) can be used to support investment, 4) putting in place long-term financial plans for the implementation period as well as for subsequent maintenance, 5) providing security about what is required for the implementation of NbS, providing certainty on what is required from certain actors (e.g. developers) through a coherent and consistent planning policy or regulatory regime, 6) promoting subsidies for installing NbS solutions in private houses or buildings to mitigate the long planning and amortisation process and 7) planning NbS in such a way that the technical specifications can be adapted to the budget without affecting the quality of the project.

Yet, some **gaps** are identified in this line, such as the lack of detailed information on NbS options (their effectiveness and quantified returns on investment), both market and non-market, inhibits the understanding of their full benefits. In addition, some barriers are specified such as 1) the short term vision in the framework of investments and their recovery, 2) the lack of sustainable public financing which discourages private financing, 3) the absence of incentives, 4) the widespread perception that construction and, above all, the maintenance of NbS are more expensive than traditional systems, 5) the poor quality and lack of disclosure of data related to insurance risk in competitive markets, and 6) market problems and the lack of public-private partnerships.

iii. Developing (alternative) business and financial opportunities and models

Finally, it is considered necessary to develop alternative and novel business and financial opportunities and models for NbS. To this end, it is pointed (a) to the promotion of local economic development, or (b) to the possible integration of green indicators in fiscal transfers between municipalities to incentivise the implementation of green infrastructure.

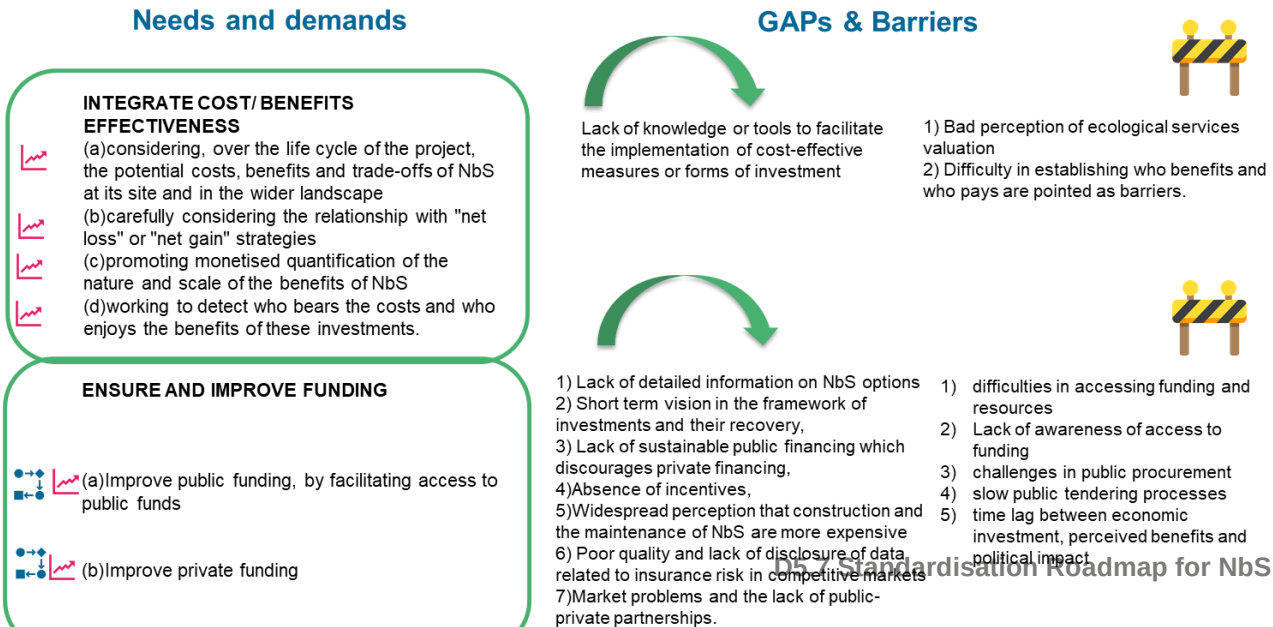


Figure 8. Needs and Demands vers gaps and barriers in NbS Financing and Economic Activities group, related to the standardisation categories

2.3.6. NbS Communication and awareness raising

In the various projects and publications analysed, three needs are considered a priority inthe communication and awareness-raising group: 1) improving communication and information, 2) awareness-raising and 3) strengthening the capacities of the population.

i) Improve communication & information

The first identified need is the improvement of communication and information by a) disseminating all relevant information on the NbS to stakeholders in a timely and appropriate manner and avoiding information overload, b) explaining the benefits, functions, and administration of the NbS in an understandable way to communities, and c) having informal communication means/spaces.

On the other side, important gaps are identified as 1) lack of or ineffective communication and the complexity of coordination and communication, 2) communication skills and information flows for mobilisation and collaboration with residents, and 3) resources to cope with change and information overload. Moreover, information overload is reported as a barrier.

ii) Raise awareness

In addition to the **need** to improve communication and information, there is also a need to raise awareness, both (a) among **citizens** and (b) among **technicians.**

On the one hand, (a) the promotion of **public awareness** points to the specific need to (1) promote ecological and social values by raising public awareness and overcoming the difficulties in changing their mentality and perception, 2) fostering understanding of how NbS can help solve challenges such as poverty and unemployment, and 3) developing research, development and education programmes (both at primary and higher levels) that raise awareness of the role of NbS and are more closely aligned with a knowledge supply chain, linking universities with industry.

On the other hand, (b) **raising awareness of the benefits of NbS among technicians** (urban planners and other departments) is related to the promotion of knowledge and training in the technique of NbS, supported, for example, by the development of brochures and biodiversity mapping.

Both needs are faced with the existence of gaps such as: 1) lack of public and societal awareness of the impacts and benefits of NbS in communities, 2) lack of learning processes, educational programmes, and awareness-raising of citizens on implemented NbS, 3) lack of knowledge of the example of NbS outside the developing departments and 4) lack of public and community support.

This group also has **barriers** such as: 1) cultural and behavioural barriers related to a negative perception due to uncertain outcomes and preference for traditional engineering and technological "grey infrastructure" (difficulties in changing the mindset and perception of citizens, resistance to new concepts), 2) risk of vandalism, 3) underestimation of environmental benefits, 4) lack of evidence on social trade-offs, 5) fear of increased costs of implementing and maintaining green spaces, distrust of publicly-advertised costs and benefits and fear of rising house prices (a product of so-called "eco" or "green gentrification"), and 6) homeowner attitudes due to perceived increased risk and damage and corresponding restoration costs, resale values and time. In addition, specifically, the reduction of the perception of safety around the NbS due to the presence of bushes that might create areas that are not fully visible .Fostering capacity building

In addition, but to a lesser extent, attention is drawn to the need **to foster capacity building**, through processes of strengthening skills, abilities, and processes related to the NbS through guidance materials and tools.

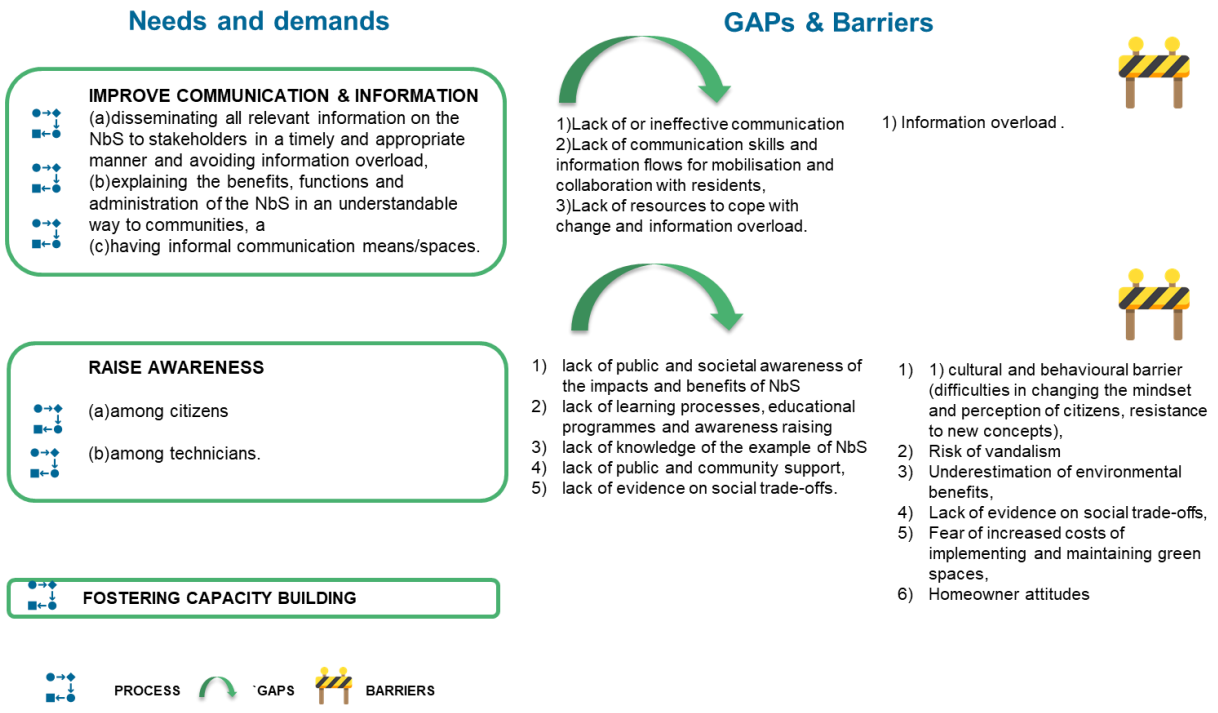


Figure 9. Needs and Demands vers gaps and barriers in NbS Communication and awareness raising group, related to the standardisation categories

2.4. Standardisable NbS Needs & Demands

2.4.1. NbS design and implementation

Regarding the **needs** identified in the previous NbS design and implementation group's analysis, four main standardisable elements have been selected:

a) To address the need to **extend and consolidate the knowledge and use of the NbS**, it is considered that the first step would be to establish a common, clear, and agreed **terminology (**definitions, NbS classification, typology etc.), matching with one of the standardisation categories.

b) To meet the demand to i**mprove technical design**, development on **technical references and standards**, directly related to **NbS architecture** is proposed**.**

c) To meet the need to **improve monitoring and evaluation of the NbS** to assess NbS performance in different dimensions, an **NbS monitoring and evaluation strategy- plan (related to process and assessment)** is proposed as well as **a protocol for assessing the effectiveness of various NbS and Decision Support (related to assessment)**.

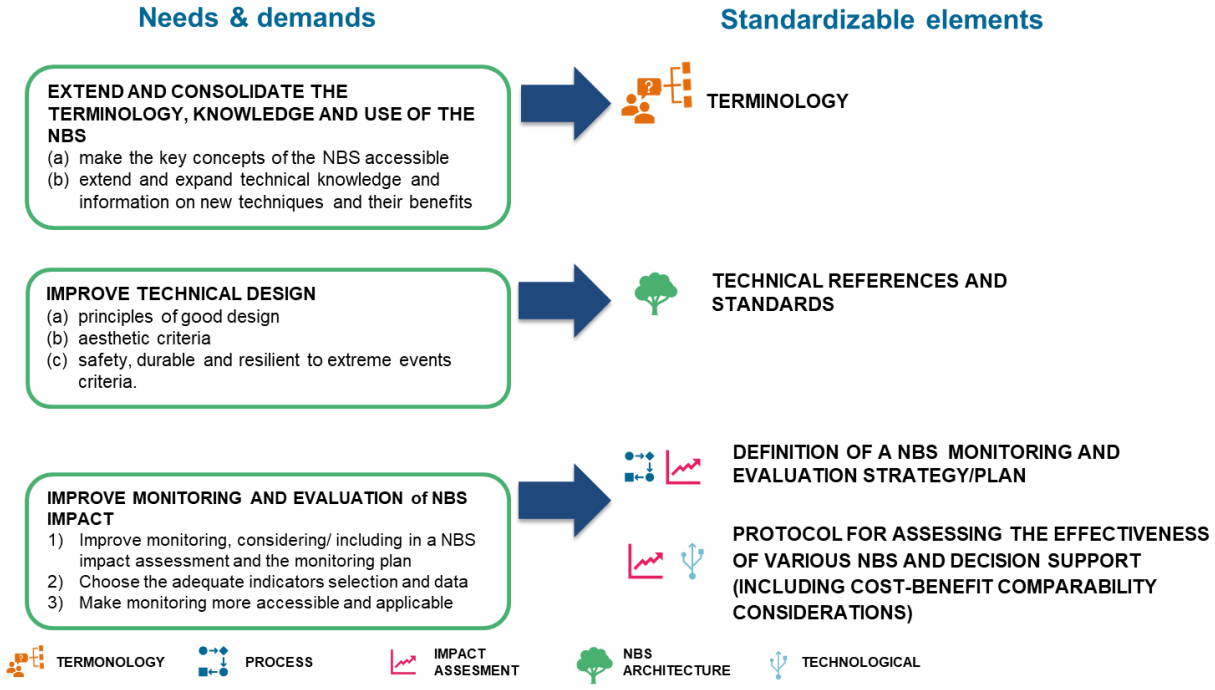


Figure 10. NbS design & implementation Needs and demands & Standarisable elements related to the standardisation categories

2.4.2. NbS planning

Considering the two main needs detected in NbS Planning, the following standardisable processes/elements have been identified:

a) To respond to the demand to i**mprove planning**, the standardisation **of a process on how to take account of NbS in planning** could be considered as a standardisable process related to assessment.

b) To address the need to **encourage replication and process-related upscaling**, it is considered appropriate to define **guidelines on considerations and steps to support the scaling up of NbS** (related to process and assessment as standardisable categories).

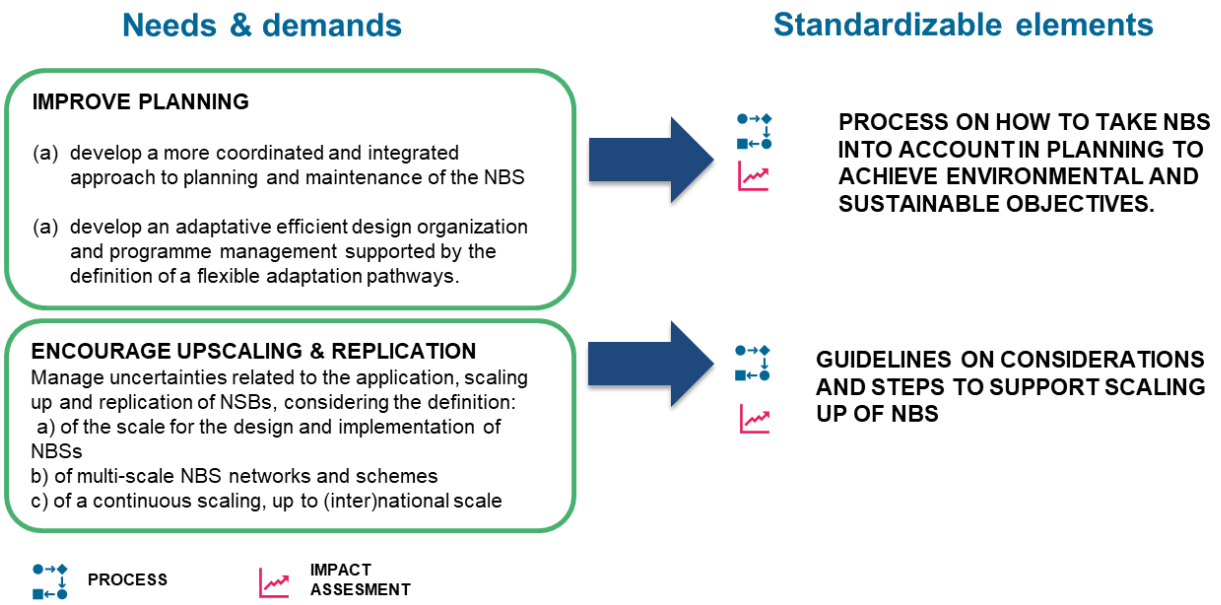


Figure 11 NbS planning Needs and demands & Standarizable elements related to the standardisation categories

2.4.3. NbS Policy & governance

Considering the main needs identified in NbS Policy and Governance, five standardisable processes have been detected:

a) To meet the need for **changing policymaking and regulatory framework**, two standardisable processes have been identified: 1) **to integrate and mainstream NbS for climate change adaptation and disaster risk reduction** and 2) **to promote political consensus and commitment that legitimizes NbS.**

b) To address the demand for **improving governance**, it is considered appropriate to develop three possible standardisable processes: **1) to strengthen collaborative governance, 2) to find the best composition of stakeholder's groups and 3) to improve horizontal and vertical coordination.**

c) To meet the need of **improving co-design and engagement processes**, standardisation development is proposed **on planning how to improve the co-design process**.

d) To meet the demand for **developing policies that favour social inclusion**, a standardisable **process on how to improve the development of socially inclusive policies is proposed**.

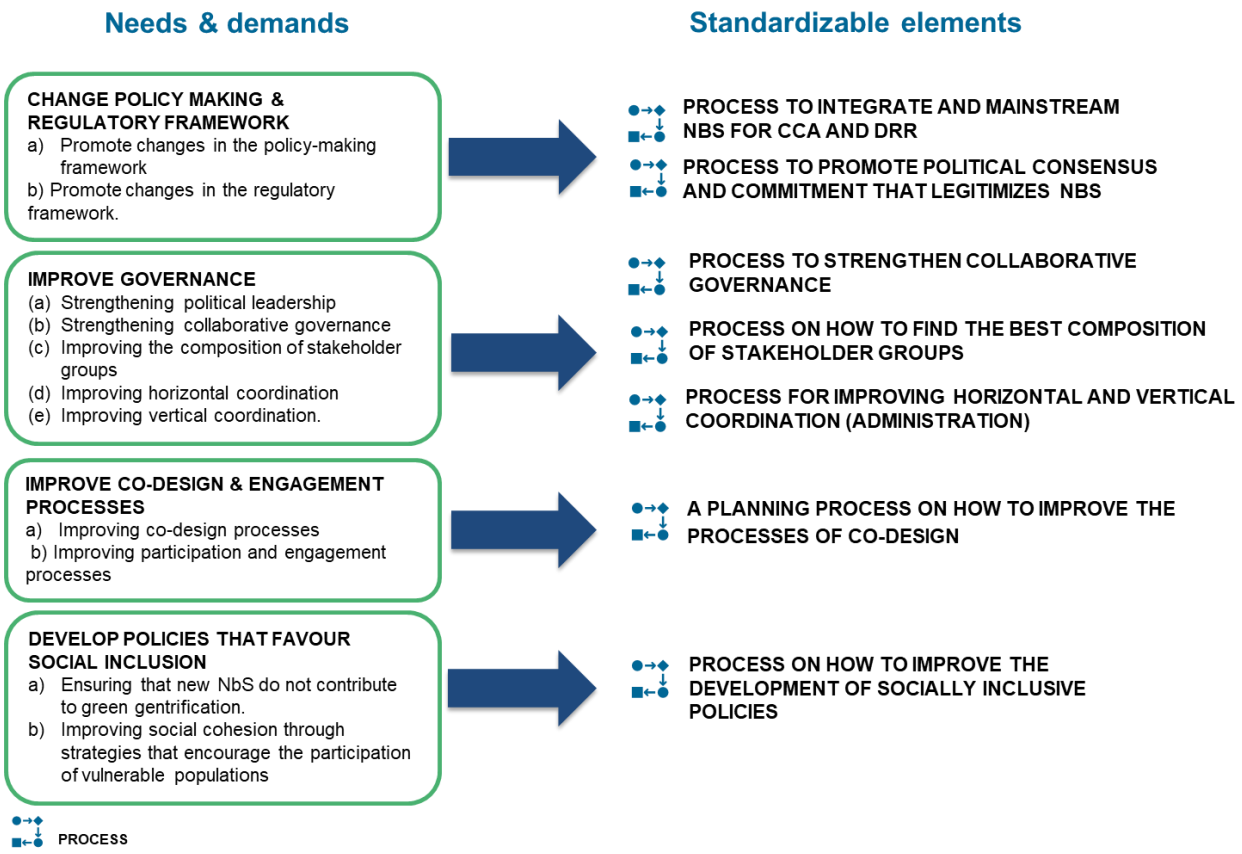


Figure 12. NbS Policy & governance Needs and demands & Standarizable elements related to the standardisation categories

2.4.4. NbS financing and economic activities

Regarding the three needs identified through the NbS financing and economic activities analysis, these are the possible standardisable processes identified:

a) To address the complex need to assess cost-benefit effectiveness, it is considered appropriate to develop two different standardisable methodologies: **1) one for assessing the cost-benefit ratio of NbS, and 2) other for the monetization of benefits of NbS or ecosystem services** (both included in the assessment standardisable category).

b) To meet the demand of ensuring and improving public and private funding, a **methodology to carry out NbS investment rating standardisation** is proposed, as a performance assessment.

c) To address the need to **develop alternative business and financial models for NbS** and opportunities, it is considered convenient **to develop a standardisable process on how to develop (alternative) business and finance opportunities and models.**

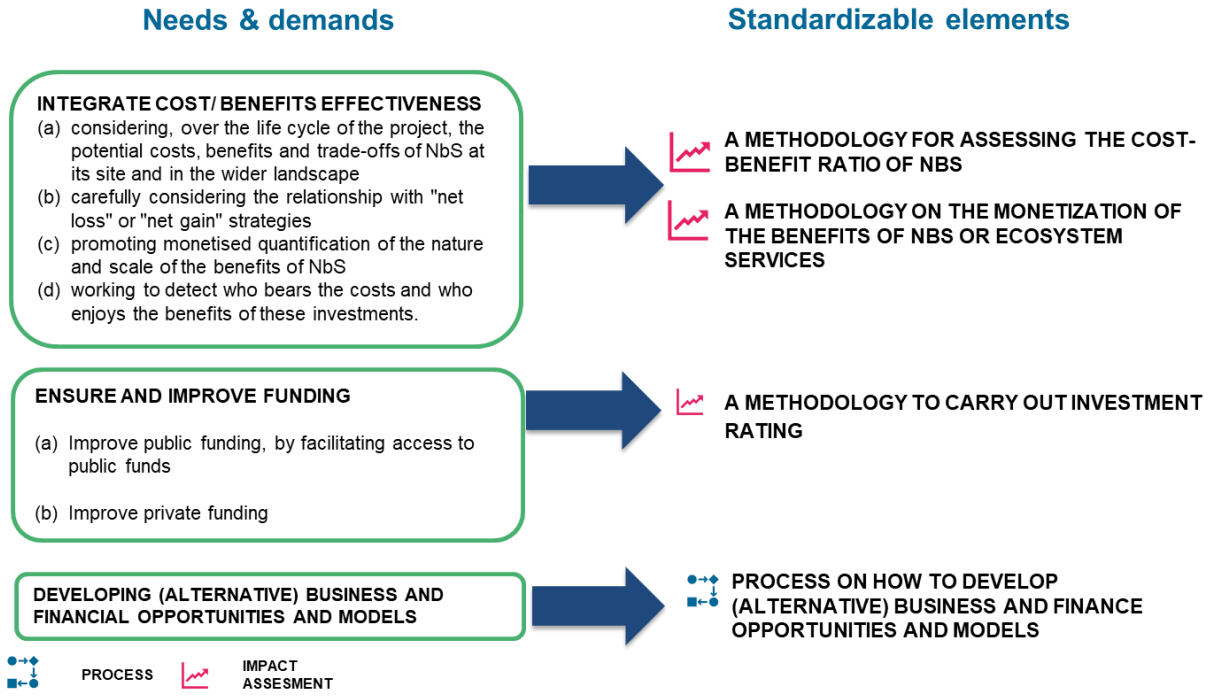


Figure 13. NbS financing and economic activities Needs and demands & Standardisable elements related to the standardisation categories

2.4.5. NbS Communication and awareness raising

Considering the three main needs identified in the communication and awareness-raising group, three standardisable processes have been chosen:

a) in order to address the need **to improve communication and information** and to **raise awareness**, it is considered appropriate to develop a standardisable process for **developing an effective communication and awareness-raising strategy**.

b) To address the need to **strengthen the capacities of the population**, a standardisable process **on how to strengthen capacity building** is proposed.

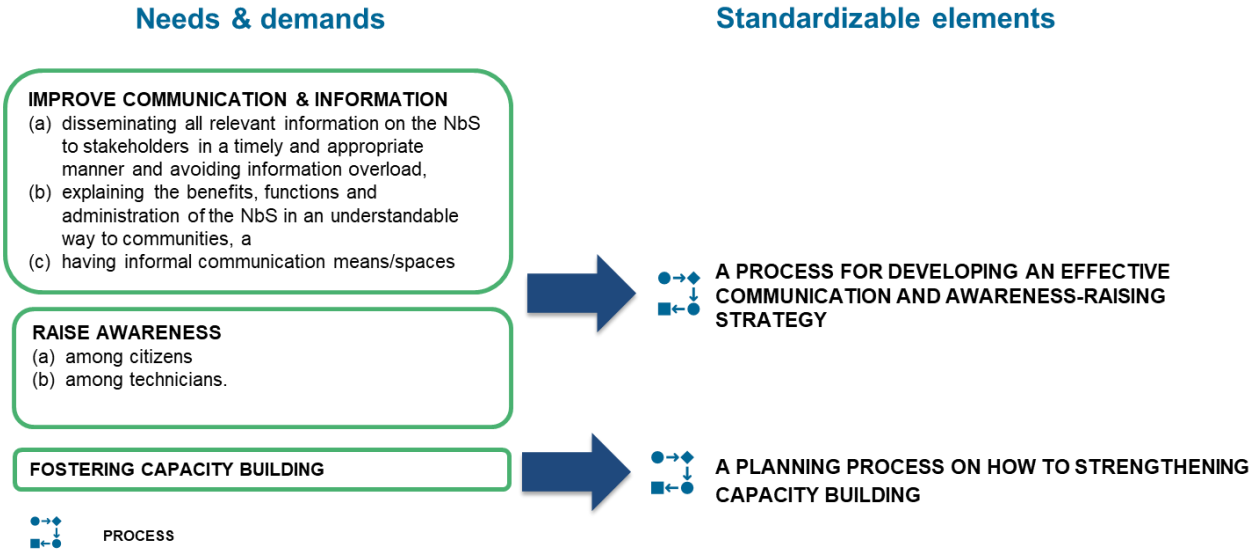


Figure 14. NbS Communication and awareness raising Needs and demands & Standarizable elements, related to the standardisation categories

2.4.6. Standardisable NbS Needs & Demands

Unifying the results from all thematic areas, 17 standardised needs were identified. However, some of them are not unique to the NbS, especially the ones in the Policy and governance thematic area, as they refer to more cross-cutting processes.

Table 5. Standardisable elements/processes categorised by topic and by standardisation category.*In black those slements specific to NbS and in grey those non-specific to NbS elements

THEMATIC SPHERES	STANDARDISABLE ELEMENTS/ PROCESSES	STANDARDISATION CATEGORY
NbS TECHNICAL DESIGN AND IMPLEMENTATION	**Terminology**	**Terminology**
	Technical references and standards	**NbS Architecture**
	Protocol for assessing the effectiveness of various NbS and decision support (including cost-benefit comparability considerations)	**Process Impact Assessment**
	Definition of an NbS monitoring and evaluation strategy/plan (Specificities to consider when assessing the impact of NbS)	**Process Impact Assessment**
NbS PLANNING	**A planning process on how to take NbS into account in planning to achieve environmental and sustainable objectives**	**Process**
	Guidelines on considerations and steps to support scaling up of NbS	**Process**
POLICY AND GOVERNANCE	**Process to promote political consensus and commitment that legitimizes NbS**	**Process**
	Process on how to find the best composition of stakeholder groups	Process
	Process for improving horizontal and vertical coordination (administration)	Process
	Process to strengthen collaborative governance	Process
	A planning process on how to improve the processes of co-design	Process
	A planning process on how to strengthen capacity building	Process
	Process on how to improve the development of socially inclusive policies	Process
NbS FINANCING AND ECONOMIC ACTIVITIES	**Methodology for assessing the cost-benefit ratio of NbS**	**Impact Assessment**
	Methodology on the monetization of the benefits of NbS or ecosystem services	**Impact Assessment**
	Methodology to carry out investment rating	**Impact Assessment**
	Process on how to develop (alternative) business and finance opportunities and models for NbS	**Process**
COMMUNICATION AND AWARENESS RAISING	A process for developing an effective communication and awareness-raising strategy	Process

2.5. Review and prioritising (NetworkNature Policy Brief)

As noted in 1.2 Methodology, the review of the elements identified in the analysis described above was the result of a questionnaire conducted within the NetworkNature Semester framework.

The second part of the survey, focused on standardisation, was based on the results shown in *Table 5. Standardisable elements/processes categorised by topic and by standardisation category*.

The following results are also compiled in the NetworkNature Knowledge brief, which sets out the work carried out during the semester.

2.5.1. Review of the identified standardisable elements / processes

One of the most important objectives of the questionnaire was to check whether **any NbS standardised needs were missing**. However, to the question *Do you think there are any missing standardisable needs? Which one(s)?*, around sixty percent of the respondents (57,89%)[7]. answered ”no” to that question .

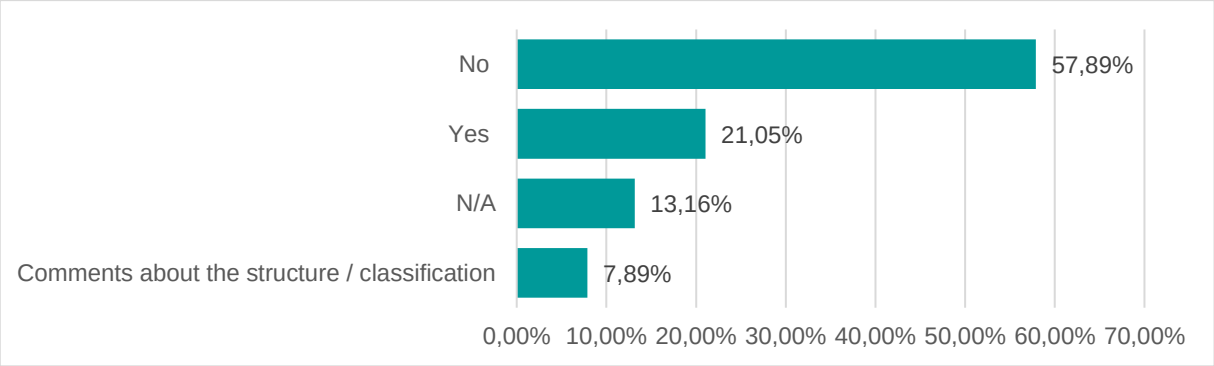


Figure 15. Answers to Do you think there are any missing standardisable needs? Which one(s)?

Respondents who claim to identify needs that are not among those identified in the previous analysis include (21,05%):

- *An **ecosystem characterisation***
- *A **goal setting** (design, evaluation, and monitoring)*
- *A **pre-project assessment** to understand local needs and existing initiatives first and foremost*
- *References to **negative environmental and economic impacts**.*
- *Quantification of **the holistic benefits** as well as acknowledges (and hopefully minimizes) the compromises that we settle for in creating a feasible project*
- *A **societal cost-benefit analysis***
- *Implementation*
- *Outcomes*

Through the analysis of these proposals, it is possible to distinguish three main blocks:

- One related to the ecosystem characterisation and the identification, prior to the start of the project, of needs and existing projects, which will make it possible to determine the objectives of the project.
- Another related to the assessment of all, negative and positive, economic, social, and environmental impacts (and/or if considered from the cost-benefit analysis), with a holistic vision that favours the project feasibility.
- And a last one, more generic, but necessarily applied to concrete cases on implementation and outcomes.

[7] Around 8% of people focused their comments on issues related to the conformation of the proposed analysis matrix (no questions were asked about it) and around 13% answered don't know, no answer.

In light of these proposals, only a possible new standardisable process came up: **A pre-NbS project assessment to understand local needs and existing initiatives to set feasible goals.** The second block of proposals related to impact assessment is considered to be included in *Methodology for assessing the cost-benefit ratio of NbS.* And the third one is considered to be included in *Technical references and standards,* because the implementation and the outcomes depend on the NbS used.

Moreover, it could be considered that there is some consensus that standardisable elements or processes were well classified, both thematically and in the standardisation category (see Figure **16** and **Figure 17**). However, in some cases, it is considered that in addition to the category in which they are placed, they could be related to other. For example:

- some respondents noted that some standardisable elements or processes were covering multiple thematic spheres (e.g. *Methodology for assessing the cost-benefit ratio of NbS* could be in the Policy and Governance sphere).
- some respondents considered that elements in planning and communication, for example, link also to impact assessment

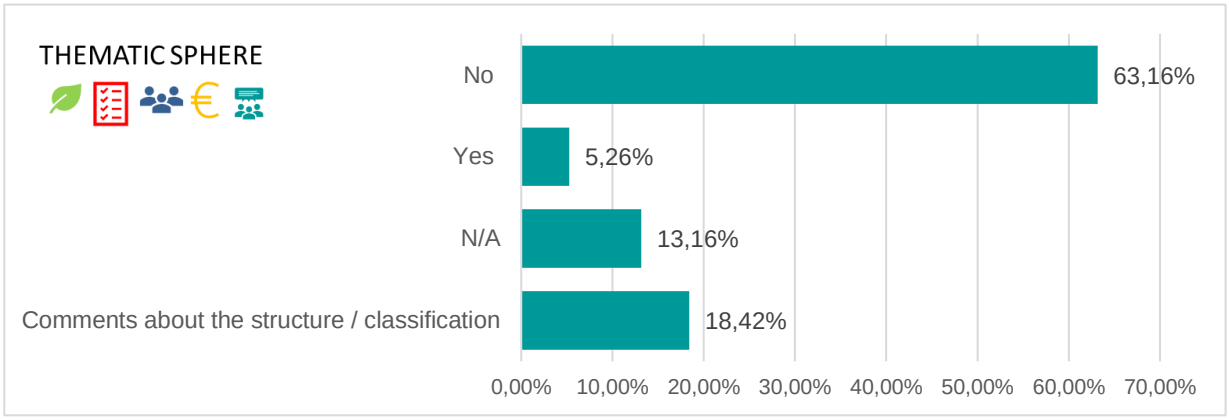


Figure 16. Standardisable elements/ processes that fall into another thematic sphere

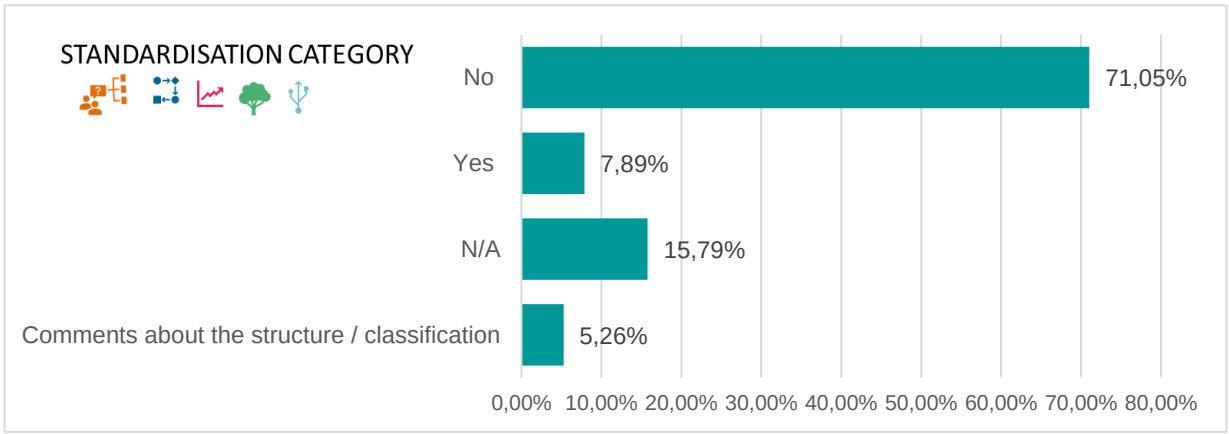


Figure 17. Standardisable elements/ processes that fall into another standardisation category

2.5.2. Prioritisation of the standarisable elements and processes identified

The prioritisation of standardisable elements or processes was carried out in the survey through two questions:

- *Considering the standardisable needs identified, and those you have included in the previous question, please select the **five that you consider being a priority***
- *Please **rank your selected five standardisable elements/processes** from highest to lowest priority (1 most important 5 less important).*

Regarding the results, it can be observed that those considered as priorities (the most frequently selected are specific to the NbS, while the transversal elements, mainly related to governance, engagement and awareness-raising processes, are considered to be of lower priority. (see **Figure 18**).

Table 6. The most frequently selected among the five priorities by thematic sphere and standardisation category

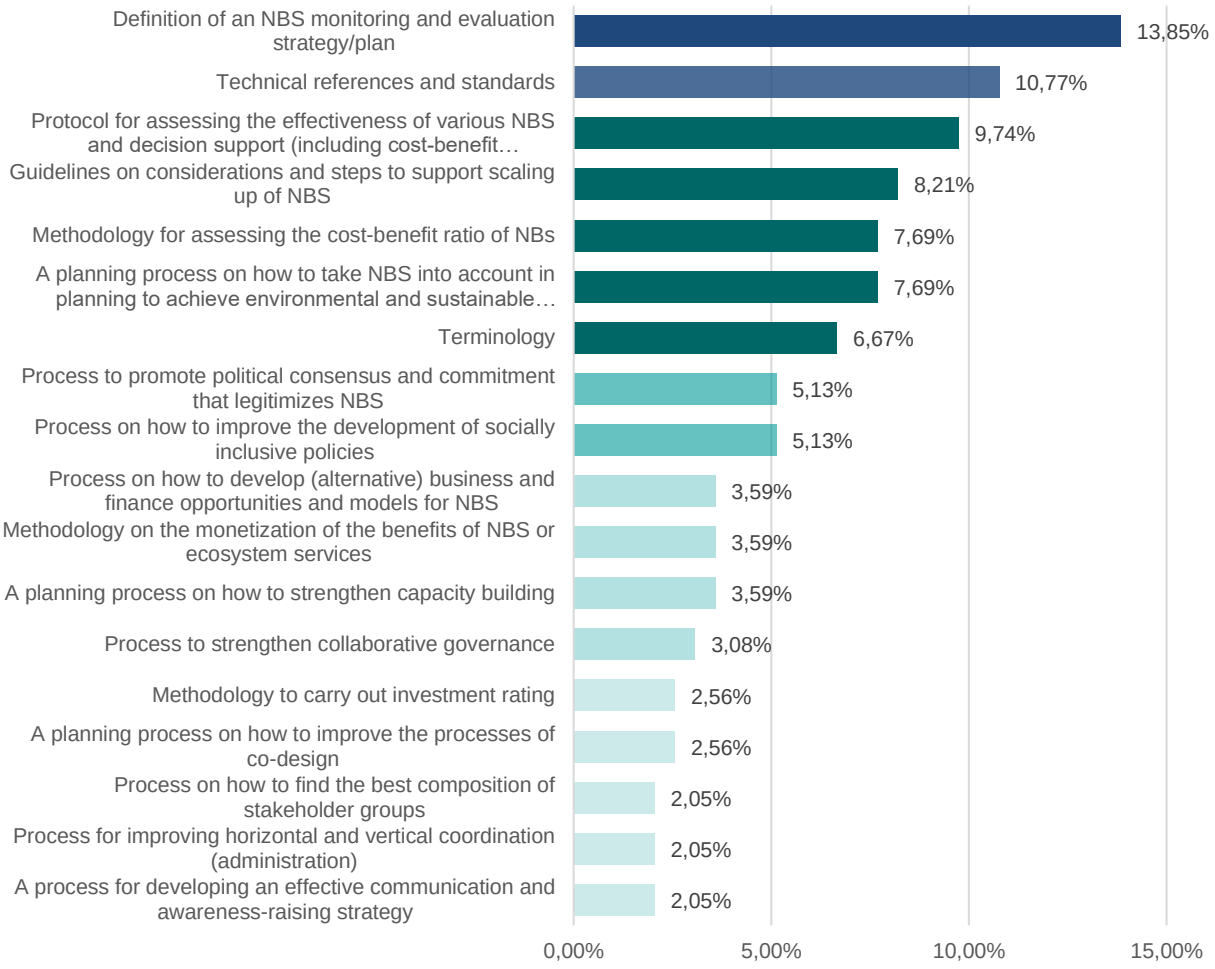


Figure 18. Prioritisation considering the highest priority among the selection of 5 standardisable elements/processes identified as priorities

STANDARDISABLE ELEMENT/PROCESS PRIORITISED	%	T	S
Definition of an NbS monitoring and evaluation strategy/plan	13,85%		
Technical references and standards	10,77%		
Protocol for assessing the effectiveness of various NbS and decision support (including cost-benefit comparability considerations)	9,74%		
Guidelines on considerations and steps to support scaling up of NbS	8,21%		
A planning process on how to take NbS into account in planning to achieve environmental and sustainable objectives	7,69%		
Methodology for assessing the cost-benefit ratio of NbS	7,69%		
Terminology	6,67%		

The four elements/processes that were considered to be the highest priority fall into the NbS Technical Design and Implementation sphere (see Table 9):

- The first, **NbS Terminology,** in the standardisation category of Terminology;
- The second, **Technical references and Standards**, in the NbS Architecture
- The next two, **Definition of an NbSmonitoring and evaluation strategy/plan** and a **Protocol for assessing the effectiveness of various NbS** and decision support, in Impact Assessment.

Behind them, there are two processes, **Guidelines on considerations and steps to support scaling up of NbS** and **A planning process on how to take NbS into account in planning to achieve environmental and sustainable objectives,** included in the NbS Planning Sphere.

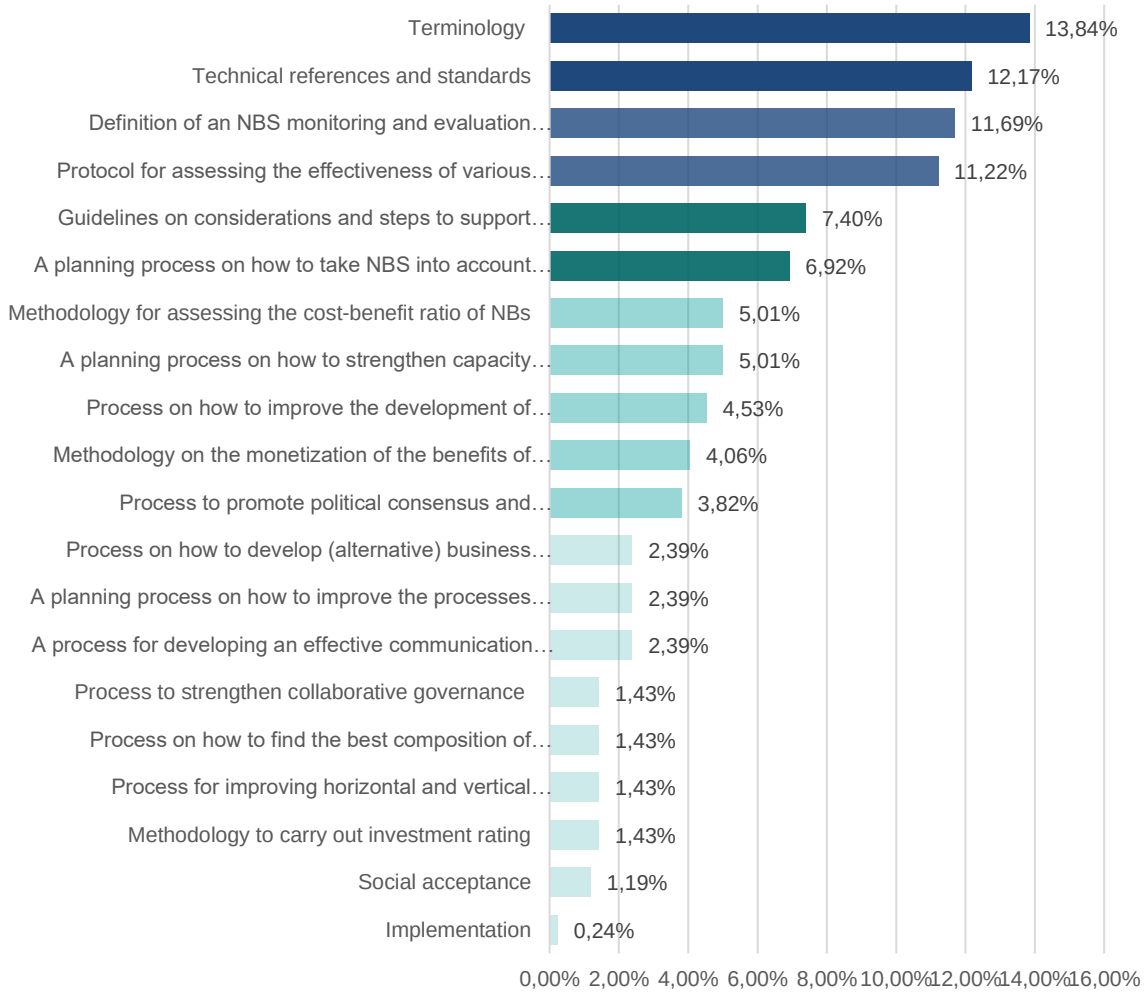


Figure 19. Prioritisation considering the highest priority among the selection of 5 standardisable elements/processes identified as priorities

Table 7. The most frequently selected among the five priorities by thematic sphere and standardisation category

STANDARDISABLE ELEMENT/PROCESS PRIORITISED	%	T	S
Terminology	13,84%		
Technical references and standards	12,17%		
Definition of an NbS monitoring and evaluation strategy/plan	11,69%		
Protocol for assessing the effectiveness of various NbS and decision support	11,22%		
Guidelines on considerations and steps to support scaling up of NbS	7,40%		
A planning process on how to take NbS into account in planning to achieve environmental and sustainable objectives	6,92%		

2.5.3. High-quality in standandarisation

Finally, in relation to the highest priority standarisable element/processes, the features that were considered the most important for delivering high-quality Nature-based Solutions was the Design (39,47%). This is consistent with the standarisable elements and processes by the top-ranked thematic sphere: NbS Technical Design and Implementation. According to the survey results, objectives and feasibility were ranked as the second and third most important high-quality features, receiving support percentages of 23.68% and 21.05% respectively. On the other hand, Post-Implementation and Implementation received significantly less support, at least half as much as the top-ranked features.

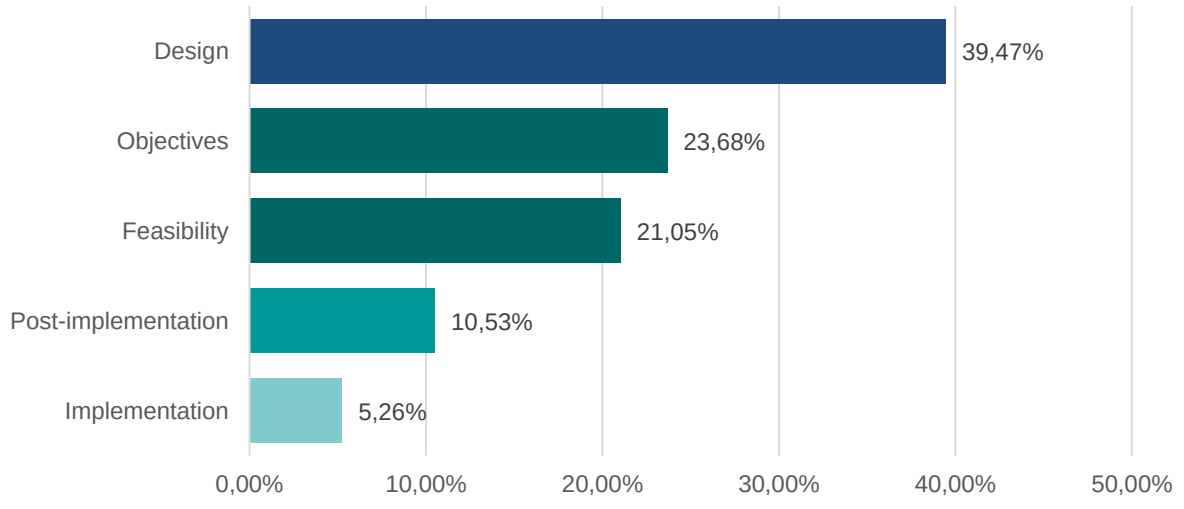


Figure 20. Features for delivering high-quality nature-based solutions considered the most important for the standardisable element/process prioritized

2.5.4. Revised standardisable elements/processes

Considering the results of the questionnaire, the list of standarisable element/processes was revised, and its prioritisation was consolidated (Table 8).

Table 8. Revised and prioritised list of standardisable elements/processes is as follows

THEMATIC SPHERES	STANDARDISABLE ELEMENTS/ PROCESSES	STANDARDISATION CATEGORY
	★ **Terminology**	
	★ **Technical references and standards**	
NbS TECHNICAL DESIGN AND IMPLEMENTATION	★ **Protocol for assessing the effectiveness of various NbS and decision support (including cost-benefit comparability considerations)**	
	★ **Definition of an NbS monitoring and evaluation strategy/plan (Specificities to consider when assessing the impact of NbS)**	
	Pre-project assessments to understand local needs and existing initiatives first and to set goals	
NbS PLANNING	★ **A planning process on how to take NbS into account in planning to achieve environmental and sustainable objectives**	
	★ **Guidelines on considerations and steps to support scaling up of NbS**	
POLICY AND GOVERNANCE	**Process to promote political consensus and commitment that legitimizes NbS**	
	Process on how to find the best composition of stakeholder groups	
	Process for improving horizontal and vertical coordination (administration)	
	Process to strengthen collaborative governance	
	A planning process on how to improve the processes of co-design	
	A planning process on how to strengthen capacity building	
	Process on how to improve the development of socially inclusive policies	
NbS FINANCING AND ECONOMIC ACTIVITIES	★ **Methodology for assessing the cost-benefit ratio of NbS**	
	Methodology on the monetization of the benefits of NbS or ecosystem services	
	Methodology to carry out investment rating	
	Process on how to develop (alternative) business and finance opportunities and models for NbS	
COMMUNICATION AND AWARENESS RAISING	A process for developing an effective communication and awareness-raising strategy	

Legend		
	★ Priority	**Incorporated after the review**
		Specific of NbS
		Non Specific of NbS

3. Review existing standards

3.1. Introduction

The European Standardisation Strategy[8] aims to promote the development and use of standards in various sectors, including NbS. It recognizes the potential of NbS in addressing societal challenges related to climate change, biodiversity, and sustainable development. By incorporating NbS into standardisation activities, the European Standardisation Strategy seeks to ensure that appropriate standards are available to support the implementation, interoperability, and quality assurance of NbS projects and initiatives across Europe. This alignment helps to foster consistency, promote best practices, and facilitate the widespread adoption and effectiveness of NbS solutions throughout the EU.

Thus, the objective of this work is to identify and map existing standards in the field of NbS. Given that standardisation in NbS is in its early stages, the aim is to include all standards relevant to NbS, regardless of whether they are formally or informally established. By doing so, the work developed within CLEVER Cities intends to create a comprehensive understanding of the existing standards landscape in NbS and provide valuable insights for further development and harmonization in the field.

In this document we call **formal standardisation** those standards developed by recognized standardisation bodies. While there are various standardisation bodies, this analysis specifically focuses on the work carried out by (**¡Error! No se encuentra el origen de la referencia.**):

- The International Organization for Standardisation (ISO), at international level
- The European Committee for Standardisation (CEN) and the European Electrotechnical Committee for Standardisation (CENELEC),
- at European level the National Organisations for Standardisation of different countries, particularly from Europe.

Figure 21. Formal Standardisation bodies and infomal standardised protocols or guidelines and their developers

[8] https://single-market-economy.ec.europa.eu/single-market/european-standards/standardisation-policy/standardisation-strategy_en

The standards that have been mapped in this analysis therefore include both approved and under development standards from:

- ISO standards (ISO);
- European Standards (EN), Technical Spacifications (TS), Technical Reports (TR), CEN Workshop Agreements (CWAs) and Eurocodes;
- National standards and internal protocols and "sectoral" technical instructions.

In turn, the term **informal standards** refers to two categories. Firstly, it encompasses standards developed by organizations that are not primarily focused on standardisation but are involved in areas such as the environment or nature conservation. These organizations may have developed their own sets of guidelines, practices, or criteria that align with the principles of NbS. Secondly, it includes guides and manuals that provide instructions on developing specific processes or elements related to NbS. These resources offer practical guidance on implementing NbS projects, outlining best practices and/or methodologies. By considering both these categories of informal standards, a more comprehensive understanding of the NbS landscape can be achieved, incorporating both formal and non-formalized approaches to NbS standardisation roadmap.

3.2. Methodology

Due to the contrasting nature of formal and informal standardisation processes, the methodology employed to identify and locate documents for each differs. This distinction arises from the fact that the platforms or sources utilized to search for formal standards and informal standards are divergent.

3.2.1. Formal standardisation analysis methodology

The review of the formal standards has been carried out based on desk analysis. The methodology involved several steps to identify relevant standards for NbS following the steps shown in Figure 22:

- The first step was to define the themes within the ISO standardisation that could be relevant to NbS (Figure 23). Additionally, key words were selected for conducting the search.
- The next step involved conducting searches for standards on the ISO and CEN websites, as well as utilizing general search engines like Google. These searches aimed to gather relevant NbS standards or those that could be applied to NbS or that could give the context for their implementation.
- Once the standards were collected, they were classified based on their relation to NbS and the thematic spheres of CLEVER Cities (Figure 24). This classification helped to organize and categorize the standards according to their specific relevance and applicability to NbS. Three levels of links were defined:
    - Directly related: Standards that directly relate to or involve specific NbS. Mostly technical standards are included that refer to specific NbS such as green roofs or facades, Sustainable Drainage Systems (SUDs), etc. Two process standards[9] related to water management are also included

[9] The potential inclusion of only grey solutions in ISO 24536:2019 introduces uncertainty on this standard

- Closely related: Standards that could include or could be adapted to NbS. It considers a wide range of terminology and process standards related to sustainability or climate change adaptation, as well as others that include indicators or forms of assessment. Some process standards related to stakeholders' engagement, horizontal coordination or communication are also included.
- Related: Standards that may be related to the NbS, but in a more indirect way, either because of their content or because of who they are addressed to (e.g. an organisation or company).

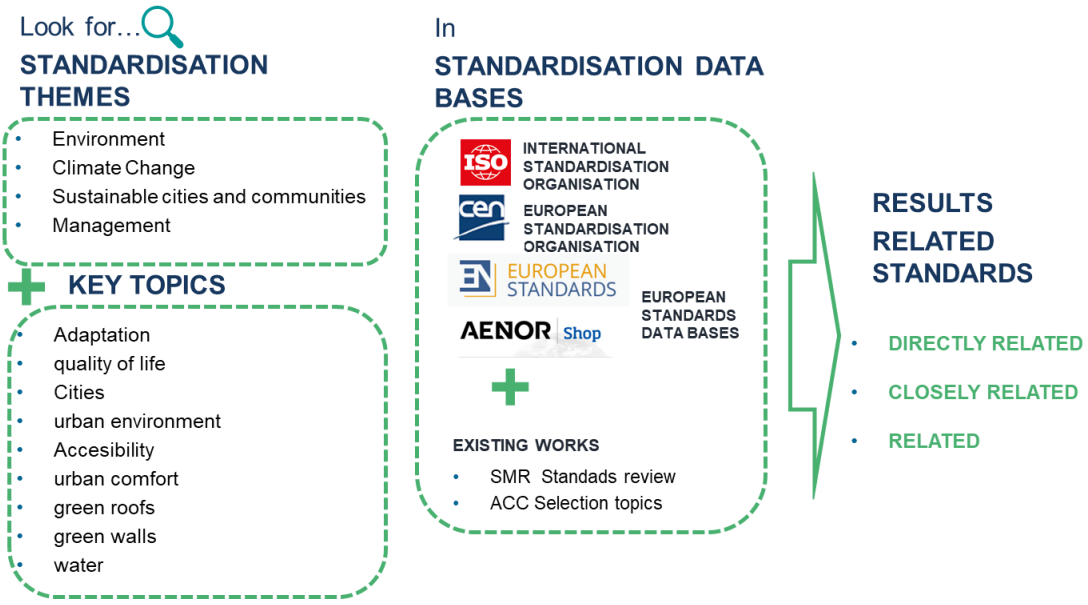


Figure 22. Summary of the formal standard search methodology and its classifciation

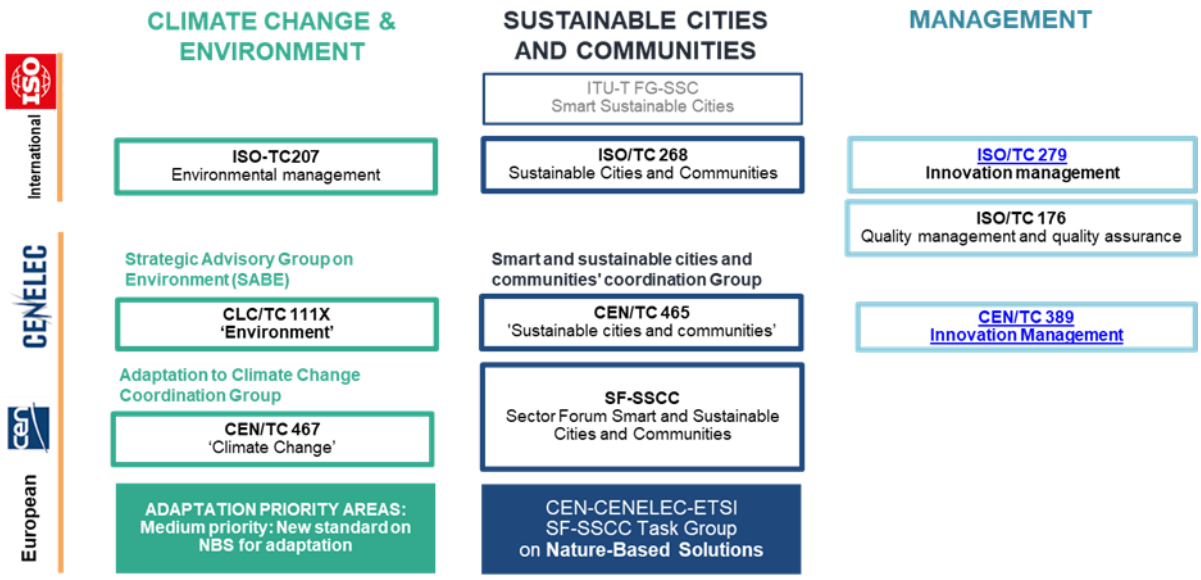


Figure 23. Search based on the documents developed by the shown tecnalical committees

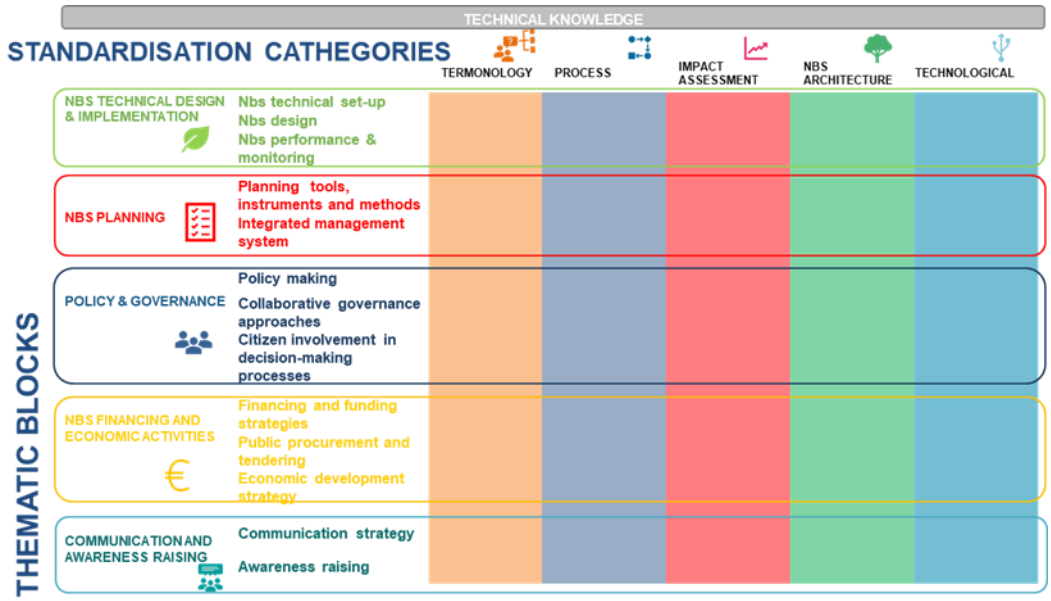


Figure 24. Categorisation of formal standards based on the CLEVER Cities thematic blocks and standardisation categories

3.2.2. Informal standardisation discussion

While the significance of informal standardisation has been acknowledged, there has been a lack of systematic analysis for this report. For this report, informal standardisation has been addressed through the selection of three good practices and the development of the NetworkNature workshop: *The way towards high quality NbS and standards: What we learned so far in the framework of the NetworkNature Semester "NbS and Standards".* The objective was to shed light on the current understanding within the NbS community on harmonised procedures and assessments as well as to identify good practices, and share the knowledge gained from the NetworkNature workshop. Valuable insights were gathered to advance the understanding and implementation or upscaling of high-quality NbS and standards.

3.3. Formal standardisation landscape

At the international level, the ISO oversees two TC, ISO/TC 207 for Environmental Management and ISO/TC 268 for Sustainable Cities and Communities. These committees are closely aligned with the themes related to NbS, although it is worth noting that the definition of NbS architecture may span across different TCs.

Within the European context, the CEN has two TCs focused on similar topics. CEN/TC 467 for Climate Change and CEN/TC 465 for Sustainable Cities and Communities play a significant role in standardisation efforts. Moreover, there is a sector forum that shares an interest in these areas. CEN/TC 467 considers NbS as one of their priorities within their standardisation roadmap. Conversely, CEN/TC 465 focuses not only on smart sustainable solutions but also on NbSs. Both TCs are actively involved in leading and promoting the standardisation of NbSs, despite the absence of concrete projects at the moment[10].

[10] NOTE: At the writting, but not in the search phase, of this document ISO/TC467 has iniciated the process to propose a NWIP (New Work Item Proposal) on NbS terminology

Furthermore, individual countries may have their own national standards focused on specific NbS aspects, such as green roofs or green facades. These national standards cater to the unique needs and contexts of each country, providing guidance and specifications for implementing specific NbS practices at a local level.

3.3.1. Structure of the technical committees

This section explains the structure of the TC at international and European level and the themes addressed by each subcommittee and active Working Group (WG).

i) Climate change and Environment

ISO/TC 207 Environmental management

The the internatipnal committee on environamntal management (ISO/TC207[11], Figure 25) focuses on environmental management and develops standards to promote best practices in this field. It consists of six subcommittees and associated working groups that cover areas such as environmental management systems, auditing, labelling, performance evaluation, life cycle assessment, and greenhouse gas management. ISO/TC 207 aims to support global sustainable development and aligns with 16 of the 17 United Nations Sustainable Development Goals (UN SDGs). It collaborates with other ISO committees to address areas of overlap and prevent duplication of standards. The committee's vision is to provide solutions for managing environmental challenges, while its mission is to develop environmental management standards that address environmental and climate impacts, including social and economic aspects.

[11] ISO/TC 207 - Environmental management

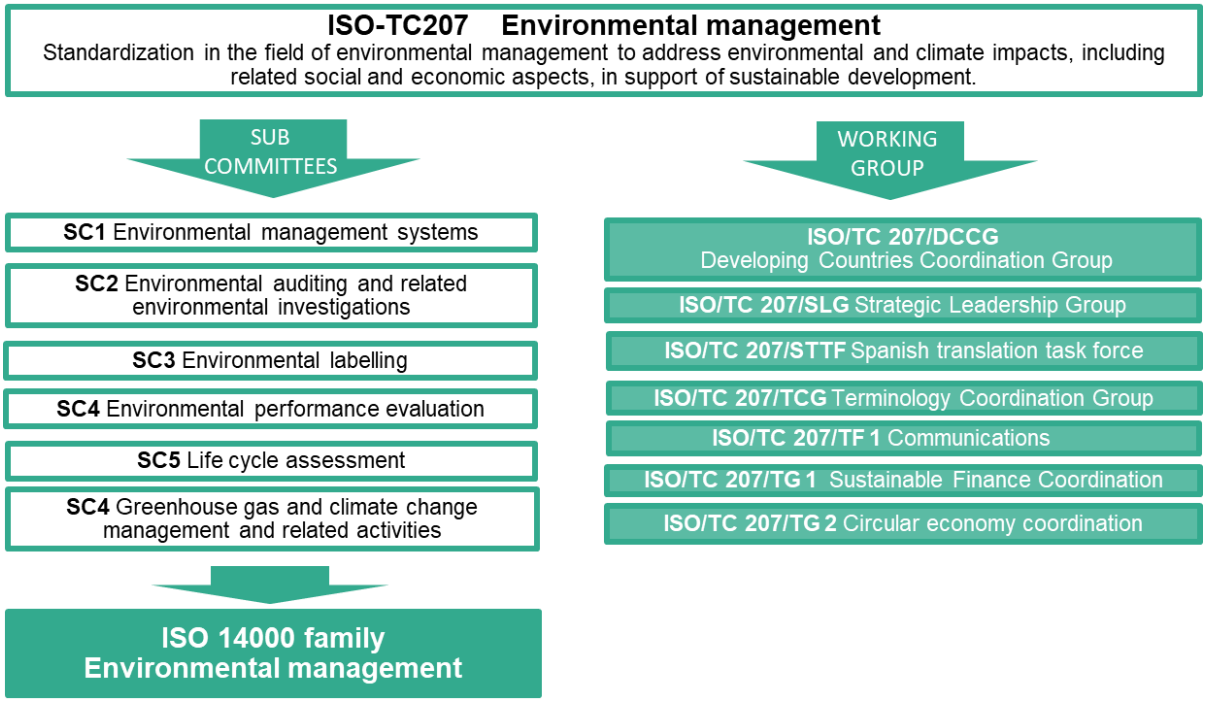


Figure 25. ISO/TC207 Structure

CEN/TC 467 on Climate Change

The Strategic Advisory Body on Environment (SABE) provides strategic advice on environmental matters related to standardisation. Its purpose is to promote the integration of environmental aspects into CEN's work and offer forward-looking advice on addressing future environmental challenges through standards. SABE became a joint body between CEN and CENELEC to emphasize the importance of environmental issues for both organizations. SABE maintains horizontal teams and topic groups to address environmental issues universally applicable in standardisation. On the other hand, the CEN-CENELEC Coordination Group 'Adaptation to Climate Change' (ACC-CG) coordinates standardisation activities in response to the EU Strategy on Adaptation to Climate Change. The ACC-CG supports the revision and development of standards for climate-resilient infrastructures in vulnerable sectors such as construction, transport, and energy. It also focuses on linking standards to future climatic conditions, scaling adaptation measures at the European level, and addressing climate change adaptation in other infrastructure standards.

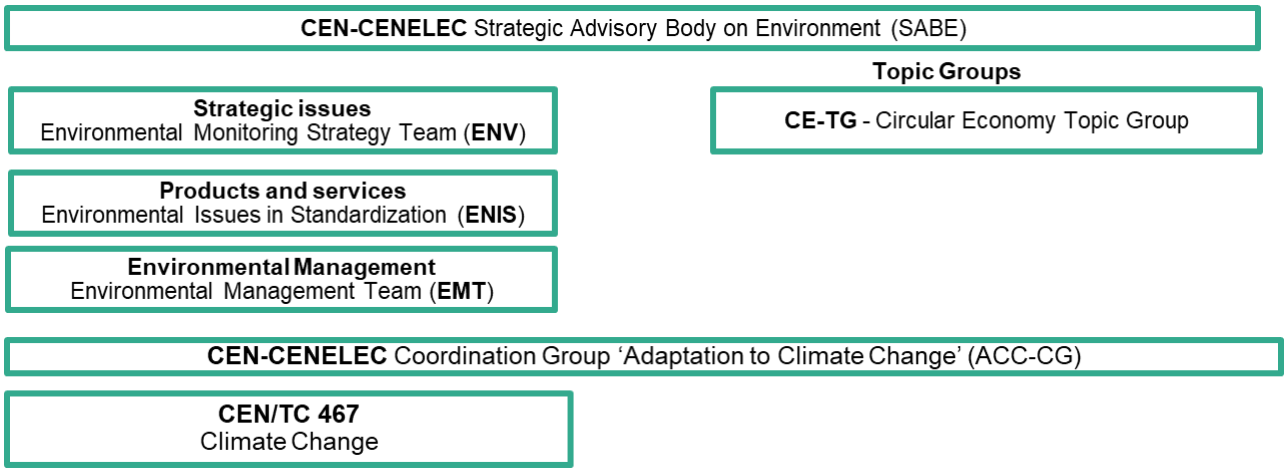


Figure 26. CEN/CENELEC Environment field structure

The aim of CEN/TC 467 is to facilitate dialogue between national standardisation bodies and CEN/ISO standardisation committees. It promotes standardisation on Climate Change issues at the local level (national, regional, and municipal administration), as well as standardising carbon footprint quantification. The committee intends to provide guidance on utilising future climate information, implementing ISO standards at the European level, and standardizing sectoral decarbonisation plans, procedures, and strategies for companies. The adoption of ISO/DIS 14068 *Greenhouse gas management and climate change management and related activities — Carbon neutrality*, which addresses carbon neutrality, is also part of their work.

This TC has stablished the following priotities where NbS has been included.

Mitigation priorities:

- Developing a standard for quantifying the carbon footprint of events.
- Establishing standards for Sectoral Decarbonization Plans.
- Standardisation on Climate Change at the local authority level.
- Proposal for a new area focused on Consumption-based GHG accounting.
- Developing guidance for the implementation of ISO standards specific to the EU.

Adaptation priorities:

- Creating documents on the use of climate information, expanding beyond the construction sector covered by ACC-CG documents.
- Developing a new standard on adaptation for:
    - Water supply and treatment infrastructure, drainage, and flood protection (high priority, possibly with documents for the local level).
    - Drought-resistant agriculture (medium priority, requiring additional expert input).
    - **Nature-based solutions for adaptation** (medium priority).
    - Climate resilience solutions for buildings (low priority).

ii) Sustainable cities and communities

ISO/TC 268 Sustainable cities and communities

ISO/TC 268 (Figure 27) focuses on standardisation in the field of Sustainable Development in Communities. The committee aims to assist communities, their suppliers, and service providers in becoming more sustainable and resilient throughout their life cycle. It develops international standards and other deliverables that promote area-based holistic and integrated approaches to sustainable development and resilience. These standards help communities meet their needs, foster collaboration, and communicate their sustainability achievements. The proposed series of International Standards will contribute to consensus-building, cross-sector policies, resource efficiency, and performance assessment in sustainability and resilience. They will provide operational frameworks for communities, facilitate interactions with contractors, and support the achievement of sustainable development goals.

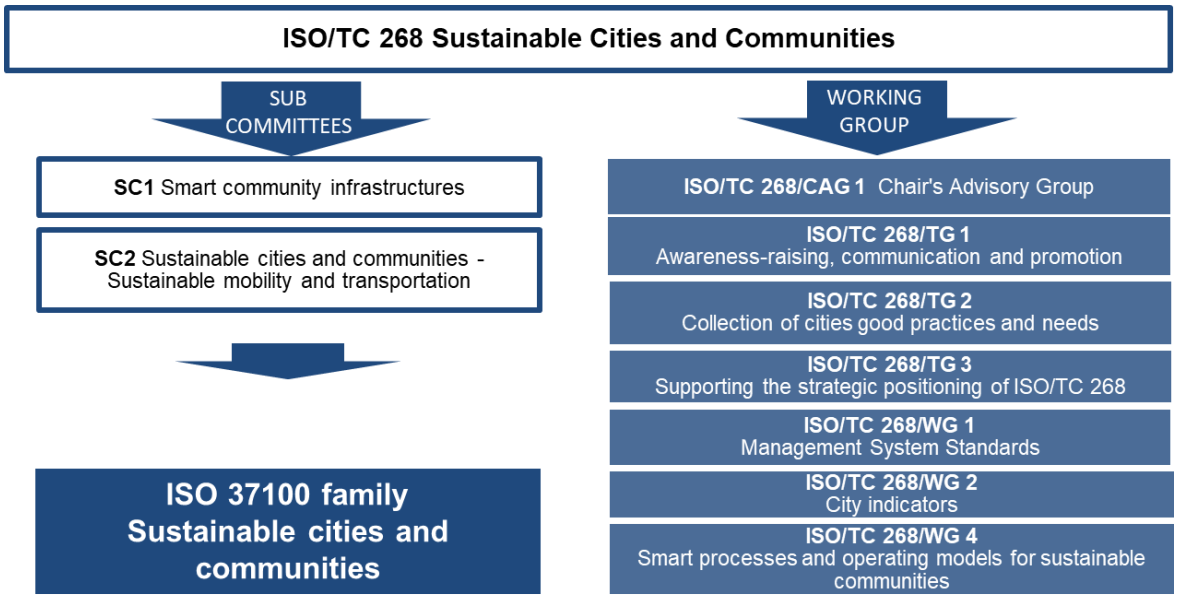


Figure 27. ISO/TC268 structure

iii) Management

ISO/TC 279 Innovation management

The purpose of standardisation in innovation management is to enable organisations to share best practices, promote collaboration, and develop the capability to innovate and bring innovations to market successfully. Sustainable development is essential and should be viewed as a source of innovation, economic development, and competitiveness. Management standards on innovation will help overcome cultural and organizational obstacles, providing best practices for implementation in various types of organizations. The standards will focus on innovation as a successfully implemented new idea and cover areas such as openness, collaboration, degree of innovation, and value creation. The ISO/TC 279 (Figure 28) aims to standardize tools and methods for innovation management, promote common understanding and practices, integrate sustainable development, and ensure coherence with existing international standards. The TC consists of working groups focused on innovation management systems, terminology,

and tools/methods, with potential inclusion of an assessment group. Regular meetings, consensus-building, and collaboration with other TCs and PCs are essential for achieving the objectives of ISO/TC 279.

ISO/TC 176 Quality management and quality assurance

ISO/TC 176 has a vision to maintain world-class quality management standards and related publications that are essential for the success of organizations implementing these documents. The committee's mission is to continually enhance its portfolio of voluntary quality management system standards, publications, and resources that are adopted globally to meet organizational needs. ISO/TC 176 encourages the participation of voluntary experts to represent diverse knowledge and values, and it establishes liaisons with organizations possessing subject matter expertise. The committee strives to ensure the relevance and recognition of its brand worldwide by developing and distributing timely standards reflecting state-of-the-art quality management practices. It also focuses on reducing industry-wide proliferation of standards and develops supporting technology standards to guide organizations in improving their performance through robust quality management systems.

ISO/TC 176's scope includes standardisation in the field of quality management, including generic quality management systems and supporting technologies. Additionally, the committee engages in quality management standardisation in specific sectors as requested by those sectors and the ISO Technical Management Board. ISO/TC 176 also serves an advisory function to all ISO and IEC technical committees to ensure the integrity of generic quality system standards and effective implementation of ISO/IEC sector policy on quality management systems deliverables. The committee operates through its subcommittees: SC1 for concepts and terminology, SC2 for quality systems, and SC3 for supporting technologies in quality management and assurance.

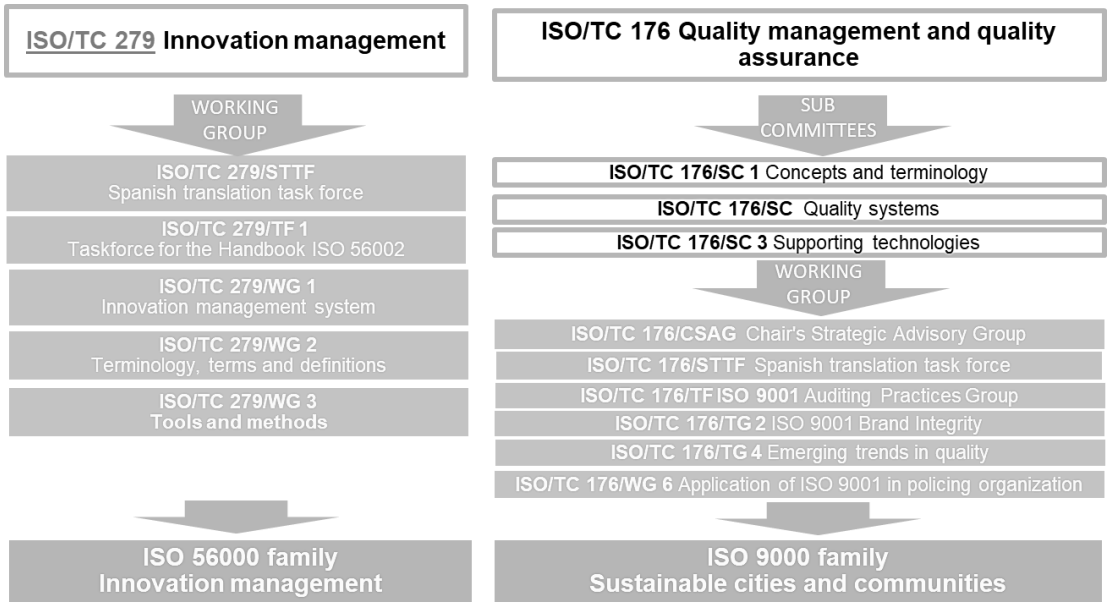


Figure 28. ISO/TC 279 and ISO/TC 176 Structure

3.3.2. Characterisation and presentation of standard search outputs

The search and analysis of standards were conducted in a two-step procedure. Initially, all standards obtained through keyword searches in the search engine were gathered (last search carried out May 2022). Subsequently, based on the title, abstract, or scope of each standard, they were classified as directly related, closely related, or related (see description in the box below). It is important to note that accessing standards typically requires a subscription or payment, which means these findings should be considered preliminary and approached with caution.

- Directly related: Standards that directly involved NbS technical design & implementation or are applied to NbS processes (e.g. planning, financing, governance, communication etc.
- Closely related: Standards that could include or could be applied/adapted to NbS.
    - It considers a wide range of terminology and process standards related to sustainability or climate change adaptation, as well as others that include indicators or forms of assessment. Some process standards related to stakeholders' engagement, horizontal coordination or communication are also included
- Related: Standards that may be related to the NbS, but in a more indirect way, either because of their content or because of who they are addressed to (e.g. an organisation or company).

After analysing the title and scope of the standards, a subset of 257 standards (from an initial pool of 500) was identified as potentially relevant to the study. Among these, the majority were associated with NbS technical design and implementation, followed by NbS planning (Figure 29). However, out of the 257, only 39 standards were considered closely related. Notably, most of these closely related standards (specifically 37) pertained to NbS architecture.

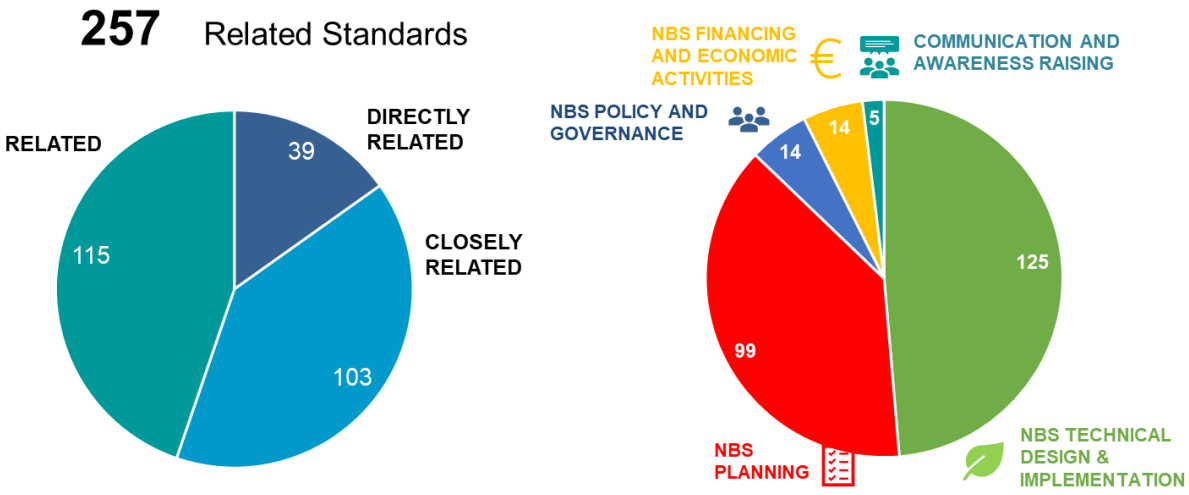


Figure 29. The characterisation of the 257 standards considered that may be of relevancy for the CLEVER Cities

The elements *directly related* cover a range of topics related to building construction, sustainability, landscaping, and water management. These topics include greening of roofs, construction methods for low-rise frame building wall systems, testing and standards for vegetative (green) roof systems, design and maintenance guidelines for green roofs, codes of practice for flat roofs and general landscape operations, tree-related recommendations, water supply systems, rainwater harvesting and reuse, permeable pavements, protection of watercourses and coastlines, thermal performance of building components, and flood protection works. These range of topics that can be grouped into the following general themes:

1. Flood protection and stormwater management
2. Green infrastructure and vegetation
3. Landscape and grounds maintenance

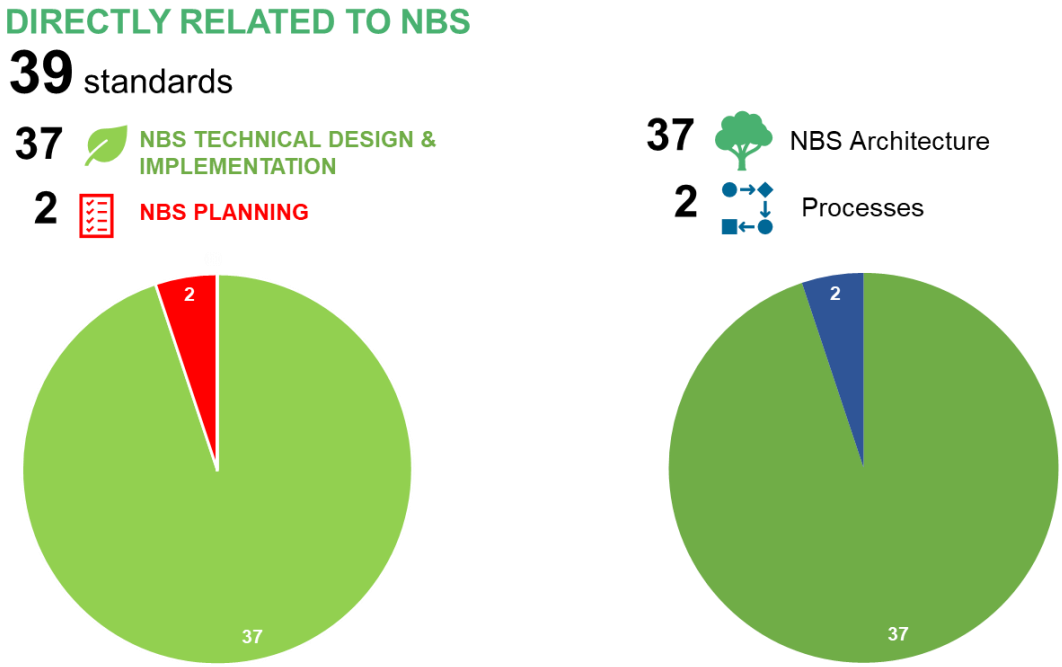


Figure 30. The characterisation of the 39 standards considered directly related to NbS

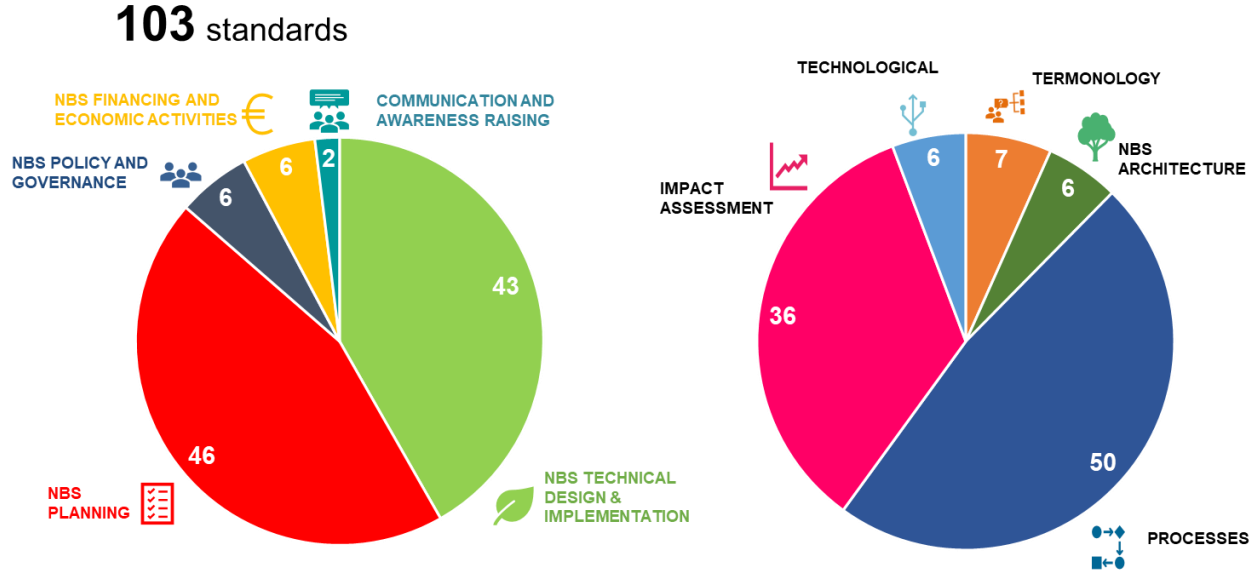


Figure 31.The characterisation of the 103 standards considered closely related to NbS

The standards within the group of *closely related* deal with themes such as sustainable cities, environmental management, energy performance of buildings, climate change adaptation, smart cities, and resilience. It covers topics such as urban planning, environmental assessment, greenhouse gas management, water management, quality management, and stakeholder engagement.

The elements listed as *closely related* that address NbS technical design and implementation are dedicated to sustainable cities and communities, building design and performance, environmental management, energy efficiency, water management, greenhouse gas emissions, flood resistance, climatic data, smart city infrastructure, and sensor network applications. More specificatlly, these include guidelines for phased implementation of sustainable practices, indicators for assessing city services and quality of life, sustainability assessment of buildings and civil engineering works, energy performance indicators, testing methods for infiltration rate and reflectance, water footprint assessment, hydrometry measurement, greenhouse gas management and verification, carbon neutrality demonstration, environmental assessment and risk management, smart community infrastructure, climatic data for building performance, smart city asset management, and deployment guidelines for sensor network applications in climate change mitigation.

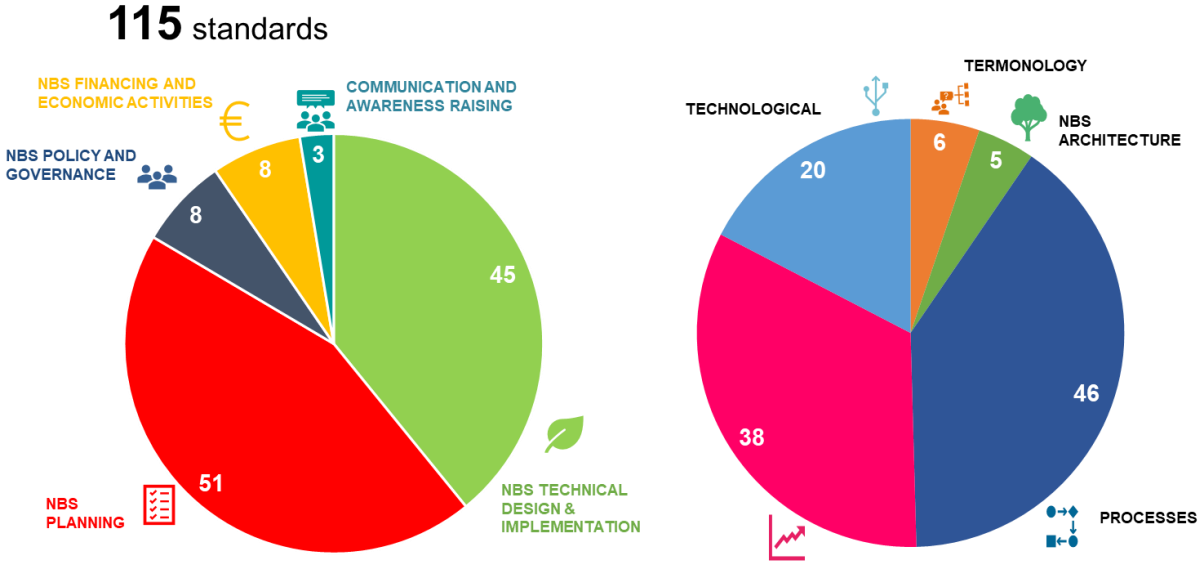


Figure 32.The characterisation of the 115 standards considered related to NbS

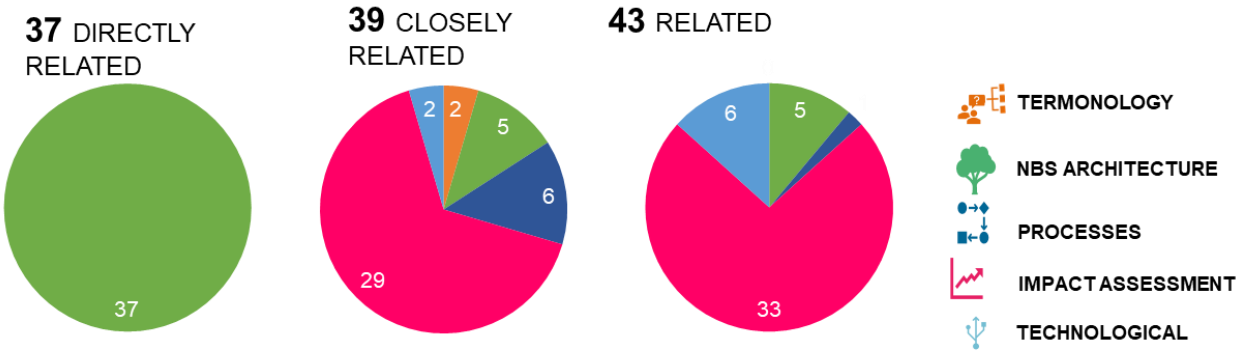
The list of *related* standards covers a wide range of themes related to environmental management, sustainability, quality management, innovation management, smart cities, and information technology. Some of the main topics covered include environmental due diligence assessment, remote auditing of environmental management systems, life cycle assessment, greenhouse gas quantification and reporting, energy efficiency calculation, smart city concepts and infrastructure, quality management systems, innovation management, and guidelines for smart city implementation. The standards and guidelines provide principles, requirements, and guidelines for various aspects of environmental management, sustainability, quality management, and smart city development, offering valuable guidance and tools for organizations and communities to improve their environmental performance, operational efficiency, and overall sustainability. In summary, these documents provide environmental, sustainable and quality frameworks.

3.3.3. Thematic results

The results can also be analysed based on the CLEVER Cities thematic blocks. This sections presents a brief summary of them.

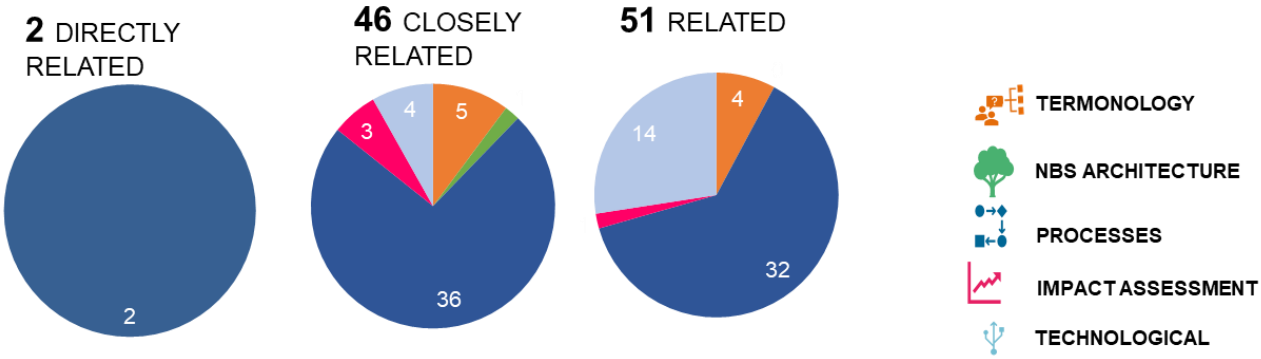
i) NbS Technical Design & Implementation

The majority of the identified standards, including both published and under development (125 standards published + 10 under development), fall into the category of NbS architecture. However, there are also several standards in the closely related or related group that cover topics related to impact assessment.



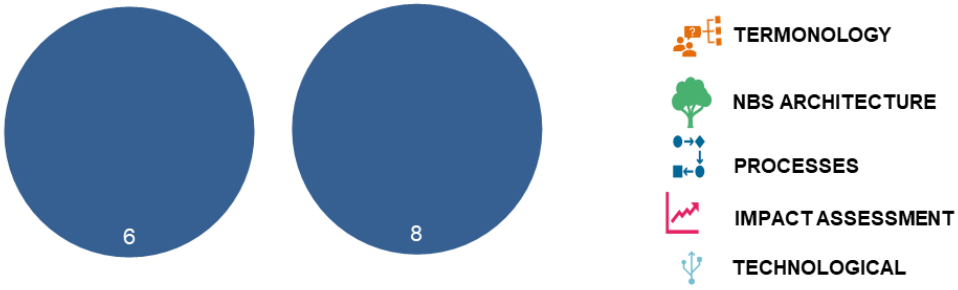
ii) NbS Planning

This group of standards is the second largest in terms of quantity, consisting of 80 published standards and 19 under development. It is noteworthy that a significant portion of the standards across all three categories (*directly related, closely related and related*) are focused on providing processes and guidelines.



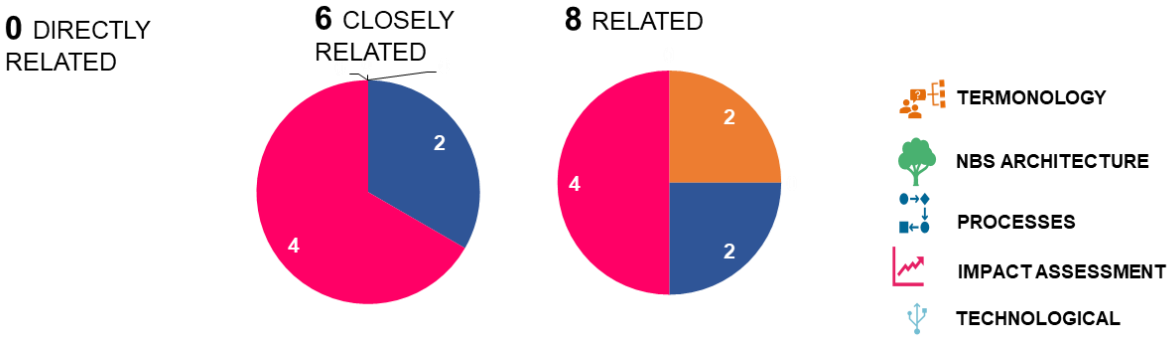
iii) NbS Policy and Governance

The standards in this category (13 published standards + one under development) cover a range of topics, including quality management systems, stakeholder engagement protocols, innovation partnerships, and management practices, among others. All standards describe processes around the previous themes.



iv) NbS Financing and Economic Activities

Within this group of standards the majority eight out of 14 (three of them under development) are linked impact assessment.



The closely related standards cover several important aspects. They include determining the environmental costs and benefits of projects, assessing the monetary value of environmental impacts, establishing mechanisms for financing local climate change adaptation, providing frameworks for assessing and reporting climate change-related investments and financing activities, and offering guidance on environmental criteria for projects to support green finance. These standards enable the evaluation, monetary valuation, financing, and support of environmentally sustainable initiatives, climate change adaptation, and the advancement of green finance.

On the other hand, the related standards address various aspects related to smart city development and environmental performance evaluation. For example, one standard focuses on the eco-technoeconomic analyses which provides principles, requirements, and guidelines for conducting analyses that assess the environmental and economic impacts of eco-technologies.

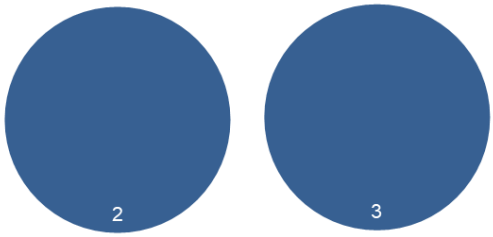
v) NbS Communication and Awareness Raising

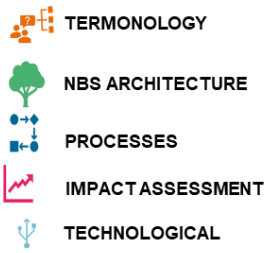
While closely related standards address topics such as environmental communication guidelines, an example of a related standard is the 'Best Practices for the Use of Social Media'.

0 DIRECTLY RELATED

2 CLOSELY RELATED

3 RELATED





3.4. Informal standardisation (NetworkNature Policy Brief)

Although a detailed analysis has not been performed for informal standarisation, a few guides, a handbook, and informal standards showcase good practices on methodologies and aspects related to NbS, that could be considered good practices on standarisation.

These reference documents were discussed during the Network Nature Workshop "*The way towards high-quality NbS and standards: What we learned so far"*, held on 26th July 2022. Through these reflections/discussions, the following examples in three different scales have been identified: International, European, and National.

3.4.1. Informal Standardisation examples

i) At the international level, the IUCN Global Standard and IUCN Mediterranean Standards, presented by Andrés Alcántara (Coordinator at IUCN Mediterranean Centre).

The IUCN has been working for a long time with Nature-based Solutions[12] and their implementation. As a part of their experience, IUCN has developed standards and indicators, and therefore, they led the development of a Global Standard on NbS, which aim is to "*help users design, implement and verify NbS actions providing clear parameters for defining NbS and a common framework to help benchmark progress*" (IUCN Global Standard for NbS).

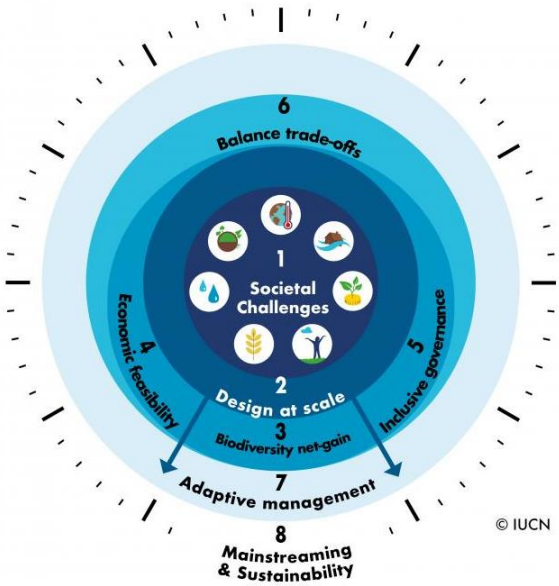


Figure 33. IUCN Global Standard 8 Criteria. Source. IUCN (2020)

[12] '*Actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits*.' UNEA-5 resolution

The IUCN Global Standard for NbS sougth to establish a robust framework for designing and verifying NbS, avoiding a rigid regulatory framework. The main purpose was to assist users in the implementation and continuous improvement of the effectiveness and sustainability of NbS, as well as the verification of results. Within the seven societal challenges that NbS addressed bythe framework (Climate change mitigation and adaptation, Disaster risk reduction, Economic and social development, Human health, Food security, Water security and, environmental degradation and biodiversity loss), there are eight criteria and 28 indicators (see Figure 33). As a part of the initial stage, a self-assessment tool has been proposed with which users can evaluate how well the assessed intervention matches eight criteria established by IUCN.

An example of the use of this standard in the project Planning and delivering Nature-based Solutions in the Mediterranean cities, which was the first assessment of the IUCN Global Standard in Mediterranean urban areas. In this project, NbS IUCN Standard has been implemented in 18 Mediterranean cities, where four NbS project types were identified:

- Type 1:Urban regeneration in global Change context.
- Type 2: Climate change and water resilience.
- Type 3: Coastal resilience under rising seas.
- Type 4: Mature projects.

Based on a semi-quantitative analysis of the results and after a cross-checking with the stakeholders, the IUCN Global standard application showed the relationship of the NbS analysed with the societal challenges.

ii) At European level, the assessment handbook "Evaluating the impact of Nature-based Solutions: a handbook for practitioners" developed by the EU NbS Task Force 2 and presented by Laura Wendling (Senior Scientist at VTT Technical Research Centre).

Usually, the performance of NbS and their impactsare considered from an individual point of view. However, standards and a common assessment framework can be really useful in order to "*develop an in-depth, common understanding of both the potential benefits of Nature-Based Solutions and any associated trade-offs*" (Wendling, 2022).

- The integrated impact assessment framework was developed by Task Force 2 (in collaboration between 17 EU-funded projects and related programmes). Gathering the most relevant existing informationto establish a common ground, was the main objective. As a result, the procedure collected 426 different indicators and methodologies in 12 societal challenge areas. These results also include:Evaluating the Impact of Nature-based Solutions: A Handbook for Practitioners that *serves as a guide for the development and implementation of scientifically-valid monitoring and evaluation plans for the evaluation of NbS impacts.*
- Appendix of Methods and the Summary for Policymakers that *provides a brief description of each method, along with guidance about the appropriateness, advantages, and drawbacks of each in different contexts.*
- *A Summary for Policymakers that include key points highlighted.*
- *Framework of common indicators and methods for assessing the performance and impact of diverse types of NbS:*
    - *A reference for relevant EU policies and activities.*
    - *Orients practitioners in developing robust impact evaluation frameworks for NbS at different scales.*

- *Comprehensive set of indicators and methodologiesa*

iii) At a national level, the Guide to municipal green infrastructure of Spain, presented by Gabino Carballo (Landscape architect and Project manager. Technician of the Conservation and Biodiversity Division of Parks and Gardens of Barcelona. Member of AEPJP)

The initiative was born from the need to explain to the practitioners that oversee green spaces what a green infrastructure is and NbS are. Specifically, regarding the timespan of the solution or projects since green spaces need to be maintained and managed. The initiative aims to help the green space managers and companies that work for the municipality to develop, implement, and maintain successfully this kind of solutions.

A diverse set of associations of green space managers ASEJA (Asociación de Empresas de Gestión de Infraestructura Verde (Spanish)/ Association of Green Infrastructure Management Companies), FEMP (Federación Española de Municipios y Provincias (Spanish)/ Spanish Federation of Municipalities and Provinces), the Biodiversity Network ("Red Biodiversidad"), Spanish Association of Parks and Gardens worked together to transform early-stage ideas into practical and applicable results in the Municipal Green Infrastructure Guide in 2019.

Nature-based Solutions were the core of this guide, which looked for international standards, norms, and regulations to improve NbS significance and how the information related to them is narrated to improve how NbS are perceived.

As a result, the guide proposes a framework where NbS can be understood by practitioners and professionals to boost NbS development and deployment, as well as allow a better understanding of NbS for politicians and the public. The guide relies on the acknowledgment that green space managers are becoming NbS prescribers on the ground in terms of application, derived from ideas such as urban space renaturalisation or the concept of resilience.

The guide was successfully received and it has been one of the pioneer tools available as an online resource published by the Spanish Government.

3.4.2. Informal Standardisation discussion

After a brief presentation of best practices and their possible relationship with standardisation, a round table including all the speakers was held. The goal was to discuss the following questions:

i) what elements of the presented experience could be subject of formal standardisation?

According to Dora Almassy, thanks to the IUCN global standard, there is, in general, a good understanding of what is expected of NbS. However, local governments, developers, green spaces managers, etc. need more support in the NbS implementation phase. Therefore, is considered a priority the standardisation of tools that help implementation, such as the *Guide to municipal green infrastructure.*

Laura Wendling noted the need for *standardisation of monitoring of both the process and the NbS implemented, which could help to understand NbS effectiveness.* In addition, Gabino Carballo pointed out that the existence of metrics that show or allow calculating the return on investment is considered key. On the other hand, Laura Wendling highlighted the importance of process standarisation, although it was not considered a priority in the results of the questionnaire. She argued that it is difficult to say whether the benefits of implementing an NbS can be separated from the co-design, co-implementation, or co-monitoring process. In addition, Andrés Alcantrá pointed out that standards, from a planning perspective, must also be considered. And Ángela Matesanz, pointing to the result of the questionnaire, said that the standardisation of common terminology is a priority in order to be able to develop the rest of the standards.

ii) what benefits would be related to that formal standardisation?

The main benefit noted was that standardisation favors the implementation of the NbS.

More specifically, Laura Wendling considered:

- on the one hand, that the "*use of standard metrics and protocols clarifies processes and enables comparisons among different NbS actions; supports knowledge retention and consistent quality of monitoring data".*
- *and on the other hand, that "standardisation of NbS processes and technical design can improve process clarity, and quality & predictability of outcomes Standardisation of co-creation and co-management processes associated with NbS actions can help guide stakeholder engagement, ensure adherence to NbS principles", such as IUCN guidelines.*

In the same line, Gabino Carballo highlighted that standards could provide safety and confidence in NbS use and could be very useful for measuring the effects of these NbS and making it easier to obtain investment. It could also incentive the use of NbS by the private sector, which is a key for the NbS mainstreaming in our cities.

However, the audience and Laura Wendling warned that if we standardise too much, we risk becoming too rigid and block the innovation. Nevertheless, other speakers considered that it is difficult that this will happen, as many local specificities must be considered in the design and implementation of the NbS.

iii) key conditions or suggestions for developing that standardisation.

The IUCN standard was considered a great step in the NbS standardisation. Test on concrete examples how standardisation is working in practices and use the feedbacks and the comments to feed into the processes and to improve that standards was proposed as a next step. Considering the IUCN proposal, it could be useful to create a standardise framework for determining how closely are the specific NbS implementation actions aligned with these guidelines. Finally, capacity building of civil servants and people that work urban planning issues, and strategic plans for cities were pointed out as a key for the standardisation process.

4. Cross-checking of results of the NbS Landscape and the review of the existing standards

This section highlights the needs and importance on advancing on the standardisation of NbS in the following types of standards. The section discusses the need for harmonisation of terminology and classification in the field of Nature-based Solutions (NbS). It highlights the importance of clear and consistent definitions to promote better collaboration, policy development, and scientific research in addressing environmental challenges such as climate change, biodiversity loss, and urbanisation. Furthermore, the section also emphasizes the need for technical references and standards, improved planning processes, business and finance opportunities, monitoring and evaluation strategies, and assessment methodologies in the context of NbS.

4.1.1. Terminology

One of the basic issues, which conditions both the use of NbS and the possible development of some of the elements/processes[13], is the existence of an agreed, accessible, and clear terminology that allows information and know-how to be spread.

Several NbS definitions have been established by different organisations or programs, such as:

- UNEP resolution on Nature-based Solutions for supporting sustainable development adopted by United Nations Environment Assembly (UNEP/EA.5/Res. 5[14])
- EU Commision definition[15]

While IUCN, with its '*Global Standard for Nature-based Solutions*', IUCN (2019), sets the criteria for designing and verifying NbS so that it yelds the set social, economic and environmental benefits wile supporting biodiversity and ecosystemservices.

Yet, there is some ambiguity on what technical solutions or actions and what not, among other things, because there is no harmonized vocabulary. Despite guidelines to clarify common misuses of NbS have been recently published (Roca Vallejo, 2023), there is a need to set standars on NbS and related terms that would contextualise the NbS, provide examples, characterise them based on certain criteria and address potential misconceptions.

Addressing these gaps requires ongoing dialogue, collaboration, and iterative refinement of the classification and terminology of NbS and related terms. It is essential to engage stakeholders from different sectors and disciplines to ensure a holistic and inclusive approach.

[13] Such as a process to achieve political consensus and commitment that legitimizes NbS, a planning process on how to improve the processes of co-design, a planning process on how to strengthen capacity building or a process for developing an effective communication and awareness-raising strategy

[14] United Nations Environment Programm: nature-based solutions are actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits

[15] EU Commision: "Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions." Nature-based solutions must therefore benefit biodiversity and support the delivery of a range of ecosystem services.

Any NbS standard on terminology should consider publish or ongoing terminology standards addressing the societal, economic and environmental challenges, like sustainability, climate change[16], biodiversity[17] etc. The development of this standardisable element requires the joint reflection of a working group, which on the one hand, establishes the basic common terms, and on the other hand, deepens on the definition of e.g. NbS typology, classification and/or characterisation.

Standardising or harmonising the terminology and associated terms of NbS is crucial for several reasons:

- **Clarity and Consistency:** NbS encompasses a wide range of approaches that utilize nature and natural processes to address environmental challenges. Standardizing the terminology helps establish clear and consistent definitions for different NbS types, ensuring that everyone involved in NbS research, policy, and implementation understands and communicates ideas effectively. It minimses confusion, promotes better collaboration, and enables comparison and evaluation of different solutions.
- **Policy Development and Implementation:** Governments and international organisations are increasingly recognising the importance of NbS for addressing environmental challenges such as climate change, biodiversity loss, and urbanisation. Standardised terminology provides a foundation for policy development and implementation, ensuring that policies are coherent, comprehensive, and effective across different jurisdictions. It enables policymakers to communicate and align their efforts, set clear targets, and monitor the progress of NbS initiatives.
- **Scientific Research and Evaluation:** A standardised classification system for NbS provides a framework for scientific research and evaluation. It allows researchers to compare different NbS approaches, assess their effectiveness, and identify knowledge gaps and areas for further investigation. By using consistent terminology, researchers can build on existing studies, aggregate data across multiple studies, and generate robust evidence to inform decision-making and policy development. This enhances collaboration, accelerates learning, and enables the development of innovative and effective solutions.

In terms of NbS classification different efforts have been put forward by some organisations and projects:

- IUCN, with its Global Standard for Nature-based Solutions‘ criteria, that relates NbS with major societal challenges addressed, ecological complexity and ecosystem services and with their scale.
- The EU taxonomy that looks for a common language and a clear definition of what is ‘sustainable’ and it is closely related to NbS.
- The publications *Nature-based solutions: state of the art in EU-funded projects*, which is based on a global analysis of the projects and knowledge developed in the field of NbS, has established a chapter classification, and *Evaluating the impact of nature-based solutions : a handbook for practitioners*, which propose three NbS‘ types.
- The publication *ThinkNature Nature-Based Solutions Handbook* that studied different NbS classifications and propose its own.
- Or several projects, such as CLEVER, that have proposed their own NbS classification.

[16] ISO 14090:2019 Adaptation to climate change – Principles, requirements and guidelines

[17] ISO/WD TS 13208 Biodiversity – Vocabulary

However, despite these efforts there are still some gaps in the classification of NbS and associated terminology:

- **Lack of Consensus:** NbS is a relatively new and rapidly evolving field, and there is still ongoing debate and discussion about the precise boundaries of different NbS types.
- **Contextual Variation:** NbS applications can vary significantly based on local ecological, social, and economic contexts. Thus, boundaries and criteria to characterise NbS regardless of the context are needed. Thus, there is still some work to be done to reach to a consensuss on the criteria and their flexibity while capturing the full diversity of NbS approaches.
- **Interdisciplinary Nature:** NbS involves the integration of ecological, engineering, social, and economic principles. Standardising terminology across these diverse disciplines can be complex. It requires collaboration and coordination among experts from different fields to develop a comprehensive and inclusive classification system.
- **Evolving Knowledge:** As scientific understanding of NbS advances, new concepts, approaches, and terminology emerge. The classification system needs to be adaptable and responsive to evolving knowledge to reflect the latest research findings and technological advancements.

In this document, the conceptual framework for the classification of NbS in various initiatives, programs, and documents is analysed. The objective of this analysis is to assist and advance the classification as part of the definition and characterisation of NbS (Table 9Table 11).

Table 9. Classifications analysis. Classifications that consider main goal, benefits, or major challenge

CHALLENGES	EU taxonomy	EC (2021a)	ThinkNature (2016)	UN SDG. EKLIPSE [118]	EC (2015) MEA (2005)[1]	IUCN (2020) Criterion 1, 3 & 2[19]	Ecosistems Services WWF, 2016	EC (2021b)	CLEVER
CLIMATE	Climate change mitigation	Climate change mitigation	n/a	Climate mitigation and adaptation	Carbon sequestration	Climate change mitigation and adaptation[20]	n/a	n/a	n/a
	Climate change adaptation	Microclimate regulation							Climate change adaptation
FLOOD	n/a	Flood mitigation and coastal resilience		Coastal resilience	Flood protection Local climate regulation	Disaster risk reduction			n/a
WATER	The sustainable use and protection of water and marine resources	Improving water quality and waterbody conditions		Water management	Water purification	Water security	Regulation		
CIRCULAR ECONOMY	The transition to a circular economy			Potential of economic opportunities and green jobs	n/a	Economic and social development	n/a		
POLLUTION	Pollution prevention and control	air quality		Air quality	Air quality regulation		n/a	n/a	
ECOSYSTEMS & BIODIVERSITY	The protection and restoration of biodiversity and ecosystems	n/a		Green space management	Maintaining populations and habitats	Environmental degradation and biodiversity loss			
URBAN	n/a			Urban regeneration			n/a		Urban regeneration
				Participatory planning and governance					n/a
				Social justice & cohesion					Social justice & cohesion
HEALTH				Public health and well-being	Pest and disease control	Human Health			Wellbeing and security
FOOD						Food security	Provisioning		n/a
ECOSYSTEM FUNCTIONS					Soil formation and composition		Supporting		

[18] ThinkNature / Nature-Based Solutions Handbook

[19] Criterion 1: NbS effectively address societal challenges; Criterion 2: Design of NbS is informed by scale Criterion 3: NbS result in a net gain to biodiversity and ecosystem integrity

[20] Major societal challenges addressed by NbS. The first six challenges, from left to right, were formulated within the IUCN definition (IUCN, 2016). The seventh societal challenge, reversing ecosystem degradation and biodiversity loss, was an outcome of the second public consultation on the Standard © IUCN

Table 10. Classifications analysis. Classifications that consider ecosystem intervention type and ecosystem services provided

CLASSIFICATION CRITERIA	EU taxonomy	EC (2021a)	ThinkNature (2016)	UN SDG. EKLIPSE [121]	EC (2015) MEA (2005)[1]	IUCN (2020) Criterion 1, 3 & 2[22]	Ecosistems Services WWF, 2016	EC (2021b)	CLEVER
ECOSYSTEM INTERVENTION	n/a	n/a	Better use of protected/ natural ecosystems	n/a	n/a	Services from natural ecosystems	n/a	Minimal or no intervention in ecosystems (maintaining or improving the delivery of ecosystem services within and beyond the protected ecosystems)	n/a
			Sustainability & multifunctionality of managed ecosystems			Managed or restored ecosystems		Extensive or intensive management approaches seeking to develop sustainable, multifunctional ecosystems and landscapes	
			Design and management of new ecosystems			Creation of novel ecosystems		Characterised by highly intensive ecosystem management or creation of new ecosystems	
ECOSYSTEM SERVICES	n/a	n/a	n/a	n/a	Fisheries and aquaculture	n/a	n/a	n/a	n/a
					Water for drinking				
					Raw (biotic) materials				
					Water for non-drinking purposes				
					Raw materials for energy				

21 ThinkNature / Nature-Based Solutions Handbook

22 Criterion 1: NbS effectively address societal challenges; Criterion 2: Design of NbS is informed by scale Criterion 3: NbS result in a net gain to biodiversity and ecosystem integrity

Table 11. Classifications analysis. Classifications that consider the scale

	EU taxonomy	EC (2021a)	ThinkNature (2016)	UN SDG. EKLIPSE [123]	EC (2015) MEA (2005)[1]	IUCN (2020) Criterion 1, 3 & 2[24]	Ecosistems Services WWF, 2016	EC (2021b)	CLEVER
SCALE	n/a	n/a	n/a	n/a	n/a	the parts within the land/seascape	n/a	n/a	Element (local: building, public space)
						the land/seascape itself			Neighborhood / District
						the wider environment around the land/seascape			City
									Territorial scale

In view of these classifications, a threefold classification is proposed in relation to:1) Societal challenges adressed: Primary benefit and co-benefits, 2) Interventions approach, and 3) scale

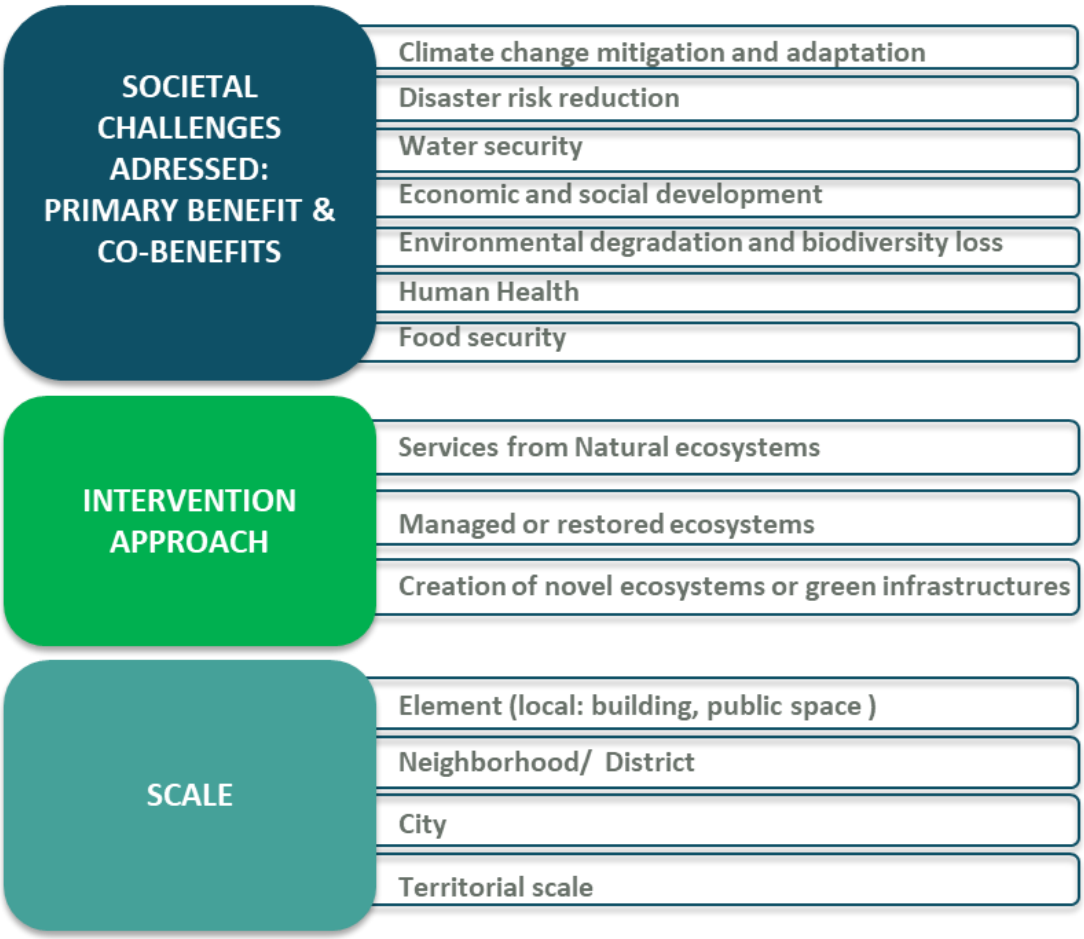


Figure 34. NbS Classification proposal

[23] ThinkNature / Nature-Based Solutions Handbook

[24] Criterion 1: NbS effectively address societal challenges; Criterion 2: Design of NbS is informed by scale Criterion 3: NbS result in a net gain to biodiversity and ecosystem integrity

4.1.2. NbS Architecture:

i) Technical references and standards

This standardised need, which is directly based on terminology and falls under the standardised category of NbS architecture, potentially generates a broad range of standardised elements depending on the type of NbS. It is also likely the area that receives the most specific attention and work.

To facilitate the journey toward standardisation in relation to technical references, it is important to highlight the progress made in other projects, such as RESIN. Although RESIN's focus is not exclusively on NbS but rather on standardisation in urban climate adaptation, it provides valuable insights. Through its analysis of structural (technical or physical) adaptation measures, the project identifies key opportunities, their current status, and priority in the categories under examination (see Table 12).

Table 12. Summary of the analysis and identified needs for standardisation. Source: RESIN project

Category	Key opportunity	Coverage	Status	Priority
I. Flood protection: dry- and wetproofing	Developing European standards for temporary flood barriers which establish performance specifications (e.g. protection up to at least 60 cm flood level and acceptable hourly leakage rate). Possibly using the British PAS 1188 as a template, since it has proven to be effective and is currently already being upgraded to a formal BS standard.	+ + *(+)*	*Medium*	*II*
II. Permanent flood measures	Raising the Dutch NTA on floating construction to a formal national (and possibly international) standard.	+ +	Low	III
III. SuDS / infiltration techniques	Develop general guidance for SuDS as a whole following BS8582 (2013) and relying on the CIRIA *SuDS Manual* (2015), which has extensive technical detail per component as well. Secondly, harmonize the haphazard formal coverage for permeable pavement or develop standards for nature-based measures such as swales.	+ + +	Low / Medium	II
IV. Cool materials	Follow American or Japanese standards for reflective roof coatings, starting with testing methods for solar reflectance.	+ +	Medium	II
V. Energy systems and cooling	Dynamic façade systems may require the revision or development of new standards.	+ + + +	High	III
VI. Green	Develop international standards for green roofs, relying on the	+ +	Low /	I

As described in Section 3, there are some standards available, mainly for green roofs, trees and the landscape of green areas as well as rainwater management guidelines. However, the number of NbS technical solutions cover many other solucions such as blue infrastructure, community gardens, green areas for water management, other nature in building solutions, urban forests, wetlands, coastal NbS…etc. Thus, the need for this type of standards is significant as without comprehensive technical standards for these diverse NbS, there can be inconsistencies, variations in quality, and inadequate implementation of these solutions.

Developing technical standards becomes crucial in this context to ensure that NbS are designed, implemented, and maintained effectively and consistently. Standards provide clear guidelines, specifications, and best practices that enable practitioners, policymakers, and stakeholders to achieve desired outcomes, enhance performance, and promote sustainability. By establishing technical standards

for a wide range of NbS, it becomes easier to assess their effectiveness, measure their impact, compare different solutions, and facilitate knowledge sharing and collaboration.

i. NbS Processes

A process on how to take NbS into account in planning to achieve environmental and sustainable objectives.

The specific gap in this issue lies in the lack of universally accepted and implemented standards for integrating NbS into planning processes. While there is growing recognition of the importance of NbS, there is no widely agreed-upon framework or set of guidelines for incorporating NbS into planning and decision-making. This gap hinders the effective integration of NbS into environmental and sustainable objectives at various levels, including national, regional, and local planning processes.The absence of standardised processes can lead to inconsistent approaches, variations in terminology and definitions, and difficulties in comparing and evaluating different NbS interventions. Standardisation would help bridge this gap by providing a common and clear methodologies, and guidelines that facilitate the systematic consideration and integration of NbS into planning efforts.

The urgent need to address and provide solutions in the areas of improved planning, integration, and adaptability incorporating NbS is underscored by the development and discussion of the Urban Greening Plan in Task Forces 3 and 6. This clearly highlight the urgent need to address and provides solutions in this areas.

Guidelines on considerations and steps to support scaling up of NbS

No standard is available addressing this topic.

The need to standardise and support the upscaling of NbS encompasses various possibilities, including determining the appropriate scale of implementation, establishing NbS networks (whether individual or a combination of multiple NbS), and ensuring continuous scaling up. In this context, the key factors influencing the implementation are not solely dependent on the typology of NbS but also on other conditioning factors specific to the location in which they are developed.

For instance, one example of standardisation could be the process of renaturing a school, hospital, or neighborhood, which is closely linked to the subsequent standardisable need. While these processes can be included within standardised frameworks, they also require the support of standardised assessments to ensure their effectiveness and impact. By developing such standards and assessments, we can facilitate the widespread adoption and successful implementation of NbS, contributing to the achievement of environmental and sustainable objectives..

A process on how to develop (alternative) business and finance opportunities and models for NbS

One of the usual tasks and/or work packages in the European NbS projects analysed is the Business Model. However, there is a demand for an agreed/standardised process for the development of alternative business models. About this, it is noted that a standard ISO/CD 14093. The mechanism for financing local adaptation to climate change: Performance-based climate resilience grants is already being developed (in the process), which could be a framework to consider or adapt when developing a specific business and finance models for NbS.

Definition of a NbS monitoring and evaluation strategy/plan

No standard is available addressing this topic.

While this topic shares similarities with assessment, it is more aligned with the standardisation of processes. The process of defining a monitoring plan or engaging in co-creation involves specific steps and considerations, which are categorised under process-related needs. Although monitoring plans contribute to assessment, their nature and focus on planning and collaborative development distinguish them as process-oriented requirements. By recognising and addressing these process-related needs, we can establish standardised approaches that facilitate effective plan definition and foster meaningful co-creation, ultimately enhancing the implementation and impact assessment of NbS initiatives.

Another area of standardisation that has been identified is the process of defining monitoring plans or strategies for assessing the impact of NbS. This involves specifying procedures and considering various factors that are essential for effective evaluation. While there are still knowledge gaps that need to be addressed, it is worth noting that significant progress has been made in this field in recent years. These advancements have contributed to a better understanding of how to monitor and measure the outcomes and effectiveness of NbS initiatives. By standardising monitoring practices and incorporating the latest knowledge, we can enhance the accuracy and reliability of impact assessments, leading to more informed decision-making and improved implementation of NbS..

ii. Assessment 

Protocol for assessing the effectiveness of various NbS and decision support (including cost-benefit comparability considerations) / A methodology for assessing the cost-benefit ratio of NbS

Closely linked to the previous standardisable demand (it could be included in monitoring plans) and to identify Knowledge gaps (see “Effectiveness in NbS” in Kabisch et alt. 2016), is the need to assess the performance in terms of environmental effectiveness, economic efficiency and social performance of NbS, both to have a tool for decision-making and to promote the use of NbS.

Furthermore, within the assessment of effectiveness, which should consider the synergies and the economic, social, and environmental benefits (from the point of view of ecosystem services), another very important demand is included: the assessment of the cost-benefit of NbS. Due to its importance, this could be considered a possible demand to be standardised on its own.

Some European NbS and climate change adaptation projects, such as ARCH or GrowGreen, are working in this field of knowledge, and there are more and more articles on the subject.

A good example of this is the Evaluating the impact of Nature-based Solutions: a handbook for practitioners, that aims “to provide practitioners with a comprehensive Nature-based Solutions (NbS) impact assessment framework, and a robust set of indicators and methodologies to assess impacts of NbS across societal challenges”.

A methodology on the monetization of the benefits of NbS ecosystem services / A methodology to carry out investment rating

In the realm of financing and business models, there are two potential standardizable methodologies closely related to cost-benefit assessments. The first methodology revolves around monetization, while the second focuses on conducting investment ratings. Despite these methods being known and applied, their application in the context of climate change can be challenging (Wise, 2022), especially for NbS, whose benefits are still to be quantified.

These methodologies provide standardised approaches for evaluating the costs and benefits associated with implementing NbS projects. The monetization methodology enables the quantification and assessment of the monetary value of the benefits derived from NbS, allowing for comparisons with traditional engineering-based solutions. On the other hand, the investment rating methodology offers a standardised fremework for evaluating the financial feasibility and attractiveness of NbS projects to potential investors.

By standardizing these methodologies, stakeholders can have a consistent and transparent way of assessing the economic viability and potential returns of NbS projects. This, in turn, facilitates informed decision-making regarding financing options and encourages greater private and public investment in sustainable NbS.

iii. Standardisable process not specific to NbS

In addition to the identified needs, based on the analysis results, there are other processes that may benefit from standardisation within the context of NbS. These processes pertain to more general aspects, such as governance, coordination, co-design, etc. For instance, when it comes to stakeholder engagement, there are two climate change-related stakeholders standards[25] available, but their relevance is not exclusive to NbS.

They include:

- A standardised process for achieving political consensus and commitment to legitimize NbS.
- A process for determining the optimal composition of stakeholder groups.
- A standardised process for enhancing horizontal and vertical coordination within administrations.
- A process to strengthen collaborative governance in NbS initiatives.
- A planning process for improving the co-design processes of NbS.
- A planning process for enhancing capacity building efforts in NbS.
- A process for improving the development of socially inclusive policies in NbS.
- A process for developing an effective communication and awareness-raising strategy for NbS.

However, it is worth noting that while some European projects, like CLEVER Cities, are specifically addressing these aspects within the co-design process, many of them are related to the knowledge gaps pointed out both in this analysis and in previous studies. (Kabisch, 2016; NetworkNature, 2021).

[25] ASTM E 3356:2022 Standard Guide for Stakeholder Engagement on Environmental Risk Management and Climate; DIN SPEC 35810:2014 Stakeholder engagement – Guidelines for decision making processes dealing with climate change

5. CLEVER Cities alignment with ongoing standardisation processes

The standardisation efforts undertaken by CLEVER Cities would not be meaningful without interaction with formal SDOs to ensure the adoption of the achieved project outputs. Consequently, to promote the project's outcomes, CLEVER partners TECNALIA and ICLEI, actively engaged and participated in the activities of the CEN/TC 465 "Sustainable Cities and Communities" and CEN-CENELEC-ETSI SF-SSCC (Smart and Sustainable Cities and Communities) Sector Forum Task Group on NbS. The SF-SSCC serves as a collaborative advisory and coordination entity for European standards pertaining to Smart and Sustainable Cities and Communities. Although the SF-SSCC itself does not create standards or other standardisation deliverables, its role involves analysing and making recommendations on standards for their development, implementation, adaptation, or revision.

Initially, TECNALIA was invited to present the work and progress of CLEVER Cities regarding NbS, both within CEN/TC 465 and SF-SSCC. The information provided was deemed relevant to the activities carried out by these organizations. Consequently, the Task Group on NbS was created.

TECNALIA, as the Spanish national CEN/TC 465 mirrow committee (UNE) member has been leading, together with the Italian national committee (UNI) the Task Group (TG) on NbS. The objective of this task group is to formulate recommendations and suggestions to the relevant technical bodies of CEN/CENELEC/ETSI regarding their future endeavors concerning NbS. The work carried out in this TG followed a three step process.

The work conducted involved the following steps:

1. Mapping the state of the art in the field of NbS with reference to the CLEVER Cities Mapping Experience. Gathering feedback from the NetworkNature meeting held in late September 2022. Collecting feedback from CEN/CENELEC/ETSI on their activities related to NbS.
2. Identifying the standardisation needs within the NbS sector.
3. Developing recommendations and suggestions for the relevant technical bodies of CEN/CENELEC/ETSI regarding their future work on NbS.

During the task force discussions, the progress achieved in CLEVER Cities and NetworkNature projects was examined in relation to the identified priorities and the categorisation of relevant standards. The work conducted in these projects was validated and thoroughly deliberated upon.

Within this task group, it was determined that policy and governance, as well as communication and awareness raising, held slightly greater importance compared to what was initially identified in NetworkNature. However, the overall order of potential elements for standardisation did not undergo significant changes.

The initial recommendations for this Technical Group (TG) are summarized in Section 6. However, it is important to note that the content of this report is part of ongoing discussions on standardization, and further work will continue in the coming years. As progress is made, there may be adaptations that result in changes or updates to the presented content. Therefore, we strongly advise referring to the official websites of standardization bodies, such as CEN, UNE, UNI, to access the most up-to-date information available..

6. Recommendations and future perspectives

The findings from the CLEVER Cities desk research and feedback received from the interactive exchange with experts form NetworkNature and SF-SSCC indicate a need for different standard types to comprehensively address various thematic spheres related to accounting for NbS from a holistic perspective. These standards can be summarized as follows:

- **Terminology:**

Develop a standardised terminology for NbS to ensure clear and consistent communication among stakeholders. This may include not only a common definition of NbS and key terms related to its implementation, monitoring, and evaluation, but characterisation criteria o typology of NbS and a list, as e.g. annex, of examples of NbS.

- **Technical References and Standards:**

Establish a comprehensive set of technical references and standards for NbS, which could be derived from the list of examples given in the terminology standard. These should cover various aspects such as design principles, performance criteria and implementation guidelines.

- **Protocols for Assessing Effectiveness:**

Develop robust protocols for assessing the effectiveness of different NbS. This protocol should consider not only environmental effectiveness but also benefit-cost analysis or cost efficiency for example. It should provide a systematic framework for evaluating the performance and impacts of NbS in different contexts.

- **NbS Monitoring and Evaluation Strategy:**

Define a monitoring and evaluation strategy specific to NbS. Consider the unique characteristics and challenges associated with assessing the impact of NbS interventions, such as long-term ecological benefits, social and cultural impacts, and economic value. This strategy should include indicators, data collection methods, and evaluation frameworks tailored to NbS.

- **NbS Planning Processes:**

Establish a planning process to incorporate NbS into the broader framework of environmental and sustainable objectives. This process should ensure that NbS is systematically considered in urban and regional planning, land use management, and infrastructure development. Develop guidelines and tools to support decision-makers in integrating NbS effectively. Establish guidelines for replication and upscaling of NbS. The guidelines should address both the process-related aspects (e.g., identifying opportunities for replication, coordinating efforts) and assessment-related aspects (e.g., evaluating the effectiveness and impact of scaled-up NbS).

- **Policy and Governance Processes:**

Establish different standards that (i) strengthen collaborative governance by finding the optimal composition of stakeholder groups and enhancing horizontal and vertical coordination, including a process to allow improved horizontal and vertical governance for the long-term operation and maintenance of the NbS, (ii) implement collaborative processes such as co-design and co-monitoring to ensure NbS relevance and effectiveness in achieving the desired benefits, increasing local ownership and support, and (iii) empower local communities, as observed in the CLEVER Cities project.

However, there exists a logical sequence for the development of these standards, as emphasised by the feedback provided by experts. The initial priority is to establish a clear and comprehensive basis for the terminology of NbS. Then this clarification will help identify the needs for the development of technical solutions falling under the NbS umbrella. This will facilitate to identify which NbS technical references or standards are then needed. The availability of these standards will enhance NbS market uptake. Given that NbS aim to address environmental, social, and economic benefits for society, it is crucial to establish monitoring and evaluation strategies that rely on performance and evaluation standards. Equally important are NbS planning standards, which ensure effective and coordinated planning processes. On the other hand, while general process standards are also relevant, they are of less immediate urgency. This is because existing environmental guidelines and protocols can be applied when incorporating NbS into local communities until specific NbS standards are developed. Table 15 provides a summary of the priorities for the various standardisation elements/themes. Figure 18 illustrates the specific elements and their respective levels of significance in the context of standardisation.

Table 13. Priorities by standard theme

Standard theme	**Priority**
Terminology	High
Technical References and Standards	High
Protocols for Assessing Effectiveness	Medium-High
NbS Monitoring and Evaluation Strategy	Medium
NbS Planning Processes	Medium
Policy and Governance Processes	Low-Medium

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NetworkNature (2021) Presentation Draft EU NbS Research & Innovation Road Map

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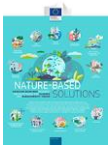
WWF (2016) Ecosistems Services

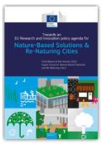
Annexes

ANNEX I : Reviewed NbS publications

The EU and IUCN publications analysed are listed in Table 14.

Table 14. NbS Publications analysed

year		Title
2021		Evaluating the impact of nature-based solutions. • policymakers • A handbook for practitioners • Appendix of methods
2021		Nature-based solutions Horizon 2020 research projects tackle the climate and biodiversity crisis
2021		Nature-based solutions in Europe policy, knowledge, and practice for climate change adaptation and disaster risk reduction
2020		IUCN Global Standard for Nature-based Solutions A user friendly framework for verification, design and scaling up of NbS
2020		Nature-based solutions. State of the art in EU-funded projects
2020		Nature-based solutions towards sustainable communities. Analysis of EU-funded projects
2020		CORDIS results pack on nature-based solutions. Unlocking nature's potential
2020		Nature-based solutions for climate mitigation. Analysis of EU-funded projects
2020		Public procurement of nature-based solutions. Addressing barriers to the procurement of urban NbS: case studies and recommendations.

2020		Biodiversity and nature-based solutions. Analysis of EU-funded projects.
2020		Nature-based solutions for flood mitigation and coastal resilience. Analysis of EU-funded projects
2020		Nature-based solutions for microclimate regulation and air quality. Analysis of EU-funded project
2020		Nature-based solutions improving water quality & waterbody conditions. Analysis of EU-funded projects
2020		IUCN Global Standard for Nature-based Solutions. A user-friendly framework for the verification, design and scaling up of NbS
2019		The EU–Brazil sector dialogue on nature-based solutions
2015		Towards an EU research and innovation policy agenda for nature-based solutions & re-naturing cities. Final report of the Horizon 2020 expert group on 'Nature-based solutions and re-naturing cities' (full version)
2015		Exploring nature-based solutions. The role of green infrastructure in mitigating the impacts of weather- and climate change-related natural hazards

ANNEX II : Reviewed EU projects

Table 15. Projects analysed by call

Call topics SCC-03-2016: New governance, business, financing models and economic, impact assessment tools for sustainable cities with nature- bases solutions (urban naturing)		Cordis EU	Project. Webpage
2016-2020	NATURVATION. NATure-based URban innoVATION	Link	Link
2016-2020	NATURE4CITIES. Nature-Based Solutions for re-naturing cities: knowledge diffusion and decision support platform through new collaborative models	Link	Link
Call Topic SC5-09-2016 Operationalising Insurance Value of ecosystems			
2016-2020	NAIAD. Nature Insurance Value: Assessment & Demonstration	Link	Link
Call Topic SCC- 02-2016- 2017. Demonstrating innovative nature-based solutions in cities			
2017-2022	CONNECTING. Connecting Nature	Link	Link
2017-2022	GROW GREEN. Green Cities for Climate and Water Resilience, Sustainable Economic Growth, Healthy Citizens and Environments	Link	Link
2017-2022	UNALAB. Urban Nature Labs	Link	Link
2017-2022	URBAN GREENUP. New Strategy for Re-Naturing Cities through Nature-Based Solutions	Link	Link
2019-2023	CLEVER Cities - Co-designing Locally tailored Ecological solutions for Value added, socially inclusivE Regeneration in Cities	Link	Link
2018-2023	EdicitNET Edible Cities Network Integrating Edible City Solutions for social resilient and sustainably productive cities	Link	Link
2018-2023	PROGIREG. Productive Green Infrastructure for post-industrial urban regeneration: nature for renewal	Link	Link
2018-2023	URBINAT. Healthy corridors as drivers of social housing neighbourhoods for the co-creation of social, environmental, and marketable NbS	Link	Link
Call topic Sc5-08-2017 Large- scale demonstrators on nature-based solutions for hydro-meteorological risk reduction			
2018-2023	PHUSICOS. “According to nature”: Solutions to reduce risk in mountain landscapes	Link	Link
2018-2023	RECONECT. Regenerating ECOsystems with Nature-based solutions for hydro-meteorological risk rEduCTion	Link	Link
2018-2023	OPERANDUM. OPEn-air laboRAtories for Nature baseD solUtions to Manage environmental	Link	Link
Call topic Sc5-13-2018-2019 International cooperation on sustainable urbanisation: NbS for restoration and rehabilitation of urban ecosystems			
2019-2023	REGREEN. Fostering nature-based solutions for smart, green, and healthy urban transitions in Europe and China	Link	Link
2019-2023	CLEARING HOUSE. Collaborative Learning in Research, Information-sharing and Governance on How Urban tree-based solutions support Sino-European urban futures	Link	Link
2020-2024	CONEXUS. CO-producing Nature-based solutions and restored Ecosystems: transdisciplinary neXus for Urban Sustainability	Link	Link
2020-2024	INTERLACE. International cooperation to restore and connect urban environments in Latin AmeriCa and Europe	Link	Link
Call Topic SC5 14-2019 Visionary and integrated solutions to improve well-being and health in cities			
2020-2024	Europolis	Link	Link
2020-2024	Go green routes. GO GREEN: Resilient Optimal Urban natural, Technological and Environmental Solutions	Link	Link
2020-2024	Inhabit. INclusive Health And wellBeing In small and medium size ciTies	Link	Link

2020-2024	Varieties. Visionary Nature Based Actions for Health, Wellbeing & Resilience in Cities (Varieties)	Link	Link
Call Topic LC-CLA- 06- 2019 Inter-relations between climate change, biodiversity, and ecosystem services			
2020-2024	Dryver. Securing biodiversity, functional integrity, and ecosystem services in DRYing riVER networks	Link	Link
2020-2024	Futuremares. Climate Change and Future Marine Ecosystem Services and Biodiversity	Link	Link
2020-2024	MaCobios. Marine Coastal Ecosystems Biodiversity and Services in a Changing World	Link	Link
2020-2024	PONDERFUL. POND Ecosystems for Resilient FUture Landscapes in a changing climate	Link	Link
Multistakeholders dialogue plataforms for NbS			
2020-2024	THINKNATURE Development of a multi-stakeholder dialogue platform and Think tank to promote innovation with Nature based solutions	Link	Link
2020-2024	NetworkNature - Advancing nature-based solutions together	Link	Link

ANNEX III : NetworkNature Survey

As part of CLEVER Cities, Tecnalia developed a standardisation component. The project has mapped the needs and demands for standardising NbS within the project as well as across other EU-funded NbS projects and recent publications, which resulted in proposals for standardisation along 5 spheres (NbS Technical Design and Implementation, Policy and Governance, NbS Planning, NbS Financing, and Economic Activities, and Communication and Awareness Raising) and 5 standardisation categories (Terminology, Process, Impact assessment, NbS architecture, and Technological).

THEMATIC SPHERES	STANDARDISABLE ELEMENTS/ PROCESSES	STANDARDISATION CATEGORY
NBS Technical Design and Implementation	Terminology	Terminology
	Technical references and standards	NBS Architecture
	Protocol for assessing the effectiveness of various NBS and decision support (including cost-benefit comparability considerations)	Process Impact Assessment
	Definition of an NBS monitoring and evaluation strategy/plan (Specificities to consider when assessing the impact of NBS)	Process Impact Assessment
NBS Planning	A planning process on how to take NBS into account in planning to achieve environmental and sustainable objectives	Process
	Guidelines on considerations and steps to support scaling up of NBS	Process
Policy and Governance	Process to promote political consensus and commitment that legitimizes NBS	Process
	Process on how to find the best composition of stakeholder groups	Process
	Process for improving horizontal and vertical coordination (administration)	Process
	Process to strengthen collaborative governance	Process
	A planning process on how to improve the processes of co-design	Process
	A planning process on how to strengthen capacity building	Process
	Process on how to improve the development of socially inclusive policies	Process
NBS Financing and Economic Activities	Methodology for assessing the cost-benefit ratio of NBs	Impact Assessment
	Methodology on the monetization of the benefits of NBS or ecosystem services	Impact Assessment
	Methodology to carry out investment rating	Impact Assessment
	Process on how to develop (alternative) business and finance opportunities and models for NBS	Process
Communication and Awareness Raising	A process for developing an effective communication and awareness-raising strategy	Process

1- In view of the results of the mapping (table 1):Do you consider that any of the proposed standardisable elements/processes fall into another THEMATIC SPHERE? *

 2- In view of the results of the mapping (table 1):Do you consider that any of the proposed standardisable elements/processes fall into another STANDARDISATION CATEGORY? *

 3- In view of the results of the mapping (table 1):Do you think there are any missing standardisable needs? Which one(s)? *

 4- Considering the standardisable needs identified, and those you have included in the previous question, please select the 5 that you consider to be a priority *

- [ ] Terminology
- [ ] Technical references and standards
- [ ] Protocol for assessing the effectiveness of various NBS and decision support (including cost-benefit comparability considerations)
- [ ] Definition of an NBS monitoring and evaluation strategy/plan (Specificities to consider when assessing the impact of NBS)
- [ ] A planning process on how to take NBS into account in planning to achieve environmental and sustainable objectives
- [ ] Guidelines on considerations and steps to support scaling up of NBS
- [ ] Process to promote political consensus and commitment that legitimizes NBS
- [ ] Methodology for assessing the cost-benefit ratio of NBs
- [ ] Methodology on the monetization of the benefits of NBS or ecosystem services
- [ ] Methodology to carry out investment rating
- [ ] Process on how to develop (alternative) business and finance opportunities and models for NBS
- [ ] A process for developing an effective communication and awareness-raising strategy
- [ ] Process on how to find the best composition of stakeholder groups
- [ ] Process for improving horizontal and vertical coordination (administration)
- [ ] Process to strengthen collaborative governance
- [ ] A planning process on how to improve the processes of co-design
- [ ] A planning process on how to strengthen capacity building
- [ ] Process on how to improve the development of socially inclusive policies

 Please rank your selected 5 standardisable elements/processes from highest to lowest priority (1 most important 5 less important) *

 What are the reasons why you have given more or less priority to the selected standardisable elements/processes?

 5- Regarding the standardisable element/process considered to be the highest priority (Nº 1), which of the following features for delivering high-quality nature-based solutions do you consider the most important for it. *

- Objectives
- Design
- Feasibility
- Implementation
- Post-implementation

[1] See NBS Quality: Features and characteristics for delivering high-quality nature-based solutions: **Objectives**: Supports biological diversity and ecosystem conservation, Supports climate mitigation, Builds resilience Addressing multiple societal challenges, Defines a clear set of goals and measurable targets, Mainstreamed into policies and plans; **Design:** Multifunctional, integrated with grey infrastructures, Designed at the landscape scale (system-scale perspective), Promotes multi-stakeholder approach, Considers traditional, local knowledge, Considers scientific knowledge/Takes an interdisciplinary approach, Considers local context (applicability), Considers the rights of indigenous and local people (avoid green gentrification and dislocation); **Feasibility:** Economic feasibility / Cost-effectiveness, Technical feasibility, A risk and benefits assessment was performed and disclosed; **Implementation:** Adaptive management, Promotes inclusive governance, Promotes/Ensures local ownership, Adhere to nature conservation norms, Implemented in conjunction with decarbonisation actions, Delivers societal benefits, Ensures the fair distribution of benefits (incl. gender equality), Considers tradeoffs (no significant tradeoffs); **Post-implementation:** Post-implementation goals, Maintenance/Performance on the long-term, Evaluation and monitoring are included, Robust and long-term monitoring system

ANNEX IV : NbS Standardisation. Existing standards (Formal). Database summary

NbS TECHNICAL DESIGN AND IMPLEMENTATION

i)- DIRECLTY RELATED

ASTM Volume 04.11	Building Constructions (I): E72 – E2166	Volumes 04.11 and 04.12 cover standards for measuring the performance of buildings, including: air leakage and ventilation; building economics; building preservation; durability of building constructions; structural performance; exterior insulation and finish systems; lead hazards; and roof systems, windows, and doors.	NbS ARCHITECTURE
ASTM Volume 04.12	Building Constructions (II): E2167 - Latest; Sustainability; Asset Management; Technology and Underground Utilities	Volume 04.12 includes standards on sustainability, including the design, construction, and operation of green buildings and environmental life cycle assessment. It also provides the latest specifications for the evaluation and selection of exhibits for environmentally sustainable meetings, events, trade shows, and conferences. This volume also provides standards for designing and implementing efficient and cost-effective personal asset management systems. These standards encompass the entire life cycle of personal property and establish the guiding principles of asset management, including administrative control of assets; physical inventory; and the assessment of loss, damage, and destruction. Volume 04.12 also covers standards on technology and underground utilities that cover rehabilitation of sewers using chemical grouting techniques, seismic fragility of water conveyance systems, deployment of optical fiber systems in natural gas pipelines.	NbS ARCHITECTURE
SIA 312-SN 564312	Greening of roofs	Greening of roofs	NbS ARCHITECTURE
ÖNORM L 1131	Horticulture and landscaping - Green area on roofs and ceilings of buildings - Directives for planning, building and maintenance (Austria)	This ÖNORM applies to the planning, execution and maintenance of greenery on structures (e.g. roofs, underground car parks, avalanche galleries). The existing ÖNORMs in Austria do not directly refer to greening of buildings; therefore, it has to be checked in each individual case to what extent they are sufficient in relation to the object. The provisions of the respective building regulations and the decrees, ordinances and approvals based on them must be complied with. The material-specific processing instructions of manufacturers must be observed.	NbS ARCHITECTURE
ASTM E2266-22	Design and Construction of Low-Rise Frame Building Wall systems to resist water intrusion	1.1 This guide describes design, specification, selection, installation, and inspection of new building wall systems, exterior deck and stair components, doors, windows, penetrations and sealant joints of wood and metal frame buildings, typically four stories or less, to minimize water intrusion. 1.2 This guide does not address prevention of damage caused by water originating from the use of wet building materials or from indoor or outdoor humidity. Water from these sources can be important, and the potential for damage caused by water from these sources must not be overlooked in building design or construction. 1.3 This guide does not address roofing systems, except when the surface of a deck also serves as a roof and at locations where roof systems interface with building walls. 1.4 This guide does not address any type of barrier wall system. 1.5 This guide does not address any exterior insulation and finish system (EIFS). 1.6 This guide does not address foundation conditions where the bottom of a slab on grade or the grade of a crawl space is at or below the water table or subject to hydrostatic pressure. 1.7 This guide is intended to supplement and not duplicate building code requirements. 1.8 Maintenance, although important, is not covered in detail. 1.9 Application of finishes, such as paint and sealers, may be important in the performance of some types of cladding; however, this is not covered in detail. 1.10 This guide applies only to constructions with sheathing, which facilitates installation of the water-resistive barrier and associated flashings in a common plane. 1.11 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard. 1.12 This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory requirements prior to use.	NbS ARCHITECTURE
ASTM E2396_E2396M-19	Standard Test Method for Saturated Water Permeability of Granular Drainage Media [Falling-Head Method] for Vegetative (Green) Roof Systems	Standard Test Method for Saturated Water Permeability of Granular Drainage Media [Falling-Head Method] for Vegetative (Green) Roof Systems	NbS ARCHITECTURE
ASTM E2397_E2397M-19	Standard Practice for Determination of Dead Loads and Live Loads Associated with Vegetative (Green) Roof Systems	Standard Practice for Determination of Dead Loads and Live Loads Associated with Vegetative (Green) Roof Systems	NbS ARCHITECTURE
ASTM E2398_E2398M-19	Standard Test Method for Water Capture and Media Retention of Geocomposite Drain Layers for Vegetative (Green) Roof Systems	Standard Test Method for Water Capture and Media Retention of Geocomposite Drain Layers for Vegetative (Green) Roof Systems	NbS ARCHITECTURE
ASTM E2399_E2399M-19	Standard Test Method for Maximum Media Density for Dead Load Analysis of Vegetative (Green) Roof Systems	Standard Test Method for Maximum Media Density for Dead Load Analysis of Vegetative (Green) Roof Systems	NbS ARCHITECTURE
ASTM E2400_E2400M-19	Standard Guide for Selection, Installation, and Maintenance of Plants for Vegetative (Green) Roof Systems	Standard Guide for Selection, Installation, and Maintenance of Plants for Vegetative (Green) Roof Systems	NbS ARCHITECTURE
ASTM E2777-20	Standard Guide for Vegetative (Green) Roof Systems	This guide identifies terminology, principles and fundamental concepts including those related to sustainability, technical requirements of construction, and types of vegetative (green) roof systems used on buildings.	NbS ARCHITECTURE
ASTM E2788_E2788M-18	Standard Specification for Use of Expanded Shale, Clay and Slate (ESCS) as a Mineral Component in the	Standard Specification for Use of Expanded Shale, Clay and Slate (ESCS) as a Mineral Component in the Growing Media and the Drainage Layer for Vegetative (Green) Roof Systems	NbS ARCHITECTURE

	Growing Media and the Drainage Layer for Vegetative (Green) Roof Systems		
BS 6229:2003	Flat roofs with continuously supported coverings. Code of practice	This code of practice gives recommendations on the design and application of flat roofs with continuously supported roof coverings. It covers weathertightness, drainage, thermal design, sound insulation, condensation control, structural support, fire precautions, maintenance and repair. The recommendations are applicable to terraces, podia, parking decks and green/garden roofs; however these particular types of roof also require consideration of additional factors, beyond the scope of this code of practice. This code of practice is applicable to roof coverings at a pitch not greater than 10° to the horizontal. NOTE Provided that the design conditions are similar, the recommendations given in this code may also be applied to roofs with slopes greater than 10°, but for steep roofs many of the recommendations may not apply. This code of practice does not apply to roofs with self-supporting coverings, cold stores and high temperature enclosures, or to slated or tiled roofs.	NbS ARCHITECTURE
BS 6229:2018	Flat roofs with continuously supported flexible waterproof coverings. Code of practice	This revised edition of BS 6229 describes best current practice in the design, construction, care and maintenance of roofs with a flat or curved surface, at a pitch not greater than 10 degrees to the horizontal, with a continuously supported flexible waterproof covering. The supporting structure is either dense and heavy (such as a concrete slab), or consists of framing members supporting a lightweight deck of metal or of timber-based material. NOTE Provided that the design conditions are similar, many of the recommendations contained in this code of practice apply to roofs at pitches greater than 10 degrees and to those designed as a Green Roof supporting planting. This British Standard does not apply to certain types of cold stores and high temperature enclosures.	NbS ARCHITECTURE
D7851 - 17	Design of Sustainable, Low-Slope Roofing Systems	1.1 This guide provides guidance and considerations related to designing sustainable low-sloped roofing systems, including exposed membrane roofs, membranes covered with vegetative (green) overburden systems, ballasted roofs, and protected membrane roofing assemblies. A sustainable roofing system minimizes environmental impact, conserves energy, and has maximized service life. 1.2 The primary purpose of a roofing system is to weatherproof the building's top surface. Implementing a sustainable roofing system is the intent of this guide. 1.3 This guide acknowledges that many factors outside the designer's control affect the longevity of a roofing system. The designer may rely on industry literature (X1.1) and personal experience with roofing systems to estimate the design life. 1.4 The premise of this guide is to focus attention on environmental and other factors that may affect the roofing system over its service life. By considering these factors and incorporating into the roofing system design certain features that mitigate these factors and their potential adverse effects on the roofing system, the roofing system would be expected to have a longer service life. 1.5 This guide includes materials used in roofing systems under jurisdiction of ASTM Committee D08 on Roofing and Waterproofing. The applicability of this guide to other systems and materials has not been determined. 1.6 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.	NbS ARCHITECTURE
BS 8616:2019	Specification for performance parameters and test methods for green roof substrates	This British Standard specifies requirements for the testing of substrates (the growing medium) for constructed green roofs intended to provide long term support for specified plant communities. This includes extensive and intensive green roof substrates. This British Standard provides methodologies for testing green roof substrates covering the complete application range, and recommended specifications for physical and chemical characteristics considered to be optimal for extensive substrates. This British Standard only addresses methods and parameters to ensure that the substrate used does not become a limiting factor for successful green roof installation. It does not address the wider range of other design considerations, such as the supporting structure, construction, planting options or post-build maintenance. It is recognized that there are green roof systems that do not incorporate a substrate layer and these are not covered in this British Standard.	NbS ARCHITECTURE
UNI 11235 (2015)	Guidelines for the design, execution, monitoring and maintenance of green roofs (Italy)	The standard defines the criteria for the design, execution, control and maintenance of continuous green roofs, according to the particular situations of climatic context, building context and intended use	NbS ARCHITECTURE
22/30433302 DC_ BS EN 805	BS EN 805. Water supply. Requirements for systems and components outside buildings	This document specifies: - general requirements for water supply systems outside buildings including potable water mains and service pipes, service reservoirs, other facilities and raw water mains but excluding treatment works and water resources development; - general requirements for components; - general requirements for inclusion in product standards which may include specifications which are more stringent; - requirements for installation, site testing and commissioning. The requirements of this document apply to: - the design and construction of new water supply systems; - the extension of significant areas forming a coherent part of an existing water supply system; - significant modification and/or rehabilitation of existing water supply systems; - all those water infrastructure systems since they are key to meet the sustainable goals of the cities and to show the urgent need to invest in them in order to consider fundamental aspects, such as resilience or mitigation/adaptation to climate change. NOTE It is not intended that existing water supply systems are to be altered to comply with this document, provided that there are no significant detrimental effects on water quantity, security, reliability and adequacy of the supply.	NbS ARCHITECTURE
UNI/PdR 8:2014	Guidelines for the Sustainable Development of Green Spaces - Planning, Design, Implementation and Maintenance	The reference practice provides guidelines for the sustainable development of urban and peri-urban green spaces - such as public and private parks and gardens, historic public and private parks and gardens, street trees, green infrastructure, tree-lined car parks, bicycle and pedestrian paths, etc. - by guiding the planning, design, construction, maintenance and production of plant material. - guiding the planning, design, implementation and maintenance of the same, as well as the production of plant material. The aim of the reference practice is to identify environmental, economic and social quality objectives for land management.	NbS ARCHITECTURE
BS 3998:2010_BSI	Tree work. Recommendations	Trees are dynamic, continually self-optimizing organisms, they maintain both their physiological functions and their structural integrity. Thus, the often massive structure of a mature tree above ground, consisting of the stem, branches, twigs, and the attached foliage, is highly efficient in intercepting, using, and storing solar energy, while also bearing its own weight and dissipating the potentially damaging forces of the wind. Below ground, although far less obvious, the extensive root system is equally efficient both in providing anchorage and in pervading the soil in order to absorb the water and mineral nutrients that are essential for survival, growth, flowering, and fruiting.	NbS ARCHITECTURE

BS 4428:1989 BSI	Code of practice for general landscape operations (excluding hard surfaces)	Landscape planning is very important to consider in developing land or restoring a city. Landscape professionals design, build, and maintain healthy green spaces in communities including sports fields, parks, gardens, and other facilities. BS 4428 discusses the code of practice for general landscape operations (excluding hard surfaces). BS 4428 code of practice gives recommendations for the following general landscape operations (excluding hard surfaces): Preliminary investigations Drainage Grading and cultivation Seeding of grass areas Turfing Amenity tree planting Woodland planting Planting of shrubs, herbaceous plants, and bulbs The code of practice includes recommendations for the gradients of sports fields that are not covered by the National Playing Fields Association technical publication Gradients for Outdoor Sports Facilities: 1983.	NbS ARCHITECTURE
BS 5837 (2012)	Trees in relation to design, demolition and construction	Trees in relation to design, demolition and construction	NbS ARCHITECTURE
BS 7370-4:1993	Grounds maintenance Recommendations for maintenance of soft landscape (other than amenity turf)	This Part of BS 7370 gives recommendations for the management and maintenance of soft landscape that is intended primarily for amenity use. It is not intended to apply to areas used for the production of fruit or timber, or to specialized areas such as internal landscapes, roof gardens and ecology parks. The recommendations for maintenance given in this Part of BS 7370 apply to the growing conditions in the cool, temperate and fairly moist climate of the United Kingdom. Operations required in different seasons on various aspects of soft landscape are summarized in annex B. Ornamental grasses and some species of grass of environmental value are covered in this Part of BS 7370, together with seminatural landscape types such as shrub and tree dominated areas, e.g. heathland, scrubland or grass and shrub dominated dune systems. This Part of BS 7370 does not cover design aspects of landscape maintenance, nor is it intended to be a textbook on horticulture or forestry. Ecological and conservation aspects of management are given prominence where appropriate, and reference is made to suitable background reading in the text and the bibliography (see annex A).	NbS ARCHITECTURE
BS 8545:2014	Trees: from nursery to independence in the landscape. Recommendations	This British Standard gives recommendations for transplanting young trees successfully from the nursery, through to achieving their eventual independence in the landscape, specifically covering the issues of planning, design, production, planting and management. This British Standard applies to trees where a distinct crown has been prepared in the nursery. It does not apply to whips, transplants and seedlings, or to other woody material. NOTE Although this standard does not give specific recommendations for other woody material, many of its provisions can be applied to such material, e.g. to shrubs.	NbS ARCHITECTURE
DIN 18919 (2016)	Vegetation technology in landscaping - Care of vegetation during development and maintenance in green areas [no access*]		NbS ARCHITECTURE
DIN 18920:2014-07 DIN	Vegetation technology in landscaping - Protection of trees, plantations and vegetation areas during construction work	The document deals with the planning and execution of any work by which a structure is constructed, maintained, altered or removed. Its aim is to protect existing individual trees and planted areas (vegetation areas) comprising, for example, trees, shrubs, grass or herbs as, generally speaking, existing plants or planted areas, whether of ecological, climatic, aesthetic, protective or other value, either cannot be replaced or are only restored to their former condition many years later.	NbS ARCHITECTURE
BS 8582:2013	Code of practice for surface water management for development sites	This British Standard gives recommendations on the planning, design, construction and maintenance of surface water management systems for new developments and redevelopment sites in: minimizing and/or mitigating flooding and other environmental risks arising from: site surface water run-off as a result of rain falling onto the development site; run-off conveyed across or arising on the site from other sources. NOTE 1 Run-off resulting from snow melt is not covered in this British Standard. maximizing the societal and environmental benefits arising from the: use of surface water run-off to protect and enhance local water resources and supplies; contribution of surface water management systems in mitigating climate risks associated with urbanization; integration of surface water management systems with urban design in delivering amenity and community value and in repairing, protecting and enhancing landscape and/or townscape character; repair, protection and enhancement of biodiversity. NOTE 2 For further information on the planning, design, construction and maintenance of SuDS see the CIRIA SuDS Manual [18]. NOTE 3 A design process map for surface water management is set out in Figure 1, which supports effective navigation through this standard. This map works in conjunction with Figure 2, which shows how the surface water management design process is linked with the development planning process. Figure 1 Surface water management: design process map	NbS ARCHITECTURE
BS 8595:2013	Code of practice for the selection of water reuse systems	This British Standard gives recommendations on how to select water reuse system(s), taking into account water resources, surface water management, water supply and sewage infrastructure. It applies to both new and existing developments in residential and non-residential premises.	NbS ARCHITECTURE

		This British Standard covers the following water reuse systems: rainwater harvesting, stormwater harvesting and greywater reuse. It covers the supply of water for domestic water uses that do not require potable water quality, such as laundry, toilet flushing and garden watering. It does not cover systems supplying potable water for drinking, food preparation and cooking, dishwashing and personal hygiene. This British Standard does not cover other sources of non-potable water, such as treated effluent, reclaimed industrial process water and water abstracted from wells and boreholes. NOTE 1 Although this British Standard does not give specific recommendations relating to the use of rainwater, stormwater or greywater for fire suppression or commercial irrigation, these applications are not excluded. It does not cover water butts or direct reuse systems for external use. It also does not cover product design for specific system components or the design and installation of water reuse systems. NOTE 2 Further information on the design and installation of water reuse systems can be found in BS 8515, BS 8525-1 and BS 8525-2.	
EN 16941-1:2018	On-site non-potable water systems Systems for the use of rainwater	This European Standard specifies the requirements and gives recommendations for the design, sizing, installation, identification, commissioning and maintenance of rainwater harvesting systems for the use of rainwater on-site as non-potable water. This European Standard also specifies the minimum requirements for these systems. Excluded from the scope of this European Standard are: - the use as drinking water and for food preparation; - the use for personal hygiene purposes; - decentralized attenuation; - infiltration. NOTE Conformity with the standard does not exempt from compliance with the obligations arising from local or national regulations.	NbS ARCHITECTURE
BS 7533-13	Pavements constructed with clay, natural stone or concrete pavers. Part 13: Guide for the design of permeable pavements constructed with concrete paving blocks and flags, natural stone slabs and setts and clay pavers	BS 7533-13:2009 Pavements constructed with clay, natural stone or concrete pavers. Guide for the design of permeable pavements constructed with concrete paving blocks and flags, natural stone slabs and setts and clay pavers BS 7533-13 gives guidance on the design of permeable pavements surfaced with: Concrete paving blocks manufactured in accordance with BS EN 1338 Concrete paving flags manufactured in accordance with BS EN 1339 Natural stone slabs manufactured in accordance with BS EN 1341 Natural stone setts manufactured in accordance with BS EN 1342 Clay pavers manufactured in accordance with BS EN 1344 BS 7533-13 applies to all pavements subjected to the usual road spectrum of axle loads up to 8 000 kg, including both highway pavements and light industrial pavements where the traffic is similar in character to highway vehicles. BS 7533-13 specifically excludes heavy duty pavements with traffic and other applications such as aircraft pavements and those in ports and specialized industrial areas.	NbS ARCHITECTURE
NEN EN 17152	Plastics piping systems for non-pressure underground conveyance and storage of non-potable water – boxes used for infiltration, attenuation and storage systems	NEN-EN 17152-1:2019 gives the definitions and specifies the minimum requirements for injection moulded, extruded and thermoformed thermoplastics cuboid shaped boxes, including integral components, used in underground systems for infiltration, attenuation and storage of non-potable water (e.g. storm water) and manufactured from polypropylene (PP) or unplasticized polyvinylchloride (PVC-U). NOTE 1 Specifications and design rules for systems will be described in part 2 of EN 17152. Product properties are determined by a combination of material specifications, design and manufacturing process. These boxes are intended for buried underground use, e.g. in landscape, pedestrian or vehicular traffic areas. A box can either be factory assembled or site assembled from different components. These boxes are intended to be used as elements in a modular system where the manufacturer has clearly stated in the documentation how the components are assembled to create a complete infiltration, attenuation or storage system.	NbS ARCHITECTURE
CEN / TR 17179	Thermoplastics piping and ducting systems – Rainwater infiltration and storage attenuation systems	This Technical Report is applicable to the installation of rainwater infiltration and storage/attenuation systems under gravity. This Technical Report covers installations including: - reservoirs made by assembled cuboid shaped thermoplastic boxes; - integral components; - ancillary components (e.g. access provisions and connections); - geotextiles and/or geomembranes; - embedment and backfill. These systems are intended for underground use in landscape, pedestrian or vehicular traffic areas and are used outside building structures. This Technical Report is only applicable to systems containing boxes to create a reservoir where the manufacturer has clearly stated in the installation instructions how the components should be assembled. This Technical Report is a guidance document. It provides a set of general guidelines which gives best practice for installation. NOTE 1 It is anticipated that additional recommendations and/or requirements (e.g. design, dimensioning and structural aspects) will be detailed in the relevant standards. NOTE 2 Attention is drawn to the need to comply with national or local regulations.	NbS ARCHITECTURE
DIN 19657:2022-06 DIN	Protection of watercourses, dikes and coastlines / Note: Date of issue 2022-05-20*Intended as replacement for DIN 19657 (1973-09).	This document applies to the design, construction and maintenance of protection in and on surface waters and surface protection of dykes, dams and coasts. The document is applicable to all coastal protection, including the tidal area of rivers, as well as to inland waters. It is also to be applied to slopes at risk of slipping that could constrict the runoff profile. This document additionally specifies building materials and construction methods that can also be used on torrents according to DIN 19663.	NbS ARCHITECTURE
DIN 19700-12:2004-07 DIN	Dam plants - Part 12: Flood retarding basins / Note: Applies in conjunction with DIN 19700-10 (2004-07), DIN 19700-11 (2004-07).	This document is applicable together with parts 10 and 11 for flood control reservoirs which are able to retain floods in river valleys, dry valleys and polder areas, which have no or only small active storages in comparison with the flood storages.	

DIN 19712	Flood protection works on rivers	The document specifies on the basis of the latest scientific knowledge and practical experience general requirements for new constructions, reconstructions, maintenance, control and provisions against floods for river dikes without tide effects, including aspects of landscape management and ecology.	NbS ARCHITECTURE
ISO 21650	Actions from waves and currents on coastal structures	ISO 21650:2007 describes the principles of determining the wave and current actions on structures of the following types in the coastal zone and estuaries: breakwaters: rubble mound breakwaters; vertical and composite breakwaters; wave screens; floating breakwaters; coastal dykes; seawalls; cylindrical structures (jetties, dolphins, lighthouses, pipelines etc.). ISO 21650:2007 does not include breakwater layout for harbours, layout of structures to manage sediment transport, scour and beach stability or the response of flexible dynamic structures, except vortex induced vibrations. Design will be performed at different levels of detail: concepts; feasibility; detailed design. ISO 21650:2007 is aimed at serving the detailed design.	NbS ARCHITECTURE
EN ISO 13786	Thermal performance of building components	ISO 13786:2017 specifies the characteristics related to the dynamic thermal behaviour of a complete building component and provides methods for their calculation. It also specifies the information on building materials required for the use of the building component. Since the characteristics depend on the way materials are combined to form building components, ISO 13786:2017 is not applicable to building materials or to unfinished building components. The definitions given in ISO 13786:2017 are applicable to any building component. A simplified calculation method is provided for plane components consisting of plane layers of substantially homogeneous building materials. Annex C provides simpler methods for the estimation of the heat capacities in some limited cases. These methods are suitable for the determination of dynamic thermal properties required for the estimation of energy consumption. These approximations are not appropriate, however, for product characterization. NOTE Table 1 in the Introduction shows the relative position of ISO 13786:2017 within the set of EPB standards in the context of the modular structure as set out in ISO 52000-1.	NbS ARCHITECTURE

ii) CLOSELY RELATED

EN 61160:2005	Design review	This International Standard makes recommendations for the implementation of design review as a means of verifying that the design input requirements have been met and stimulating the improvement of the product's design. The intention is for it to be applied during the design and development phase of a product's life cycle.	PROCESS
ISO/CD 37111	Sustainable cities and communities − Urban districts, towns, counties and neighbourhoods − Guidelines for flexible approaches to phased implementation of ISO 37101	Under development	PROCESS
ISO/FDIS 37108	Sustainable cities and communities — Business districts — Guidance for practical local implementation of ISO 37101	Under development	PROCESS
ISO/AWI 37114	Sustainable cities and communities — Appraisal framework for datasets and data processing methods that create urban management information	This document provides appraisal framework **to create and use urban management information derived from statistics, objectives, indicators and long-term goals for sustainable development of cities and communities**. This document enables numerous combinations of data sources and data processing methods, making it easier to create and maintain urban management information and get ready for value mining of the big data of cities and communities. The methodology is presented as a conceptual framework that allows implementation in a variety of ways. This can include the use of spreadsheets and databases on both a desktop and an online basis. This document aids the communication among various stakeholders such as top management, data enablers, data architects, property owners, facilities management (including asset management), statistics bodies, and so on. The methodology is also technologically agnostic, allowing organizations to adopt different technical solutions to generate and use data in line with specific UN SDGs, sustainability purposes and issues, objectives, or indicators. This document includes data-specific guidance to implement the overarching strategy elaborated by ISO 37106 as being citizen-centric, digital and open and collaborative. This document does not include statistics or guidance on how to use the ISO 37120 series. Although not an AI subject standard, this document will be AI-compatible to facilitate cities and communities to get ready for the future application of Artificial Intelligence (AI) within the digital development topics relevant to sustainable cities and communities, including the use of AI techniques to process and analyse data collected from various owners, and to identify and solve problems that cities and communities face, to aid decision-making and achieve the sustainability purposes (as listed by ISO 37101) and UN Sustainable Development Goals in long term.	IMPACT ASSESSMENT
ISO 37120:2018	Sustainable cities and communities — Indicators for city services and quality of life	This document defines and establishes **methodologies for a set of indicators to steer and measure the performance of city services and quality of life. It follows the** principles set out in ISO 37101 and can be used in conjunction with ISO 37101 and other strategic frameworks. This document is applicable to any city, municipality or local government that undertakes to measure its performance in a comparable and verifiable manner, irrespective of size and location.	IMPACT ASSESSMENT
ISO 37122:2019	Sustainable cities and communities — Indicators for smart cities	This document specifies and **establishes definitions and methodologies for a set of indicators for smart cities**. As accelerating improvements in city services and quality of life is fundamental to the definition of a smart city, this document, in conjunction with ISO 37120, is intended to provide a complete set of indicators to measure progress towards a smart city. This is represented in Figure 1.	IMPACT ASSESSMENT
ISO 37123:2019	Sustainable cities and communities — Indicators for resilient cities	This document **defines and establishes definitions and methodologies for a set of indicators on resilience in cities.** This document is applicable to any city, municipality or local government that undertakes to measure its performance in a comparable and verifiable manner, irrespective of size or location. Maintaining, enhancing and accelerating progress towards improved city services and quality of life is fundamental to the definition of a resilient city, so this document is intended to be implemented in conjunction with ISO 37120. This document follows the principles set out in ISO 37101, and can be used in conjunction with this and other strategic frameworks.	IMPACT ASSESSMENT
DIN EN 15643-5	Sustainability of construction works - Sustainability assessment of buildings and civil engineering works - Part 5: Framework for the assessment of sustainability performance of civil engineering works	This European Standard provides specific principles and requirements for the **assessment of environmental, social and economic performance of civil engineering works taking into account its technical characteristics and functionality**. Assessments of environmental, social and economic performance are the three aspects of sustainability assessment of civil engineering works. The framework applies to all types of civil engineering works, both new and existing, and it is relevant for the assessment of the environmental, social and economic performance of new civil engineering works over their entire life cycle, and of existing civil engineering works over their remaining service life and end of life stage.	IMPACT ASSESSMENT
ISO/TR 52018-2:2017	Energy performance of buildings—Indicators for partial EBP requirements related to thermal energy balance and fabric features	ISO 52018-1 gives a succinct enumeration of possible requirements related to thermal energy balance features and to fabric features. It also provides tables for regulators to report their choices in a uniform manner. ISO/TR 52018-2:2017 provides many background considerations that can help both private actors and public authorities, and all stakeholders involved, to take informed decisions.	IMPACT ASSESSMENT
ISO 16813	Building environment design — Indoor environment — General principles	**ISO16813:2006 establishes the general principles of building environment design taking into account healthy indoor environment for the occupants, and protecting the environment for future generations. ISO16813:2006 promotes an approach in which the various parties involved in building environmental design collaborate with one another to provide a sustainable building environment**. The unique features of the design process are articulated by the following aims: to provide the constraints concerning sustainability issues from the initial stage of the design process, including building and plant life cycle together with owning and operating costs to be considered at all stages in the design process;to assess the proposed design with rational criteria for indoor air quality, thermal comfort, acoustical comfort, visual comfort, energy efficiency and HVAC system controls at every stage of the design process;to make iterations between decisions and evaluations of the design throughout the design process. ISO16813:2006 is applicable to building environment design for new construction and the retrofit of existing buildings.	PROCESS
ISO 16818:2008	Building environment design. Energy efficiency. Terminology	This standard BS ISO 16818:2008 Building environment design. Energy efficiency. Terminology is classified in these ICS categories: 01.040.91 Construction materials and building (Vocabularies) 91.040.01 Buildings in general 91.120.10 Thermal insulation of buildings	TERMONOLOGY
ASTM D5093 – 15	Standard Test Method for Field Measurement of Infiltration Rate Using Double-Ring Infiltrometer with Sealed-Inner Ring	1.1 This test method describes **a procedure for measuring the infiltration rate of water through in-place soils using a double-ring infiltrometer with a sealed inner ring**. 1.2 This test method is useful for soils with infiltration rates in the range of 1 × 10−5 cm/s to 1 × 10−8 cm/s. When infiltration rates ≥1 × 10−5 cm/s are to be measured Test Method D3385 shall be used.	IMPACT ASSESSMENT

		1.3 All observed and calculated values shall conform to the guide for significant digits and rounding established in Practice D6026. 1.4 This test method provides **a direct measurement of infiltration rate, not hydraulic conductivity**. Although the units of infiltration rate and hydraulic conductivity are similar, there is a distinct difference between these two quantities. They cannot be directly related unless the hydraulic boundary conditions, such as hydraulic gradient and the extent of lateral flow of water are known or can be reliably estimated. 1.5 This test method can be used for natural soil deposits, recompacted soil layers, and amended soils such as soil bentonite and soil lime mixtures. 1.6 Units—The values stated in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to inch-pound units, which are provided for information only and are not considered standard. 1.7 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.	
ISO 17785-1	Testing methods for pervious concrete — Part 1:Infiltration rate	ISO 17785-1:2016 specifies **the procedure for testing the infiltration rate of hardened pervious concrete pavement specimens** in the laboratory. It is not a method for measuring the permeability of pervious concrete. The specimens can either be prepared in the laboratory or cored from field placements, but not representing field conditions. This part of ISO 17785 also specifies procedures to make and cure hardened pervious concrete samples in the laboratory.	NbS ARCHITECTURE
BS 8550	Flood resistant and resilient construction - guide to improving the flood performance of buildings	This British Standard gives recommendations and guidance on how to improve **the resistance and resilience of buildings to reduce the impacts of flooding from all sources**, by the use of suitable materials and construction details. Specifically, it provides: recommendations for the adoption of flood resistant and resilient construction measures, including when to apply resistance and when to apply resilience; and guidance on the design and specification of flood resistance and resilience for new buildings, extensions and retrofits. The guidance covers masonry, light-weight steel-frame and timber-frame buildings. It is not applicable to: the structural design or layout of buildings; the selection, fixing and deployment of flood protection products which are covered by other standards, such as PAS 1188 and Delivering benefits through evidence: Temporary and Demountable Flood Protection Guide [1]; the design of watertight concrete, which is specified in BS EN 1992-3; the construction of amphibious or floating properties; the construction of properties on stilts; or detailed avoidance measures outside the perimeter (footprint) of the building, such as local land raising above the predicted flood level.	NbS ARCHITECTURE
ASTMC1549–16	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer	1.1 This test method covers a technique **for determining the solar reflectance of flat opaque materials in a laboratory or in the field using a commercial portable solar reflectometer. The purpose of the test method is to provide solar reflectance data required to evaluate temperatures and heat flows across surfaces exposed to solar radiation.** 1.2 This test method does not supplant Test Method E903 which measures solar reflectance over the wavelength range 250 to 2500 nm using integrating spheres. The portable solar reflectometer is calibrated using specimens of known solar reflectance to determine solar reflectance from measurements at four wavelengths in the solar spectrum: 380 nm, 500 nm, 650 nm, and 1220 nm. This technique is supported by comparison of reflectometer measurements with measurements obtained using Test Method E903. This test method is applicable to specimens of materials having both specular and diffuse optical properties. It is particularly suited to the measurement of the solar reflectance of opaque materials. 1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard. 1.4 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.	IMPACT ASSESSMENT
JIS K 5602	Determination of reflectance of solar radiation by paint film	Determination of reflectance of solar radiation by paint film	NbS ARCHITECTURE
NEN ISO 16345	Water-cooling towers -Testing and rating of thermal performance	ISO 16345:2014 covers the measurement of the thermal performance and pumping head of open- and closed-circuit, mechanical draft, wet and wet/dry cooling towers and natural draft and fan-assisted natural draft, wet and wet/dry cooling towers. The standard rating boundaries for series mechanical draft, open- and closed-circuit cooling towers are specified.	IMPACT ASSESSMENT
ISO 14045:2012	Environmental management — Eco-efficiency assessment of product systems — Principles, requirements and guidelines	ISO 14045:2012 describes the **principles, requirements and guidelines for eco-efficiency assessment for product systems including:** the goal and scope definition of the eco-efficiency assessment; the environmental assessment; the product-system-value assessment;	IMPACT ASSESSMENT

		the quantification of eco-efficiency; interpretation (including quality assurance); reporting; critical review of the eco-efficiency assessment. Requirements, recommendations and guidelines for specific choices of categories of environmental impact and values are not included. The intended application of the eco-efficiency assessment is considered during the goal and scope definition phase, but the actual use of the results is outside the scope of ISO 14045:2012.	
ISO 14046:2014	Environmental management — Water footprint — Principles, requirements and guidelines	ISO 14046:2014 **provides principles, requirements and guidelines for conducting and reporting a water footprint assessment as a stand-alone assessment, or as part of a more comprehensive environmental assessment.** Only air and soil emissions that impact water quality are included in the assessment, and not all air and soil emissions are included. The result of a water footprint assessment is a single value or a profile of impact indicator results. Whereas reporting is within the scope of ISO 14046:2014, communication of water footprint results, for example in the form of labels or declarations, is outside the scope of ISO 14046:2014.	IMPACT ASSESSMENT
ISO 14017:2022	Environmental management — Requirements with guidance for verification and validation of water statements	This document specifies principles, **requirements and guidelines for the verification and validation of water statements.** It is applicable to **organizational, product and project water statement verification and validation**, and can also be used to provide confidence in reported water information on a local, regional or national level. This document is programme neutral. If a programme is applicable, requirements of that programme are additional to the requirements of this document. NOTE Legislation can differ from jurisdiction to jurisdiction. It is the user's responsibility to determine how applicable legal requirements relate to this document.	IMPACT ASSESSMENT
ISO 14033:2019	Environmental management — Quantitative environmental information — Guidelines and examples	This document gives **guidelines for the systematic and methodical acquisition and review of quantitative environmental information and data about systems**. It supports the application of standards and reports on environmental management. This document gives guidelines for organizations on the **general principles, policies, strategies and activities necessary to obtain quantitative environmental information for internal and/or external purposes**. Such purposes can be, for example, to establish inventory routines and support decision making related to environmental policies and strategies, aimed in particular at comparing quantitative environmental information. The information is related to organizations, activities, facilities, technologies and products. This document addresse**s issues related to defining, collecting, processing, interpreting and presenting quantitative environmental information**. It provides guidelines on how to establish accuracy, verifiability and reliability for the intended use. It uses proven and well-established approaches for the preparation of information adapted to the specific needs of environmental management. This document is applicable to all organizations, regardless of their size, type, location, structure, activities, products, level of development and whether or not they have an environmental management system in place. NOTE 1 Quantitative information specifically addresses quantification of environmental performance in the form of environmental performance indicators in accordance with ISO 14031. NOTE 2 Quantitative information also addresses quantification of risk for risk management purposes. This document supplements the contents of other International Standards on environmental management. NOTE 3 Annexes A and B provide illustrative and general examples of how to apply the guidelines and the framework. Annexes C and D provide sector-specific case studies on the application of the framework and case studies on selected documents from the ISO 14000 family, respectively. Annex E provides explanatory information to prevent misinterpretation of the guidance of this document.	IMPACT ASSESSMENT
ISO 9825:2005 ISO	Hydrometry — Field measurement of discharge in large rivers and rivers in flood	ISO 9825:2005 deals specifically **with the measurement of discharge in large rivers and the measurement of rivers in flood. It also describes the relevant field measurements when it** becomes necessary to use indirect methods of estimating discharge.	IMPACT ASSESSMENT
ISO 14064-2:2019	Greenhouse gases — Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements	This document specifies **principles and requirements and provides guidance at the project level for the quantification, monitoring and reporting of activities intended to cause greenhouse gas (GHG) emission reductions or removal** enhancements. It includes requirements for planning a GHG project, identifying and selecting GHG sources, sinks and reservoirs (SSRs) relevant to the project and baseline scenario, monitoring, quantifying, documenting and reporting GHG project performance and managing data quality. The ISO 14060 family of standards is GHG programme neutral. If a GHG programme is applicable, the requirements of that GHG programme are additional to the requirements of the ISO 14060 family of standards.	IMPACT ASSESSMENT
ISO 14064-3:2019	Greenhouse gases — Part 3: Specification with guidance for the verification and validation of greenhouse gas statements	This document **specifies principles and requirements and provides guidance for verifying and validating greenhouse gas (GHG) statements.** It is applicable to **organization, project and product** GHG statements. The ISO 14060 family of standards is GHG programme neutral. If a GHG programme is applicable, requirements of that GHG programme are additional to the requirements of the ISO 14060 family of standards.	IMPACT ASSESSMENT
PAS 2060:2014	Specification for the demonstration of carbon neutrality	This PAS specifies requirements to be met by any entity **seeking to demonstrate carbon neutrality through the quantification, reduction and offsetting of greenhouse gas (GHG)** emissions from a uniquely identified subject. It is not the intention of this PAS to exclude any specific subjects or entities. It is intended that this specification be used by any entity, including: regional or local government; communities; organizations/companies or parts of organizations (including brands); clubs or social groups; families; individuals. This specification is applicable to the demonstration of carbon neutrality in respect of any subjects selected and defined by the applying entity, including for their: activities; products;	IMPACT ASSESSMENT

		services; buildings; **projects and major developments;** towns and cities; events. Achieving carbon neutrality solely through reduction of direct GHG emissions will not be practicable in most instances and hence carbon offsets (see 3.7) are likely to play a role in achieving carbon neutrality. However, this specification does not make provision for a declaration of the achievement of carbon neutrality solely through offsetting other than for the first application period, where to facilitate initiation of the process, concession is made to enable entities to take up the option of making a declaration of the achievement of carbon neutrality solely through carbon offsets. In all subsequent periods it is essential that a reduction in absolute terms and/or a reduction in emission intensity be evident for the defined subject, if carbon neutral status in accordance with PAS 2060 is to be claimed. This specification provides for communication at two levels. The primary level requires one of two forms of declaration as follows: The declaration of commitment to carbon neutrality requires the entity to establish the carbon footprint of the subject and to document a carbon footprint management plan describing how the entity intends to achieve carbon neutrality with respect to the defined subject. The declaration of achievement of carbon neutrality requires the entity to have achieved reductions in the carbon footprint of the subject and to have offset remaining GHG emissions. Such declarations of achievement therefore only apply to the scope and period validated and should the entity intend to extend its claim to future periods, further validation will be required. The secondary level is a “representative statement” couched in more consumer friendly terms, for use in promotional material. However, the use of a representative statement is only permitted in addition to the publication of the formal declaration. This specification provides for the validation of declarations by the entity itself as well as by other parties and independent third parties, engaged to do so. To claim compliance with this PAS, it is necessary that the entity satisfy all of the requirements within the specification relevant to the declaration being made. This specification establishes a set of principles against which the selection of methodologies for GHG emissions quantification and offsetting can be undertaken. It also incorporates examples of widely accepted standards and methodologies (see Annex C) that can be presumed to meet those principles although other standards can also meet this requirement. However, the entity undertaking assessment is still required to confirm that the methodology accepted is being used in accordance with those principles.	
ISO/CD 14068	Greenhouse gas management and climate change management and related activities — Carbon neutrality	Under development	IMPACT ASSESSMENT
PAS 2070:2013+A1:2014	Specification for the assessment of greenhouse gas emissions of a city. Direct plus supply chain and consumption-based methodologies	This standard PAS 2070:2013+A1:2014 **Specification for the assessment of greenhouse gas emissions of a city**. Direct plus supply chain and consumption-based methodologies is classified in these ICS categories: 13.020.30 Environmental impact assessment	IMPACT ASSESSMENT
ISO/TR 14073:2017	Environmental management — Water footprint — Illustrative examples on how to apply ISO 14046	ISO/TR 14073:2017 provides illustrative examples of how to apply **ISO 14046, in order to assess the water footprint of products, processes and organizations based on life cycle assessment.** The examples are presented to demonstrate particular aspects of the application of ISO 14046 and therefore do not present all of the details of an entire water footprint study report as required by ISO 14046.	IMPACT ASSESSMENT
ISO 52010-1	Energy performance of buildings - External climatic conditions -Part 1: Conversion of climatic data for energy calculations [also uses the input from ISO 15927 – 4 below]	ISO 52010-1:2017 specifies a **calculation procedure for the conversion of climatic data for energy calculations.** The main element in ISO 52010-1:2017 is the calculation of solar irradiance on a surface with arbitrary orientation and tilt. A simple method for conversion of solar irradiance to illuminance is also provided. The solar irradiance and illuminance on an arbitrary surface are applicable as input for energy and daylighting calculations, for building elements (such as roofs, facades and windows) and for components of technical building systems (such as thermal solar collectors, PV panels). Other parameters of climatic data needed to assess the thermal and moisture performance of buildings, building elements or technical building systems [like wind, temperature, moisture and long-wave (thermal) radiation] are to be obtained according to the procedures in ISO 15927-4. These data are listed in ISO 52010-1:2017 as input and passed on as output without any conversion. NOTE 1 The reason for passing these data via ISO 52010-1:2017 is to have one single and consistent source for all EPB standards and to enable any conversion or other treatment if needed for specific application. NOTE 2 Table 1 in the Introduction shows the relative position of ISO 52010-1:2017 within the set of EPB standards in the context of the modular structure as set out in ISO 52000-1.	IMPACT ASSESSMENT
ISO 52017 - 1	Energy performance of buildings - Sensible and latent heat loads and internal temperatures – general calculation procedures	ISO 52017-1:2017 **specifies the general assumptions, boundary conditions and equations for the calculation, under transient hourly or subhourly conditions, of the internal temperatures (air and operative) and/or the heating, cooling and humidification and dehumidification loads to hold a specific (temperature, moisture) set point, in a single building zone.** No specific numerical techniques are imposed by ISO 52017-1:2017.	IMPACT ASSESSMENT

		Specific calculation procedures based on the generic calculation procedures of ISO 52017-1:2017 are given in ISO 52016-1. The specific simplifications, assumptions and boundary conditions in ISO 52016-1 are tailored to the respective application areas, such as the energy need for heating and cooling and for humidification and dehumidification, hourly internal temperature, design heating and cooling and humidification and dehumidification load. NOTE Table 1 in the Introduction shows the relative position of ISO 52017-1:2017 within the set of EPB standards in the context of the modular structure as set out in ISO 52000-1.	
ISO 52022-1	Energy performance of buildings - Thermal, solar and daylight properties of building components and elements - Part 1: Simplified calculation method of the solar and daylight characteristics for solar protection devices combined with glazing	ISO 52022-1:2017 **specifies a simplified method based on thermal, solar and light characteristics of the glazing and solar and light characteristics of the solar protection device, to estimate the total solar energy transmittance**, direct energy transmittance and the light transmittance of a solar protection device combined to a glazing.	IMPACT ASSESSMENT
ASTM Volume 11.05	Environmental Assessment, Risk Management and Corrective Action	Environmental Assessment—includes the popular ASTM Phase I Environmental Site Assessment (ESA) standard (E1527) and Phase II ESA standard (E1903). Other standards address corrective action, environmental risk management, pollution prevention, real estate assessment and management, Brownfield redevelopment, property condition assessments (PCAs), mold baseline survey process, asbestos screens, use of activity and use limitations (AULs), and screening for vapor encroachment. It also covers financial disclosures and risks attributed to climate change assessment.	IMPACT ASSESSMENT
ISO 21931-2	Sustainability in buildings and civil engineering works — Framework for methods of assessment of the environmental, social and economic performance of construction works as a basis for sustainability assessment — Part 2: Civil engineering works	This document provides a general framework for **improving the quality and comparability of methods for assessing the contribution of civil engineering works and their related external works to sustainable development based on a life cycle approach.** This document aims to bridge the gap between regional and national methods for the assessment of the sustainability performance of civil engineering works by providing a common framework for their expression. This document identifies and describes issues to be taken into account in the development and use of methods for the assessment of the sustainability performance for all types of civil engineering works, both new and existing, and it is relevant for the assessment of the environmental, social and economic performance of both new and existing civil engineering works over their entire life cycle. The object of assessment in this document is the civil engineering works itself and its area of influence. NOTE 1 For example, the assessment includes any local civil engineering works beyond the immediate area of the civil engineering works; the transportation of the users of the civil engineering works; and the use and exploitation of the civil engineering works itself. Assessments can be undertaken either for the whole civil engineering works, for a part of the civil engineering works, or for a combination of several civil engineering works. This document excludes environmental, social and economic risk assessment, but the results of a risk assessment can be taken into consideration. This document is intended to be used in conjunction with, and following the principles set out in, ISO 15392 and the ISO 14000 family of International Standards. The evaluation of technical and functional performance of the civil engineering works is outside the scope of this document, but the technical and functional characteristics are considered within this framework by reference to the functional equivalent. The functional equivalent takes into account the technical and functional requirements and forms the basis for comparisons of the results of the assessment. Assessment methods that consider only one or two of the three dimensions of sustainability are outside the scope of this document. This document does not set benchmarks or levels of performance relative to environmental, social and economic aspects and impacts. NOTE 2 Valuation methods, levels, classes or benchmarks can be prescribed in the requirements for environmental, social and economic performance in the client's brief, construction regulations, national standards, national codes of practice, civil engineering works assessment and certification schemes, etc. The rules for methods of assessment to consider in the assessment of environmental, social and economic aspects of operation practices are included within this framework, and the consequences of decisions or actions that influence the environmental, social and economic performance of the object of assessment are identified so that they can be taken into account.	IMPACT ASSESSMENT
ISO/TS 37151:2015	Smart community infrastructures — Principles and requirements for performance metrics	ISO/TS 37151:2015 **gives principles and specifies requirements for the** · definition, · identification, · optimization, and harmonization of community infrastructure performance metrics, and gives recommendations for analysis, including · smartness, · interoperability, · synergy, · resilience, · safety, and · security **of community infrastructures.** Community infrastructures include, but are **not limited to, energy, water, transportation, waste, and ICT.** The principles and requirements of ISO/TS 37151:2015 are applicable to communities of any size sharing geographic areas that are planning, commissioning, managing, and assessing all or any element of its community infrastructures. However, the selection and the importance of metrics or (key) performance indicators of community infrastructures is a result of the application of ISO/TS 37151:2015 and depends on the characteristics of each community. In ISO/TS 37151:2015, the concept of smartness is addressed in terms of performance relevant to technologically implementable solutions, in accordance with sustainable development and resilience of communities as defined in ISO/TC 268.	IMPACT ASSESSMENT
ISO 37153:2017	Smart community infrastructures — Maturity model for assessment and improvement	ISO 37153:2017 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.	IMPACT ASSESSMENT
UNE 66182:2015	Guide for comprehensive assessment of local government and transformation into a smart city.	This standard provides an **evaluation tool that includes all municipal activities;** it is the basis of a comprehensive quality management, and helps to strengthen the confidence of citizens in the management of the local administration.	IMPACT ASSESSMENT

NEN 5060	Hygrothermal performance of buildings - Climatic reference data [Netherlands]	This standard contains climatic refrence data for the determination of the energy perfomance of buildings and for the dimensioning of heating, cooling and air treatment installations in buildings.	NbS ARCHITECTURE
EN ISO 15927-4	Hygrothermal performance of buildings – Calculation and presentation of climatic data. Part 4: hourly data for assessing the annual energy use for heating and cooling	ISO 15927-4:2005 **specifies a method for constructing a reference year of hourly values of appropriate meteorological data suitable for assessing the average annual energy for heating and cooling**. Other reference years representing average conditions can be constructed for special purposes. The procedures in this part of ISO 15927-4:2005 are not suitable for constructing extreme or semi-extreme years for simulation of, for example, moisture damage or energy demand in cold years. Meteorological instrumentation and methods of observation are not covered.	NbS ARCHITECTURE
CEN/TR 14383-2	Prevention of crime - Urban planning and building design - Part 2: Urban planning	This **Technical Report gives guidelines on methods for assessing the risk of crime and/ or fear of crime and measures, procedures and processes aimed at reducing these risks.** Design guidelines are given for specific types of environments to prevent or counteract different crime problems consistently with the urban planning documents.	IMPACT ASSESSMENT PROCESS
UNE 178303:2015	Smart Cities. Assetc management of the city. Specifications.	This standard specifies the requirements to establish, implement, maintain and improve a municipal management system.	PROCESS
UNE 178405:2018	Smart Cities. Environmental sensorisation. Intelligent irrigation system	This standard UNE 178405:2018 Smart Cities. Environmental sensoring. Smart irrigation system is classified in these ICS categories: 35.240.01 65.060.35	TECHNOLOGICAL
ISO/IEC 21972	Information technology — Upper level ontology for smart city indicators	This document establishes general principles and gives guidelines for an indicator upper level ontology (IULO) for smart cities that enables the representation of indicator definitions and the data used to derive them. It includes: — concepts (e.g., indicator, population, cardinality); and — properties that relate concepts (e.g., cardinality_of, parameter_of_var).	TERMONOLOGY
CWA 17381	The Description and Assessment of Good Practices for Smart City solutions	This CEN Workshop Agreement (CWA) defines requirements to describe and assess good practices of Smart City Solutions. This document is intended to support the decision-making of smart cities in the interest of their citizens, and of those who advise them, such as companies providing products and services, consultants, and associations.	
ITU-T Y.4700	Deployment guidelines for ubiquitous sensor network applications and services for mitigating climate change	This Recommendation provides deployment guidelines for ubiquitous sensor network (USN) applications and services for mitigating climate change. The scope of this Recommendation includes: – an overview of climate change monitoring; – analysis of environmental impact by USN applications and services; and – the requirements for deployment of USN applications and services for mitigating climate change. Monitoring climate change covers monitoring the status of greenhouse gas (GHG) emissions, as well as monitoring climate change by tracing temporal changes of GHG emissions.	TECHNOLOGICAL

ii) RELATED

ISO 14015:2022	Environmental management — Guidelines for environmental due diligence assessment	This document **gives guidance on how to conduct an environmental due diligence (EDD) assessment through a systematic process of identifying environmental aspects**, issues and conditions as well as determining, if appropriate, their business consequences. This document does not provide guidance on how to conduct other types of environmental assessment, such as: a) environmental audits; b) environmental impact assessments; c) environmental performance, efficiency, or reliability assessment; d) intrusive environmental investigations and remediation.	IMPACT ASSESSMENT
ISO/AWI PAS 14018	Guidelines for the Remote Auditing of Environmental Management Systems	This PAS Standard provides guidance on the **application of remote auditing methods in the conduct of internal or external audits of environmental management systems (EMS),** and on the competence of auditors in the use of remote methods. It is intended to apply to a broad range of potential users, including auditors, organizations implementing environmental management systems, organizations needing to conduct audits of environmental management systems for contractual reasons, and organizations involved in auditor certification or training, in certification/registration of management systems, and in accreditation or in standardisation in the area of conformity assessment. The guidance in this PAS Standard is intended to be flexible as the use of these guidelines can be applied to the auditing of an organization irrespective of its size, nature and complexity, as well as the objectives and scopes of the audits to be conducted. Throughout this PAS Standard, examples on specific topics will be provided to assist understanding and facilitate implementation of the guidance. Specific guidance will to support implementation of this PAS Standard in small organizations.	IMPACT ASSESSMENT
ISO 14026:2017	Environmental labels and declarations — Principles, requirements and guidelines for communication of footprint information	ISO 14026:2017 provides principles, **requirements and guidelines for footprint communications for products addressing areas of concern relating to the environment.** ISO 14026:2017 also provides requirements and guidelines for footprint communication programmes, as well as requirements for verification procedures. ISO 14026:2017 does not address the quantification of a footprint, nor does it address the communication of footprints that are not related to the environment, e.g. footprints addressing social or economic issues. In particular, footprint communications relating to the economic and social dimensions of sustainable development are outside the scope of ISO 14026:2017. Footprint communications relating to organizations are also outside the scope of ISO 14026:2017.	IMPACT ASSESSMENT
ISO/TS 14027:2017	Environmental labels and declarations — Development of product category rules	ISO/TS 14027:2017 **provides principles, requirements and guidelines for developing, reviewing, registering and updating PCR within a Type III environmental declaration or footprint communication programme based on life cycle assessment (LCA)** according to ISO 14040 and ISO 14044 as well as ISO 14025, ISO 14046 and ISO/TS 14067. It also provides guidance on how to address and integrate additional environmental information, whether or not it is based on LCA in a coherent and scientifically sound manner according to ISO 14025.	PROCESS
ISO 14031:2021	Environmental management — Environmental performance evaluation — Guidelines	This document gives guidelines for the design and **use of environmental performance evaluation (EPE) within an organization. It is applicable to all organizations, regardless of type, size, location and complexity.** This document does not establish environmental performance levels. It is not intended for use for the establishment of any other environmental management system (EMS) conformity requirements.	IMPACT ASSESSMENT

		The guidance in this document can be used to support an organization's own approach to EPE including its commitments to compliance with legal and other requirements, the prevention of pollution and continual improvement, among others. NOTE This document is a generic standard and does not include guidance on specific methods for valuing or weighting different kinds of impacts in different kinds of sectors, disciplines, etc. Depending on the nature of the organization's activities, there is often a need to also go to other sources for additional information and guidance on sector-specific topics, different subject matters or different scientific disciplines.	
ISO 14034:2016	Environmental management — Environmental technology verification (ETV)	ISO 14034:2016 specifies **principles, procedures and requirements for environmental technology verification (ETV).**	IMPACT ASSESSMENT
ISO 14040:2006	Environmental management — Life cycle assessment — Principles and framework	ISO 14040:2006 describes **the principles and framework for life cycle assessment (LCA) including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA)** phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, the relationship between the LCA phases, and conditions for use of value choices and optional elements. ISO 14040:2006 covers life cycle assessment (LCA) studies and life cycle inventory (LCI) studies. It does not describe the LCA technique in detail, nor does it specify methodologies for the individual phases of the LCA. The intended application of LCA or LCI results is considered during definition of the goal and scope, but the application itself is outside the scope of this International Standard.	IMPACT ASSESSMENT
ISO 14044:2006	Environmental management — Life cycle assessment — Requirements and guidelines	ISO 14044:2006 **specifies requirements and provides guidelines for life cycle assessment (LCA) including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI**) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, relationship between the LCA phases, and conditions for use of value choices and optional elements. ISO 14044:2006 covers life cycle assessment (LCA) studies and life cycle inventory (LCI) studies.	IMPACT ASSESSMENT
ISO/TR 14047:2012	Environmental management — Life cycle assessment — Illustrative examples on how to apply ISO 14044 to impact assessment situations	The purpose of IS**O/TR 14047:2012 is to provide examples to illustrate current practice of life cycle impact assessment according to ISO 14044:2006**. These examples are only a sample of all possible examples that could satisfy the provisions of ISO 14044. They offer "a way" or "ways" rather than the "unique way" of applying ISO 14044. They reflect the key elements of the life cycle impact assessment (LCIA) phase of the LCA. The examples presented in ISO/TR 14047:2012 are not exclusive and other examples exist to illustrate the methodological issues described.	IMPACT ASSESSMENT
ISO/TR 14049:2012	Environmental management — Life cycle assessment — Illustrative examples on how to apply ISO 14044 to goal and scope definition and inventory analysis	ISO/TR **14049:2012 provides examples about practices in carrying out a life cycle inventory analysis (LCI) as a means of satisfying certain provisions of ISO 14044:2006.** These examples are only a sample of the possible cases satisfying the provisions of ISO 14044. They offer "a way" or "ways" rather than the "unique way" for the application of ISO 14044. These examples reflect only portions of a complete LCI study.	IMPACT ASSESSMENT
ISO/TS 14071:2014	Environmental management — Life cycle assessment — Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006	ISO/TS 14071:2014 **provides additional specifications to ISO 14040:2006 and ISO 14044:2006. It provides requirements and guidelines for conducting a critical review of any type of LCA study and the competencies required for the review. ISO/TS 14071:2014 provides:** details of a critical review process, including clarification with regard to ISO 14044:2006; guidelines to deliver the required critical review process, linked to the goal of the life cycle assessment (LCA) and its intended use; content and deliverables of the critical review process; guidelines to improve the consistency, transparency, efficiency and credibility of the critical review process; the required competencies for the reviewer(s) (internal, external and panel member); the required competencies to be represented by the panel as a whole. ISO/TS 14071:2014 does not cover the applications of LCA.	IMPACT ASSESSMENT
ISO/TS 14072:2014	Environmental management — Life cycle assessment — Requirements and guidelines for organizational life cycle assessment	ISO/TS 14072:2014 **provides additional requirements and guidelines for an effective application of ISO 14040 and ISO 14044 to organizations.** This Technical Specification details ? the application of Life Cycle Assessment (LCA) principles and methodology to organizations, ? the benefits that LCA can bring to organizations by using LCA methodology at organizational level, ? the system boundary, ? specific considerations when dealing with LCI, LCIA, and interpretation, and ? the limitations regarding reporting, environmental declarations, and comparative assertions. This Technical Specification applies to any organization that has interest in applying LCA. It is not intended for the interpretation of ISO 14001 and specifically covers the goals of ISO 14040 and ISO 14044.	IMPACT ASSESSMENT
ISO/DTS 14074	Environmental management — Life cycle assessment — Principles, requirements and guidelines for normalization, weighting and interpretation	Under development	IMPACT ASSESSMENT
ISO/AWI 14075	Principles and framework for social life cycle assessment	Under development	IMPACT ASSESSMENT
ISO 14064-1	Greenhouse gases - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals	This document specifies principles and requirements at the organization level for the quantification and reporting of greenhouse gas (GHG) emissions and removals. It includes requirements for the design, development, management, reporting and verification of an organization's GHG inventory.	IMPACT ASSESSMENT
ISO 14067:2018	Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification	This document specifies **principles, requirements and guidelines for the quantification and reporting of the carbon footprint of a product (CFP), in a manner consistent with International Standards on life cycle assessment (LCA) (ISO 14040 and ISO 14044). Requirements and guidelines for the quantification of a partial CFP are also specified.** This document is applicable to CFP studies, the results of which provide the basis for different applications (see Clause 4). This document addresses only a single impact category: climate change. Carbon offsetting and communication of CFP or partial CFP information are outside the scope of this document.	IMPACT ASSESSMENT

		This document does not assess any social or economic aspects or impacts, or any other environmental aspects and related impacts potentially arising from the life cycle of a product.	
ISO/DTR 14069	Greenhouse gases — Quantification and reporting of greenhouse gas emissions for organizations — Guidance for the application of ISO 14064-1	Under development	IMPACT ASSESSMENT
ISO/TR 14069:2013	Greenhouse gases — Quantification and reporting of greenhouse gas emissions for organizations — Guidance for the application of ISO 14064-1	ISO/TR 14069:2013 describes the principles, concepts and methods relating to the quantification and reporting of direct and indirect greenhouse gas (GHG) emissions for an organization. It provides guidance for the application of ISO 14064-1 to greenhouse gas inventories at the organization level, for the quantification and reporting of direct emissions, energy indirect emissions and other indirect emissions. ISO/TR 14069:2013 describes for all organizations, including local authorities, the steps for: establishing organizational boundaries, in accordance with either a control approach (financial or operational) or an equity share approach; establishing operational boundaries, by identifying direct emissions and energy indirect emissions to be quantified and reported, as well as any other indirect emissions the organization chooses to quantify and report; for each category of emission, guidance is provided on specific boundaries and methodologies for the quantification of GHG emissions and removals; GHG reporting: guidance is provided to promote transparency regarding the boundaries, the methodologies used for the quantification of direct and indirect GHG emissions and removals, and the uncertainty of the results.	IMPACT ASSESSMENT
ASTM E 2725	Standard Guide for Basic Assessment and Management of Greenhouse Gases	1.1 Overview- This guide presents a generalized systematic approach to voluntary assessment and management of the causes and impacts of GHGs. It includes actions, both institutional (legal) and engineering (physical) controls for GHG reductions, impacts, and adaptations. Options for a tiered analysis provide a priority ranking system, to address the "worst first" challenges of a facility, addressing practicality and cost-benefit. 1.2 Purpose- The purpose of this guide is to provide a series of options consistent with basic principles and practices for GHG-related action. This guide encourages consistent and comprehensive assessment and management of GHG outcomes from facility and business operations. 1.2.1 The guide also provides some high-level options for the monitoring, tracking and performance to evaluate the effectiveness of the commercial entity's strategy to ensure that a reasonable approach is taken. 1.2.2 This standard ties into the ASTM Committee E50 standards series related to environmental risk assessment and management. 1.3 Objectives- The objectives of this guide are to determine the conditions of the facility and or/property with regard to the status of GHGs and actions to be taken to manage and reduce or offset those emissions. 1.3.1 The guide provides a three-tiered decision strategy that focuses on business risk, cost-effective solutions in response to greenhouse gases, and related issues such as the need for energy independence. 1.4 Limitations of this Guide- Given the variability of the different types of facilities that may wish to use this guide, and the existence of state and local regulations, it is not possible to address all the relevant standards that might apply to a particular facility. This guide uses generalized language and examples to guide the user. If it is not clear to the user how to apply standards to their specific circumstances, it is recommended that users seek assistance from qualified professionals. 1.4.1 Insurance Industry- The effects of GHG on insurers are not clear. The definition of an insurable occurrence and a commencement point for when insurable claims are made, along with when conditions were discovered and the actionable information leading to an insurable loss is not clear. It may be inappropriate to speculate on GHGs that are highly uncertain for purposes of insurance related to specific events. 1.4.2 This guide does not take a position on the science of climate change, its association with anthropogenic greenhouse gases, or various mathematical models generated by international bodies. 1.4.3 The guide does not address water vapor as a greenhouse gas. 1.4.4 The guide only addresses anthropogenic greenhouse gases. 1.5 The guide uses references and information on the control, management and reduction of GHGs from many cited sources such as the Intergovernmental Panel on Climate Change, ISO, the World Resources Institute, and the National Academy of Sciences. 1.6 Several U.S.-based federal regulatory agencies served as sources of information on existing and anticipated regulation and management of GHGs including the Environmental Protection Agency, the Department of Energy, and the Securities and Exchange Commission. Note 1: New Source Performance Standards regulating methane emissions from natural gas wells are codified in 40 CFR 60 Subpart OOOO. 1.7 This guide relies on current regulatory information about GHGs from various state agencies, including the California Air Resources Board, the Massachusetts and Connecticut Departments of Environmental Protection, the Washington Department of Ecology, the Western Climate Initiative, and the Regional Greenhouse Gas Initiative. 1.8 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard. 1.9 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use. 1.10 This international standard was developed in accordance with internationally recognized principles on standardisation established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.	IMPACT ASSESSMENT
ISO 50046	General methods for predicting energy savings	This document specifies general methods for the calculation of predicted energy savings (PrES), using measure-based calculation methods, also known as bottom-up or energy performance improvement actions (EPIAs)-based methods (see ISO 17742). Indicator-based methods (see ISO 17742) and total-consumption-based methods (see ISO 50047) are not included in the scope of this document. This document provides general principles for categorizing and choosing the method, taking account of the context, targeted accuracy and resources available for calculating the PrES. It also provides guidance on the conditions for ensuring the quality of the PrES, their documentation and validation. It is applicable to calculation of PrES for any: — type of EPIA; — end-use sector; — energy end-use; — level of aggregation of energy savings; — stakeholder. NOTE 1 Stakeholders can include private or public organizations, energy auditors, energy services companies, energy and equipment suppliers, policy makers, etc. This document considers PrES from: — an EPIA; and/or — an action plan, programme or policy (aggregated energy savings). NOTE 2 An action plan, programme or policy can be implemented at different scales (organization, city, region, country). This document describes how to calculate PrES over a prediction period. It can be used to calculate PrES in terms of primary energy or final (or delivered) energy (as defined in ISO 50047 and ISO/IEC 13273-1).	IMPACT ASSESSMENT
ISO 50049	Calculation methods for energy efficiency and energy consumption variations at country, region and city levels	This **document gives guidelines for methods for analysing changes in energy efficiency and energy consumption, and for measuring energy efficiency progress, for countries, regions and cities.** It is composed of three different calculation methods: — evaluation of structure effects in the variation of energy intensity; — calculation of energy efficiency indices; — decomposition analysis of energy consumption variation. This document is applicable to providing an aggregated statistical evaluation for a country, region or city. It does not apply to calculating changes in the energy consumption or in energy efficiency at the individual consumer's level (e.g. households, organizations, companies).	IMPACT ASSESSMENT
ISO 17742	Energy efficiency and savings calculation for countries, regions and cities	ISO 17742:2015 **provides a general approach for energy efficiency and energy savings calculations with indicator-based and measure-based methods for the geographical entities countries, regions, and cities**. ISO 17742:2015 considers all end-use sectors, such as households, industry, tertiary (services, etc.), agriculture, and transport. It does not incorporate calculation of energy efficiency and energy savings in energy supply sectors, such as power plants, refineries, and coal mines.	IMPACT ASSESSMENT

ASTM E 2921	Standard Practice for Minimum Criteria for Comparing Whole Building Life Cycle Assessments for Use with Building Codes and Rating Systems	This practice provides **criteria to be applied irrespective of the assessment (LCA) tool that is used when LCA is undertaken** at the whole building level to compare a final whole building design to a reference building design. The purpose of this practice is to support the use of whole building Life Cycle Assessment (LCA) in building codes and building rating systems by ensuring that comparative assessments of final whole building designs relative to reference building designs take account of the relevant building features, life cycle stages, and related activities in similar fashion for both the reference and final building designs of the same building.	NbS ARCHITECTURE
EN 15804:2012+A1:2013	Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products	**This European standard provides core product category rules (PCR) for Type III environmental declarations for any construction product and construction service**. NOTE The assessment of social and economic performances at product level is not covered by this standard. The core PCR: - defines the parameters to be declared and the way in which they are collated and reported, - describes which stages of a product's life cycle are considered in the EPD and which processes are to be included in the life cycle stages, - defines rules for the development of scenarios, - includes the rules for calculating the Life Cycle Inventory and the Life Cycle Impact Assessment underlying the EPD, including the specification of the data quality to be applied, - includes the rules for reporting predetermined, environmental and health information, that is not covered by LCA for a product, construction process and construction service where necessary, - defines the conditions under which construction products can be compared based on the information provided by EPD. For the EPD of construction services the same rules and requirements apply as for the EPD of construction products.	IMPACT ASSESSMENT
EN 16450:2017	Ambient air. Automated measuring systems for the measurement of the concentration of particulate matter (PM10; PM2,5)	In **order to be in compliance with EU Air Quality Directive requirements, the reference methods given in the Directive 2008/50/EC [1] for the measurement of mass concentrations of particulate matter are not commonly used for operation in routine monitoring networks.** These networks usually apply automated continuous measurement systems (AMS), such as those based on the use of oscillating microbalances, ß-ray attenuation, or in-situ optical methods. Such AMS are typically capable of producing 24-hour average measurement values over a measurement range up to 1 000 µg/m3 and 1-hour average measurement values up to 10 000 µg/m3, if applicable, where the volume of air is the volume at ambient conditions near the inlet at the time of sampling. The 1-hour average values may be used for: a) direct information of the public; b) aggregation to produce daily or yearly average concentration values for regulatory reporting purposes. Directive 2008/50/EC allows the use of such systems after demonstration of equivalence with the reference method, i.e. after demonstration that these systems meet the Data Quality Objectives for continuous measurements. Guidelines for the demonstration of equivalence are given in Reference [2]. This European Standard lays down the minimum performance requirements and test procedures for the type approval of appropriate AMS for particulate matter. This includes the evaluation of its equivalence with the reference method as laid down in Directive 2008/50/EC. Further, this European Standard describes minimum requirements for ongoing quality assurance – quality control (QA/QC) of AMS deployed in the field. These requirements are necessary to ensure that uncertainties of measured concentrations are kept within the required limits during extended periods of continuous monitoring in the field, and include procedures for maintenance, calibration and control checks. Additional procedures are described that determine whether an instrument's equivalence to the reference method is maintained through possible pollution climate changes, over periods longer than five years. Lastly, this European Standard describes harmonized requirements and procedures for the treatment and validation of raw measurement data that are used for the assembly of daily or yearly average concentration values. Experience with existing methods for data treatment and validation – for similar AMS – has shown that the different ways of data treatment and validation applied may lead to significant differences in reported results for similar datasets [3]. When the European Standard is used for purposes other than measurements required by Directive 2008/50/EC, the range and uncertainty requirements may not apply. This European Standard contains information for different groups of users. Clauses 5 and 6 and Annex A contain general information about the principles of automated continuous measurement systems for particulate matter, and relevant equipment. Clause 7 and Annexes B and C are specifically directed towards test houses and laboratories that perform type-approval testing of automated continuous measurement systems for particulate matter. These clauses contain information about: c) type-approval test conditions, test procedures and test requirements; d) system performance requirements; e) evaluation of the type-approval test results; f) evaluation of the uncertainty of the measurement results of the automated continuous measurement systems for particulate matter based on the type-approval test results. Clauses 8 to 11 are aimed at monitoring networks performing the practical measurements of particulate matter in ambient air. These clauses contain information about: g) initial installation of the system in the monitoring network and acceptance testing; h) ongoing quality assurance/quality control; i) on-going verification of suitability; j) treatment, validation and reporting of measurement results.	IMPACT ASSESSMENT
EN 16757:2017	Sustainability of construction works. Environmental product declarations. Product Category Rules for concrete and concrete elements	This European Standard complements the core rules for the product category of construction products as defined in EN 15804:2012+A1:2013 and is intended to be used in conjunction with that standard. This European Standard applies to concrete and concrete elements for building and civil engineering, excluded autoclaved aerated concrete. This document defines the parameters to be reported, what EPD types (and life cycle stages) to be covered, what rules to be followed in order to generate Life Cycle Inventories (LCI) and conduct Life Cycle Impact Assessment (LCIA) and the data quality to be used in the development of EPDs. In addition to the common parts of EN 15804:2012+A1:2013, this European Standard for concrete and concrete elements: - defines the system boundaries; - defines the modelling and assessment of material-specific characteristics; - defines allocation procedures for multi-output processes along the production chain; - defines allocation procedures for reuse and recycling; - includes the rules for calculating the LCI and the LCIA underlying the EPD; - provides guidance/specific rules for the determination of the reference service life (RSL); - gives guidance on the establishment of default scenarios; - gives guidance on default functional units for concrete elements. This document is intended to be used either for cradle to gate, cradle to gate with options or cradle to grave assessment, provided the intentions are properly stated in the system boundary description. Within the construction works context, a cradle to grave declaration delivers a more comprehensive understanding of the environmental impact associated with concrete and concrete elements.	IMPACT ASSESSMENT
IEEE/ISO/IEC 18880-2015 -	ISO/IEC/IEEE Information technology-Ubiquitous green community control network protocol	Adoption Standard - Active. The standard identifies gateways for field-bus networks, data storage for archiving and developing data sharing platforms, and application units as important system components for developing digital communities, i.e., building-scale and city-wide ubiquitous facility networking infrastructure. The standard defines a data exchange protocol that generalizes and interconnects these components (gateways, storage, application units) over the IPv4/v6-based networks. This enables integration of multiple facilities, data storage, application services such as central management, energy saving, environmental monitoring, and alarm notification systems.	IMPACT ASSESSMENT
ASTM E 2986	Standard Guide for Evaluation of Environmental Aspects of Sustainability of Manufacturing Processes	This guide **provides guidance to develop manufacturer-specific procedures for evaluating the environmental sustainability performance of manufacturing processes.** This guide introduces decision support methods that can be used to improve sustainability performance.	TECHNOLOGICAL
IEEE -2019 - IEEE Ubiquitous Green Community Control Network - IEEE 1888(TM) Series (Bundle)	IEEE Ubiquitous Green Community Control Network - IEEE 1888(TM) Series (Bundle)	The standard describes a **remote control architecture of digital community, intelligent building groups, and digital metropolitan networks; specifies interactive data formats between devices and systems; and gives a standardised definition of equipment, service services, signals, and interactive messages in this digital community network**. The digital community remote control network opens application interfaces for public administration, public services, property management services, and individual service services, which enables intelligent interconnection, collaboration service, remote surveillance, and central management to be feasible. Surveillance networks, consumer electronics, remote service systems, public administration systems, security linkage systems, and emergency reaction systems will be integrated into the community network seamlessly. Based on TCP/IP open systems, the network architecture adopts active and emerging technologies, supporting diverse access technologies in the physical layer, supporting IPv4/v6 in the network layer, and integrating well with the next generation converged networks. The standard aims to provide proper remote control and collaborating management solutions for operators, community administrators, public service providers, government departments, and individual users, so as to use and control facilities in community and building groups effectively, such as sensors, surveillance monitors, HVAC, lighting	TECHNOLOGICAL

		systems, fire-fighting systems, consumer electronics, and so on; The public environment monitor mechanism is set up to ease energy shortage and environment degradation through remote surveillance, operation, management, and maintenance, leaving a secure, comfortable, and convenient living environment. Energy, environment, and security are taken into consideration to realize reasonable plans and remote control in community networks. Revision Standard - Active. The standard identifies gateways for field-bus networks, data storage for archiving and developing data sharing platforms, and application units as important system components for developing digital communities, i.e., building-scale and city-wide ubiquitous facility networking infrastructure. The standard defines a data exchange protocol that generalizes and interconnects these components (gateways, storage, application units) over the IPv4/v6-based networks. This enables integration of multiple facilities, data storage, application services such as central management, energy saving, environmental monitoring, and alarm notification systems.	
ISO/IEC 30182	Smart city concept model — Guidance for establishing a model for data interoperability	ISO/IEC 30182:2017 **describes, and gives guidance on, a smart city concept model (SCCM) that can provide the basis of interoperability between component systems of a smart city, by aligning the ontologies in use across different sectors**. It includes: - concepts (e.g. ORGANIZATION, PLACE, COMMUNITY, ITEM, METRIC, SERVICE, RESOURCE); and - relationships between concepts (e.g. ORGANIZATION has RESOURCEs, EVENT at a PLACE). The SCCM does not replace existing models where they exist, but, by mapping from a local model to a parent model, questions can be asked about data in a new and joined-up way. ISO/IEC 30182:2017 is aimed at organizations that provide services to communities in cities, and manage the resulting data, as well as decision-makers and policy developers in cities.1) The SCCM is relevant wherever many organizations provide services to many communities within a place. It does not cover the data standards that are relevant to each concept in the SCCM and does not attempt to list or recommend the sources of identifiers and categorizations that cities map to the SCCM. The SCCM has been devised to communicate the meaning of data. It does not attempt to provide concepts to describe the metadata of a dataset, for example, validity and provenance of data. It covers semantic interoperability, that is, defining the meaning of data, particularly from many sources. It does not cover other barriers to interoperability, some of which are described at 3.2.	TECHNOLOGICAL
ISO/TR 37150:2014	Smart community infrastructures — Review of existing activities relevant to metrics	ISO/TR 37150:2014 **provides a review of existing activities relevant to metrics for smart community infrastructures.** In ISO/TR 37150:2014, the concept of smartness is addressed in terms of performance relevant to technologically implementable solutions, in accordance with sustainable development and resilience of communities, as defined in ISO/TC ISO/TR 37150:2014 addresses community infrastructures such as energy, water, transportation, waste and information and communications technology (ICT). It focuses on the technical aspects of existing activities which have been published, implemented or discussed. Economic, political or societal aspects are not analyzed in ISO/TR 37150:2014. NOTE ISO/TR 37150:2014 is not a recommendation document for best practices. Although sustainability objectives have been considered, the main subject of ISO/TR 37150:2014 is the analysis of existing methodologies for smart community infrastructures.	IMPACT ASSESSMENT
ISO 37166:2022	Smart community infrastructures — Urban data integration framework for smart city planning (SCP)	**This document establishes a data framework that involves possible multi-source common data through standardised data integration and sharing mechanisms. It includes recommendations for:** — precision, dimensions of the data, data collection, updates and storing mechanisms; — a data model for data integration, data standardisation and data fusion approaches for heterogeneous smart city infrastructure data; — a data security level and sharable attributes for all involved data, principles on data sharing or exchange. This document focuses on the integration and application of heterogeneous data from urban infrastructure systems, such as water, transport, energy, drainage and waste, so as to support smart city planning (SCP). It contains case studies, in Annex A, of various smart city projects.	IMPACT ASSESSMENT
ISO/CD 37173	Smart city infrastructure — Development guidelines for information-based system of smart building	Under development	IMPACT ASSESSMENT
EN IEC 60068-3-7:2020	Environmental testing Supporting documentation and guidance. Measurements in temperature chambers for tests A (Cold) and B (Dry heat) (with load)	IEC 60068-3-7:2020 is available as IEC 60068-3-7:2020 RLV which contains the International Standard and its Redline version, showing all changes of the technical content compared to the previous edition. IEC 60068-3-7:2020 specifies a uniform and reproducible method of confirming that temperature test chambers conform to the requirements specified in the climatic test procedures of IEC 60068-2-1 and IEC 60068-2-2, when loaded with either heat-dissipating or non heat-dissipating specimens under conditions which take into account air circulation inside the working space of the chamber. This document is intended primarily for users when conducting regular chamber performance monitoring. This second edition cancels and replaces the first edition published in 2001. This edition constitutes a technical revision. This edition includes the following significant technical changes with respect to the previous edition: - verbal forms have, in many parts, been changed to express requirements instead of recommendations ('shall' instead of 'should'); - Table 1 has been updated.	IMPACT ASSESSMENT
PD CEN/TS 17660-1:2021	Air quality. Performance evaluation of air quality sensor systems Gaseous pollutants in ambient air	This **document specifies the general principles, including testing procedures and requirements, for the classification of performance of low-cost sensor systems for the monitoring of gaseous compounds in ambient air at fixed sites.** The classification of sensor systems includes tests that are performed under prescribed laboratory and field conditions. The procedure described is applicable to the determination of the mass concentration of air pollutants. The pollutants that are considered in this document are the gaseous pollutants regulated under Directive 2008/50/EC (O3, NO/NO2/NOx, CO, SO2 and benzene) in the range of concentrations expected in ambient air. This document provides a classification that is consistent with the requirements for indicative measurements and objective estimation defined in Directive 2008/50/EC. In addition, it provides a classification for applications (non-regulatory measurements) that require more relaxed performance criteria. This document applies to sensor systems used as individual systems. It does not apply to sensor systems as part of a sensor network. However, for some applications (e.g. in cities) sensor systems are deployed as part of a sensor network. Annex A gives information on the use of sensor systems as nodes in a sensor network. This document gives guidance on the testing of CO2 sensor systems in Annex B since, although not listed in Directive 2008/50/EC, CO2 is an interesting indicator as proxy for activities involving combustion processes or for CO2 evaporation from soil or water.	IMPACT ASSESSMENT
ISO 23611-6	Soil quality — Sampling of soil invertebrates — Part 6: Guidance for the design of sampling programmes with soil invertebrates	This part of ISO 23611 provides guidance for the design of field studies with soil invertebrates (e.g. for the monitoring of the quality of a soil as a habitat for organisms). Detailed information on the sampling of the most important soil organisms is provided in the other parts of this International Standard (ISO 23611-1 to ISO 23611-5). This part of ISO 23611 is used for all terrestrial biotopes in which soil invertebrates occur. Basic information on the design of field studies in general is already laid down in ISO 10381-1. This information can vary according to the national requirements or the climatic/regional conditions of the site to be sampled. NOTE While this part of ISO 23611 aims to be applicable globally for all terrestrial sites that are inhabited by soil invertebrates, the existing information refers mostly to temperate regions. However, the (few) studies from other (tropical and boreal) regions, as well as theoretical considerations, allow the conclusion that the principles laid down in this part of ISO 23611 are generally valid, References [4], [6], [40], [21]. This part of ISO 23611 gives information on site-specific risk assessment of contaminated land, study of potential side effects of anthropogenic	IMPACT ASSESSMENT

		impacts (e.g. the application of chemicals or the building of roads), the biological classification and assessment of soils in order to determine the biological quality of soils, and longterm biogeographical monitoring in the context of nature protection or restoration, including global change (e.g. as in long-term ecological research projects).	
ISO/IEC 30146	Information technology — Smart city ICT indicators	**This document defines a comprehensive set of evaluation indicators specially related to information and communication technologies (ICT)** adoption and usage in smart cities. Firstly, it establishes an overall framework for all the indicators. Then, it specifies the name, description, classification and measurement method for each indicator.	IMPACT ASSESSMENT
ISO 19289:2015	Air quality. Meteorology. Siting classifications for surface observing stations on land	This International Standard indicates exposure rules for various sensors, but what should be done when these conditions are not fulfilled? There are sites that do not respect the recommended exposure rules. Consequently, a classification has been established to help determine the given site's representativeness on a small scale (impact of the surrounding environment). Hence, a class 1 site can be considered as a reference site. A class 5 site is a site where nearby obstacles create an inappropriate environment for a meteorological measurement that is intended to be representative of a wide area (at least tens of km2). The smaller the siting class, the higher the representativeness of the measurement for a wide area. In a perfect world, all sites would be in class 1 but the real world is not perfect and some compromises are necessary. A site with a poor class number (large number) can still be valuable for a specific application needing a measurement in this particular site, including its local obstacles. The classification process helps the actors and managers of a network to better take into consideration the exposure rules and thus it often improves the siting. At least, the siting environment is known and documented in the metadata. It is obviously possible and recommended to fully document the site but the risk is that a fully documented site might increase the complexity of the metadata, which would often restrict their operational use. That is why this siting classification is defined to condense the information and facilitate the operational use of this metadata information. A site as a whole has no single classification number. Each parameter being measured at a site has its own class and is sometimes different from the others. If a global classification of a site is required, the maximum value of the parameters' classes can be used. The rating of each site should be reviewed periodically as environmental circumstances can change over a period of time. A systematic yearly visual check is recommended: if some aspects of the environment have changed, a new classification process is necessary. A complete update of the site classes should be done at least every five years. In this International Standard, the classification is (occasionally) completed with an estimated uncertainty due to siting, which has to be added in the uncertainty budget of the measurement. This estimation is coming from bibliographic studies and/or some comparative tests. The primary objective of this classification is to document the presence of obstacles close to the measurement site. Therefore, natural relief of the landscape may not be taken into account, if far away (i.e. >1 km). A method to judge if the relief is representative of the surrounding area is the following: Does a move of the station by 500 m change the class obtained? If the answer is no, the relief is a natural characteristic of the area and is not taken into account. Complex terrain or urban areas generally lead to high class numbers. In such cases, an additional flag "S" can be added to class numbers 4 or 5 to indicate specific environment or application (i.e. 4S).	IMPACT ASSESSMENT
ITU-T L.1500	Framework for information and communication technologies and adaptation to the effects of climate change	ITU-T Recommendation L.1500 describes a framework for Information and Communication Technologies (ICT) and adaptation to the effects of climate change. This framework identifies and defines the basis for the development of the following Recommendations:	TECHNOLOGICAL
ITU-T L.1501	Best practices on how countries can utilize ICTs to adapt to the effects of climate change	ITU-T Recommendation L.1501 on how countries can use ICTs to adapt to the effects of climate change. It also provides a framework and checklist for countries integrating ICTs into their national climate change adaptation strategies. Examples of checklists, use cases, best practices, guidelines, consideration points, etc. will be added where appropriate	TECHNOLOGICAL
IEEE 1888-2014	IEEE Standard for Ubiquitous Green Community Control Network Protocol	The standard describes a remote control architecture of digital community, intelligent building groups, and digital metropolitan networks; specifies interactive data formats between devices and systems; and gives a standardised definition of equipment, service services, signals, and interactive messages in this digital community network. The digital community remote control network opens application interfaces for public administration, public services, property management services, and individual service services, which enables intelligent interconnection, collaboration service, remote surveillance, and central management to be feasible. Surveillance networks, consumer electronics, remote service systems, public administration systems, security linkage systems, and emergency reaction systems will be integrated into the community network seamlessly. Based on TCP/IP open systems, the network architecture adopts active and emerging technologies, supporting diverse access technologies in the physical layer, supporting IPv4/v6 in the network layer, and integrating well with the next generation converged networks. The standard aims to provide proper remote control and collaborating management solutions for operators, community administrators, public service providers, government departments, and individual users, so as to use and control facilities in community and building groups effectively, such as sensors, surveillance monitors, HVAC, lighting systems, fire-fighting systems, consumer electronics, and so on; The public environment monitor mechanism is set up to ease energy shortage and environment degradation through remote surveillance, operation, management, and maintenance, leaving a secure, comfortable, and convenient living environment. Energy, environment, and security are taken into consideration to realize reasonable plans and remote control in community networks. Revision Standard - Active. The standard identifies gateways for field-bus networks, data storage for archiving and developing data sharing platforms, and application units as important system components for developing digital communities, i.e., building-scale and city-wide ubiquitous facility networking infrastructure. The standard defines a data exchange protocol that generalizes and interconnects these components (gateways, storage, application units) over the IPv4/v6-based networks. This enables integration of multiple facilities, data storage, application services such as central management, energy saving, environmental monitoring, and alarm notification systems.	TECHNOLOGICAL
ISO 22522	Crop protection equipment — Field measurement of spray distribution in tree and bush crops	ISO 22522:2007 is applicable to the field measurement of quantities of spray deposit, applied using ground sprayers, on tree and bush crops. It covers measurements of the volume or mass of spray deposits (both absolute and distribution) on target structures such as leaves, fruits and ground losses.	NbS ARCHITECTURE

21/30440329 DC BSI	BS 851188-1 AMD1. Flood resistance product. Part 1. Building products. Specification		NbS ARCHITECTURE
21/30440333 DC BSI	BS 851188-2 AMD1. Flood resistance products. Part 2. Perimeter barrier systems. Specification		NbS ARCHITECTURE
ISO/AWI 59014	Secondary materials — Principles, sustainability and traceability requirements	Under development	NbS ARCHITECTURE

NbS PLANNING

a. DIRECTLY RELATED

ISO/DIS 20325	Guidelines for stormwater management in urban areas	This international standard provides guidance to stormwater management authorities in and relevant stakeholders on both structural and non-structural stormwater management approaches. The guidance includes consideration of relevant policies, planning, design criteria and implementation processes for stormwater management, and performance evaluation. This standard can be applied to new stormwater systems and to the extension or improvement of existing systems for both fully separated and combined storm and sanitary sewers. This international standard is not applicable to sanitary sewer systems. However, there is collateral interest in as much as combine sewer systems contain sanitary flows.	NbS ARCHITECTURE
BS ISO 24536:2019 BSI	Service activities relating to drinking water supply, wastewater and stormwater systems. Stormwater management. Guidelines for stormwater management in urban areas	This document provides guidance to stormwater management authorities and relevant stakeholders on both structural and non-structural stormwater management approaches. The guidance includes consideration of relevant policies, planning, design criteria and implementation processes for stormwater management, and performance evaluation. This document can be applied to new stormwater systems and to the extension or improvement of existing systems for both fully separated and combined storm and sanitary sewers. This document is applicable to stormwater sewer systems as well as combined sewer systems. This document is not applicable to sanitary sewer systems.	NbS ARCHITECTURE

ii) CLOSELY RELATED

ASTM E 2432	Standard Guide for General Principles of Sustainability Relative to Buildings	Sustainability has three types of general principles: environmental, economic, and social. This guide covers the fundamental concepts and associated building characteristics for each of the general principles of sustainability	TERMONOLOGY
ISO 37100:2016	Sustainable cities and communities — Vocabulary	ISO 37100:2016 defines terms relating to sustainable development in communities, smart community infrastructure and related subjects.	TERMONOLOGY
ISO 37101:2016	Sustainable development in communities — Management system for sustainable development — Requirements with guidance for use	ISO 37101:2016 establishes **requirements for a management system for sustainable development in communities, including cities, using a holistic approach, with a view to ensuring consistency with the sustainable development policy of communities**. The intended outcomes of a management system for sustainable development in communities include: · managing sustainability and fostering smartness and resilience in communities, while taking into account the territorial boundaries to which it applies; · improving the contribution of communities to sustainable development outcomes; · assessing the performance of communities in progressing towards sustainable development outcomes and the level of smartness and of resilience that they have achieved; · fulfilling compliance obligations. ISO 37101:2016 is intended to help communities become more resilient, smart and sustainable, through the implementation of strategies, programmes, projects, plans and services, and demonstrate and communicate their achievements. ISO 37101:2016 is intended to be implemented by an organization designated by a community to establish the organizational framework and to provide the resources necessary to support the management of environmental, economic and social performance outcomes. A community that chooses to establish the organizational framework by itself is considered to constitute an organization as defined in ISO 37101:2016. ISO 37101:2016 is applicable to communities of all sizes, structures and types, in developed or developing countries, at local, regional or national levels, and in defined urban or rural areas, at their respective level of responsibility. ISO 37101:2016 can be used in whole or in part to improve the management of sustainable development in communities. Claims of conformity to ISO 37101:2016, however, are not acceptable unless all its requirements are incorporated into an organization's management system for sustainable development in communities and fulfilled without exclusion.	PROCESS
ISO/DIS 37102	Sustainable development and resilience of communities - Vocabulary	Under development - by ISO/TC 268 - Sustainable development in communities	TERMONOLOGY
BS ISO 37104:2019	Sustainable cities and communities. Transforming our cities. Guidance for practical local implementation of ISO 37101	This standard BS ISO 37104:2019 **Sustainable cities and communities. Transforming our cities. Guidance for practical local implementation of ISO 37101 is classified in these ICS categories:** **13.020.20 Environmental economics** 1 This document provides guidance on how to implement and maintain a management system for sustainable development based on ISO 37101 principles, specifically in the context	PROCESS

		of cities, but applicable to other forms of settlement. This document: — provides guidance for practical implementation of a management system for sustainable development in cities and other settlements, based on ISO 37101 ; — establishes a methodological framework for the systematic evaluation of the sustainable development schemes and achievements in the city or other settlements, based on the cross-analysis of the six purposes of sustainability and the 12 areas of action of ISO 37101 ; — illustrates how other International Standards can be used to support successful implementation of ISO 37101 , including, in particular, ISO 37120 (which recommends a suite of city indicators mapped against the six purposes of ISO 37101) and ISO 37106 (which provides practical guidance on how to implement joined-up delivery and innovation across organizational boundaries within the city or settlement). This document is intended for organizing bodies, decision-makers, executive officers and managers in cities – usually, in the first instance, the relevant local governments. This document is intended to help cities become more sustainable, through the implementation at city level of strategies, programmes, projects, plans and services referred to in this document as schemes (see Note 1 and 3.7). It also provides a platform to help demonstrate and communicate their commitment, progress and achievements.	
ISO 37105:2019	Sustainable cities and communities — Descriptive framework for cities and communities	This document specifies a descriptive framework for a city including an associated foundational ontology of the anatomical structure of a city or community. The descriptive framework is intended to have the following qualities: — timeless, i.e. compatible with any human settlement at any time in history; — acultural, i.e. valid for any culture and any type of city; — scalable, i.e. valid for a metropolis, a city, a small town or a village; — generic, so that everything we could define as a "human settlement", such as a "smart city", has a place in this structure.	PROCESS
BS ISO 37108. Sustainable cities and communities. Business districts. Guidance for practical local implementation of ISO 37101	BS ISO 37108. Sustainable cities and communities. Business districts. Guidance for practical local implementation of ISO 37101	This standard 21/30397765 DC BS ISO 37108. **Sustainable cities and communities. Business districts. Guidance for practical local implementation of ISO 37101 is classified in these ICS categories:** 13.020.20 Environmental economics This document provides guidance on **how to implement and maintain a management system for sustainable development in cities and communities according to ISO 37101 in the context of a Business District.** This document defines the Business District and the procedure it should follow to establish and implement a sustainable development policy and continuous improvement initiative for the duration of the Business District's lifecycle. This document identifies the general principles of sustainable development management and how to apply them in a Business District, within both new developments and in operations to upgrade and renovate existing ones. It relates to all interested parties and all stages of the business district lifecycle, including planning, design, construction, operation, maintenance and renovation. This document is intended to serve as the basis for assessing and improving economic, social, environment, infrastructure, and governance outcomes and to provide a guide for conducting comparative analyses for Business Districts. Based on the ISO 37101 and on the Plan-Do-Check-Act (PDCA) model, it requires the following steps: Plan: establish objectives and processes necessary to deliver a strategy for the sustainable development of Business Districts in accordance with city and community purposes; Do: implement processes and achieve objectives; Check: monitor and measure established processes against policy, objectives and commitments, and report the results; Act: take necessary actions to improve performance. Figure 1 illustrates how this document follows a PDCA approach in the management of sustainable development in Business Districts. NOTE In Figure 1, clauses 1 to 3 are not shown as they do not define proper guidance, but are useful information: 1 being the scope of this document, 2 being the normative references and 3 being the relevant terms and definitions.	PROCESS
ISO/TR 37121:2017	Sustainable development in communities — Inventory of existing guidelines and approaches on sustainable development and resilience in cities	ISO/TR 37121:2016 provides an inventory of existing guidelines and approaches on sustainable development and resilience in cities. ISO/TR 37121:2016 focuses on resilience understood as the ability of a city, system, community, local government or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. Resilience indicators are intended to assess the extent to which cities are helping residents, businesses, institutions, and infrastructure resist, absorb, accommodate to and recover from the effects of hazards in a timely and efficient manner.	PROCESS
ISO 14050:2020	Environmental management — Vocabulary	This document defines terms used in documents in the fields of environmental management systems and tools in support of sustainable development. These include management systems, auditing and other types of assessment, communications, footprinting studies, greenhouse gas mitigation and adaptation to climate change.	TERMONOLOGY
ISO 14050:2020/DAmd 1	Environmental management — Vocabulary — Amendment 1	Under development	TERMONOLOGY

ISO 14055-1:2017	Environmental management — Guidelines for establishing good practices for combatting land degradation and desertification — Part 1: Good practices framework	ISO 14055-1:2017 provides guidelines for establishing good practices in land management to prevent or minimize land degradation and desertification. It does not include management of coastal wetlands. ISO 14055-1:2017 defines a framework for identifying good practices in land management, based on assessment of the drivers of land degradation and risks associated with current and past practices. Guidance on monitoring and reporting implementation of good practices is also provided. ISO 14055-1:2017 is intended for use by private and public sector organizations with responsibility for land management and will allow an organization to communicate implementation of good practices.	PROCESS
ISO/TR 14055-2:2022	Environmental management — Guidelines for establishing good practices for combatting land degradation and desertification — Part 2: Regional case studies	This document provides regional case studies of good practices in land management to prevent or minimize land degradation and desertification in support of ISO 14055-1:2017. The case studies are presented to facilitate the application of ISO 14055-1 across a wide of range of geographical and local conditions. NOTE The cases studies are presented as different ways of applying good practice and do not preclude alternative ways of applying good practices in accordance with ISO 14055-1.	PROCESS
ISO/TS 14092:2020	Adaptation to climate change — Requirements and guidance on adaptation planning for local governments and communities	This document specifies **requirements and guidance on adaptation planning for local governments and communities. This document supports local governments and communities in adapting to climate change based on vulnerability, impacts and risk assessments. In working with relevant interested parties, it also supports the setting of priorities, and the development and subsequent updating of an adaptation plan.**	PROCESS
ISO 14091:2021	Adaptation to climate change — Guidelines on vulnerability, impacts and risk assessment	This document **gives guidelines for assessing the risks related to the potential impacts of climate change.** It describes how to **understand vulnerability and how to develop and implement a sound risk assessment in the context of climate change. It can be used for assessing both present and future climate change risks.** Risk assessment according to this document provides a basis for climate change adaptation planning, implementation, and monitoring and evaluation for any organization, regardless of size, type and nature.	IMPACT ASSESSMENT
CEN/CENELEC Guide 32	Guide for adressing climate change adaptation in standards	This Guide **provides guidance on addressing aspects of climate change adaptation in European standardisation documents**. This Guide is applicable to product (including design), service, infrastructure and testing standards. For the purposes of this Guide, the definition of the term “product” has been expanded to cover all these aspects.	NbS ARCHITECTURE
BIP 2178	Climate change adaptation	Adapting **to climate risks using ISO 9001, ISO 14001, BS 25999 and BS 31100**	PROCESS
BS 8631:2021	Adaptation to climate change. Using adaptation pathways for decision making. Guide	This standard BS 8631:**2021 Adaptation to climate change. Using adaptation pathways for decision making. Guide is classified in these ICS categories:** 13.020.40 Pollution, pollution control and conservation This British Standard gives recommendations and guidance to support organizations implementing adaptation pathways (APs). APs can be used within a broader planning process or as a stand-alone adaptation planning tool, in order to assist organizations to create long-term plans and make decisions within the uncertainty and risks of a changing climate. NOTE 1 BS EN ISO 14090 provides a full framework for implementing an adaptation plan and can be used in conjunction with this British Standard. This British Standard sets out a nine-step process for developing and applying APs. It includes guidance on each step, decision-making within the steps and continuous learning across the approach. The intended users of this British Standard are adaptation professionals or persons assigned by an organization to use the standard (such as the environment or sustainability manager). NOTE 2 The information that results from the implementation of this British Standard can benefit strategic planners and decision makers within organizations who are involved in making short, medium and long-term decisions and adaptation plans.	PROCESS
ISO Guide 84	Guidelines for addressing climate change in standards	This document provides guidance to standards developers on **how to take account of climate change in the planning, drafting, revision and updating of ISO standards and other deliverables**. It outlines a framework and general principles that standards developers can use to develop their own approach to addressing climate change on a subject-specific basis. It aims to enable standards developers to include adaptation to climate change (ACC) and climate change mitigation (CCM) considerations in their standardisation work. Considerations related to ACC are intended to contribute to increasing preparedness and disaster reduction as well as impacting the resilience of organizations and their technologies, activities or products (TAPs). Considerations related to CCM consist primarily of approaches that seek to avoid, reduce or limit the release of GHG emissions and/or increase GHG removals	PROCESS
ASTM E 3032	Standard Guide for Climate Resiliency Planning and Strategy	1.1 Overview- For the purposes of this guide, 'resiliency' refers to efforts by entities, organizations, or individuals to prepare for or adjust to future extreme weather and related physical conditions. The primary purpose is to reduce negative economic impacts associated with extreme weather. 1.1.1 **This guide presents a generalized, systematic approach to voluntary assessment and risk management of extreme climate related events and conditions.** It helps **the user structure their understanding of the climate related vulnerabilities and consequences they seek to manage**. It helps the user identify adaptive actions of both an institutional (legal), as well as engineering (physical) nature. Options for analysis provide a priority ranking system to address the "worst first" risks of a municipality, local area or facility, addressing practicality and cost-benefit. Users may approach this analysis having initially undertaken a risk assessment to determine what they are seeking to manage, or use the guide to help determine the likely areas of greatest need. 1.1.2 These climate adaptations or adjustments may be either protective (that is, guarding against negative impacts of extreme weather), or opportunistic (that is, taking advantage of any beneficial effects of extreme weather). 1.1.3 This guide addresses adaptation strategies and planning in response to various impacts that may occur to individuals, organizations, human settlements or ecosystems in a broad variety of ways. For example, extreme weather might increase or decrease rainfall, influence agricultural crop yields, affect human health, cause changes to forests and other ecosystems, or impact energy supply or infrastructure. 1.1.4 Climate-related impacts may occur locally within a region or across a country and may affect many sectors of the economy. In order to meet these challenges, this guide provides an organized, uniform approach to prepare for the impacts of extreme weather through planned "resiliency" strategies. 1.1.5 This guide addresses options to deal with risk factors that may be key drivers for the economy, human health, the environment, or ecosystems. The guide is aimed at helping users understand risks and potential losses, and offers options and a generalized approach to bolster human and ecosystem resiliency to a changing climate. This includes sustainability concepts such as support of economic stability and a good quality of life. 1.1.6 Adaptation can involve responses to extreme weather and long-term preparation for future events. Local conditions will require risk evaluation and analysis of both likely weather events and/or extreme weather trends. 1.1.7 This guide does not address the causes of extreme weather. 1.2 Purpose- The purpose of this guide is **to provide a series of options consistent with preparing for extreme weather events.** This guide encourages consistent management of climate exposures and risks. The guide presents practices and recommendations for regions, zones, and planning horizons to address institutional and engineering actions for reduction of physical and financial vulnerability attributable to extreme weather. It reviews available technologies, institutional practices, and engineering actions that can be implemented by individuals and organizations seeking to increase their adaptive capacity. 1.2.1 The guide also provides some high-level options for the monitoring and tracking of	PROCESS/ IMPACT ASSESSMENT

		performance of an individual or organization's chosen strategy in order to evaluate its effectiveness and ensure that the approach continues to be reasonable. 1.2.2 This guide ties into the ASTM E50 standards series related to environmental risk assessment and management. 1.3 Objectives- The objectives of this guide are to determine the conditions of the community, facility and or/property with regard to risks of extreme weather events and actions to be taken to manage those risks. 1.3.1 The guide presents information on planning and strategies for response to extreme weather events such as: drought, flood, fire, storms, landslides, tidal surge, and extreme temperatures. 1.3.2 The guide encourages users to set priorities, using a matrix based upon regions in the United States. For each region the guide identifies key climate vulnerabilities, requiring preparation for future events. These could be extrapolated to other regions if there are similar conditions. 1.4 Limitations of this Guide- Given the different types of organizations that may wish to use this guide, as well as variations in State and Local regulations, it is not possible to address all the relevant circumstances that might apply to a particular facility. This guide uses generalized language and examples to guide the user. If it is not clear to the user how to apply standards to their specific circumstances, it is recommended that users seek assistance from qualified professionals. 1.4.1 The guide assumes risks are already identified and is not intended to provide assistance with identifying or evaluating risks. 1.4.2 Insurance Industry- The effects of climate extremes on insurers are not clear. The definition of an insurable occurrence and a commencement point for when insurable claims are made, along with when conditions were discovered and the actionable information leading to an insurable loss is not clear. It may be inappropriate to speculate on climate effects that are highly uncertain for purposes of insurance related to specific events. While there are exclusions for "acts of God," for example, claims associated with increasing extreme weather events may still have serious impacts on the insurance industry. 1.4.3 This guide does not take a position on the causes or science of extreme weather. 1.5 The guide uses references and information on the control, management and reduction of impacts from many cited sources. 1.6 Several national and international agencies served as sources of information on existing and anticipated levels and management of climate risks including: the Australian Ministry of Environment; the Federal Emergency Management Agency; the National Oceanographic and Atmospheric Administration; the Securities and Exchange Commission; the U.S. Army Corps of Engineers; the U.S. Department of Agriculture; the U.S. Department of Energy; the U.S. Environmental Protection Agency; and, the U.S. Department of Defense. 1.7 This guide relies on current regulatory information about risks from various state agencies, including the California Air Resources Board, the Massachusetts and Connecticut Departments of Environmental Protection, the Western Climate Initiative, and other published high-level strategies and guidance. For example, the National Academy of Sciences guidance and the Climate and Risk section of the Envision rating system published by the Institute of Sustainable Infrastructure. 1.8 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.	
BS 67000:2019	City resilience. Guide	This standard BS 67000:2019 City resilience. Guide is classified in these ICS categories: 03.100.01 Company organization and management in general 13.200 Accident and disaster control This British Standard **provides practical guidance and tools for increasing city resilience**. It is intended for use by all stakeholders who contribute to city resilience: citizens, organizations, communities, government and business. The guidance is also relevant to towns or a wider area, such as that covered by a local enterprise partnership (LEP). This British Standard builds on the growing portfolio of guidance on this evolving subject from initiatives such as the UNISDR ten essentials [1] and the 100 Resilient Cities [2] programme (pioneered by the Rockefeller Foundation), and lessons learned from cities. It defines key concepts and terms, and sets out a general framework (see Clause 5 and Figure 2) that assists the prioritization, integration and development of local strategies and plans, to increase a city's resilience. The guidance is intended to support the following activities: engage and motivate city, community and business leaders to address resilience and provide the necessary conditions for success; improve a city's understanding of resilience challenges over the short, medium and long term; support and build deeper, broader and more integrated capacity in the city; and prioritize and strengthen investment decisions.	PROCESS
DIN CWA 17300	City Resilience Development - Operational Guidance; English version CWA 17300:2018	This CEN Workshop Agreement (CWA) defines an operational framework for cities that provides guidance on local resilience planning and supports their efforts in building resilience. The document is intended to be used by policy and decision-makers at city level and councilors working for climate change adaptation and resilience in their city, as well as by any other city stakeholder working on resilience (for examples but not limited to: critical infrastructure managers, service providers, emergency services, the media, civil society associations, non-governmental organizations, academic and research institutions as well as consultancies). The Operational Guidance consists of five steps that have to be repeated regularly. The five steps implemented in a full cycle are the following: Baseline Review, Risk Awareness, Resilience Strategy, Implementation and Monitoring, Evaluation and Reporting. The CWA is part of the "City Resilience Development" series, which intends to support cities in becoming more resilient against various kinds of threats. The series consists of the following other two CWAs: "CWA 17301 City Resilience Development - Maturity Model" and "CWA 17302 City Resilience Development - Information Portal". The CWA on Operational Guidance is the overarching document that refers to the CWA 17301, CWA 17302, as well as to other supporting tools	PROCESS
DIN CWA 17301	City Resilience Development - Maturity Model; English version CWA 17301:2018	The aim of the Maturity Model is to provide a tool for reflection and guidance on the resilience-building process of cities, which will enable them to compile an analysis of their current resilience status. It is primarily designed to assist local governments in assessing their current maturity stage and to identify future resilience demands and capacities needed to advance to a more mature level. The Maturity Model defines five incremental stages, which guide local governments through the ideal path for building-resilience: Starting, Moderate, Advanced, Robust, and Vertebrate. Each of these maturity stages includes a description of the objectives of each stage, the stakeholders actively involved in each maturity stage, and a list of policies that should be followed. This CEN Workshop Agreement (CWA) is part of the "City Resilience Development" series, which intends to support cities in becoming more resilient against various kinds of threats. The series consists of the following other two CWAs: "CWA 17300 City Resilience Development - Operational Guidance" and "CWA 17302 City Resilience Development - Information Portal". The CWA on Operational Guidance is the overarching document that refers to the CWA 17301, CWA 17302, as well as to other supporting tools.	PROCESS
ISO 25552	Ageing societies — Framework for dementia-inclusive communities	This document provides a framework for dementia-inclusive communities, including principles and the considerations of inclusion, quality of life, built environments, special needs groups, and stakeholder engagement. It also provides guidance on how to systematically leverage, improve, and interconnect their existing assets and structures and transform efficiently into a dementia-inclusive community. This document does not provide any clinical standards.	PROCESS
PAS 184:2017	Smart Cities. Developing project proposals for delivering smart city solutions. Guide	It gives **practical guidance on how to develop project proposals** for smart city solutions, using case studies to illustrate **good practice in smart city procurement**. The content reflects current good practice as identified by a broad range of public, private and voluntary sector practitioners engaged in developing smart city solutions.	PROCESS
ISO 37106:2021	Sustainable cities and communities — Guidance on establishing smart city operating models for sustainable communities	This document gives guidance for **leaders in smart cities and communities (from the public, private and voluntary sectors) on how to develop an open, collaborative, citizen-centric and digitally-enabled operating model for their city that puts its vision for a sustainable future into operation.** This document does not describe a one-size-fits-all model for the future of cities. Rather, the focus is on the enabling processes by which innovative use of technology and data, coupled with organizational change, can help each city deliver its own specific vision for a sustainable future in more efficient, effective and agile ways. This document provides proven **tools that cities can deploy when operationalizing the vision, strategy and policy agenda they have developed following the adoption of ISO 37101**, the management system for sustainable development of communities. It can also be used, either in whole or in part, by cities that have not committed to deployment of the ISO 37101 management system.	PROCESS

ISO/TS 37107:2019	Sustainable cities and communities — Maturity model for smart sustainable communities	This document provides **a top-level maturity model for smart sustainable communities (MMSSC), which can be used for self-assessment by individual cities and communities and as the basis for cross-city benchmarking.** The MMSSC is a simple way **for community leaders to assess how mature their community is in its journey towards adoption of good practices** as set out in ISO standards for sustainable and smart-enabled development; to identify strengths and weaknesses; and then to quickly find their way to the international standards and guidance that are most relevant to their needs.	PROCESS
ISO/DIS 37109	Sustainable cities and communities — Recommendations and requirements for project developers — Meeting ISO 37101 framework principles	Under development	PROCESS
ISO 37110:2022	Sustainable cities and communities — Management requirements and recommendations for open data for smart cities and communities — Overview and general principles	This document provides an **overview and general principles, including requirements and recommendations, for open data management for sustainable cities and communities**. It is intended to be used as a base document for open data management framework standards.	PROCESS
ISO 37155-1:2020	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	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.	PROCESS
ISO 37155-2:2021	Framework for integration and operation of smart community infrastructures — Part 2: Holistic approach and the strategy for development, operation and maintenance of smart community infrastructures	This document describes **the interactions of smart community infrastructures (interactions between multiple infrastructures, between infrastructures and stakeholders, and between infrastructures and the external environment).** It describes the framework (a set of processes and methodologies) for these interactions to ensure the consistency of smart community infrastructures is well identified and managed. There are two potential use cases for this document. The first is for the green field site, 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 is for the brown field site and 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 aims to ensure the consistency among different systems consisting of smart community infrastructures, the scope of this document does not overlap with any existing works that are developed or being developed at the 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.	PROCESS
PAS 181	Smart city Framework. Guide to establishing strategies for smart cities and communities	This PAS establishes a good practice framework for **city leaders to develop, agree and deliver smart city strategies that can help transform their city's ability to meet its future challenges and deliver its future a**spirations.	PROCESS
PAS 182	Smart city concept model. Guide to establishing a model for data interoperability	PAS 182:2014 gives guidance on how to apply a data concept model to promote data sharing across sectors in a city and help bridge the differences in data analysis between sectors like health, education and transport. It is intended to facilitate discussions between decision-makers and the specialists who build and design the systems and services that enable a city to function. The guidance in PAS 182:2014 addresses the fact that service providers do not always have the expertise to analyse the data they accumulate, that different sectors use a different language when describing data and offers a model that can be used by a variety of sectors. PAS 182:2014 is aimed at service providers such as national and local government departments, utilities, healthcare providers, transport, construction companies, ICT solution providers, city planners and developers.	PROCESS
PD 8100	Smart cities overview. Guide	PD 8100 gives guidance on how to adopt and implement smart city products and services in order to facilitate the rapid development of an effective smart city. It describes in detail the potential benefit of smart city strategies, provides recommendations on how to identify the first steps towards making the city smarter and covers the role of technology and data in providing the tools in this process. The guide is part of the smart cities suite of documents. PD 8100:2015 is a guide for city leaders in the public, private or community sectors and is intended to help them find the standards that are related to what they are doing. It is particularly relevant to national and local government departments, utility companies, healthcare providers, transport service providers, construction companies, network companies, city planners and developers, designers, and vendors of ICT solutions be they big players, SMEs, or their clients.	PROCESS
PD 8101	Smart cities. Guide to the role of the planning and development process	PD 8101:2014 provides **guidance on how the planning and implementation of developments and infrastructure projects can equip cities to benefit from smart technologies.** The guide is relevant to major developments, infrastructure projects, refurbishment programmes and improvements to public spaces. It considers how each stage of the planning and development process could support smart city opportunities and sets out what needs to be done at each stage. PD 8101:2014 is intended for the use of those involved in the planning and implementation of developments and infrastructure projects, including city leadership, planning policy makers, planning case officers, regeneration officers and developers and the consultants who work with them.	PROCESS
UNE 178101-1:2015	Smart Cities. Infrastructures. Utility Networks. Part 1: Water networks.	This standard UNE 178101-1:2015 Smart cities. Infrastructures. Public Service Networks. Part 1: Water Networks. is classified in these ICS categories: 13.020.20 35.240.01	TECHNOLOGICAL

UNE 178101-2:2018	Smart Cities. Infrastructures. Utility Networks. Part 2: Waste networks.	This standard UNE 178101-2:2018 Smart cities. Infrastructures. Public Service Networks. Part 2: Waste Networks. is classified in these ICS categories: 13.020.20 35.240.01	TECHNOLOGICAL
UNE 178104:2017	Smart cities. Infrastructures. Comprehensive systems for a Smart City management	This standard has as objective to **identify the capacities that a city platform should have, to structure those capacities into a model and to identify components needed.**	TECHNOLOGICAL
ISO 50001	Energy management systems — Requirements with guidance for use	This document specifies **requirements for establishing, implementing, maintaining and improving an energy management system (EnMS).** The intended outcome is to enable an organization to follow a systematic approach in achieving continual improvement of energy performance and the EnMS. This document: a) is applicable to any organization regardless of its type, size, complexity, geographical location, organizational culture or the products and services it provides; b) is applicable to activities affecting energy performance that are managed and controlled by the organization; c) is applicable irrespective of the quantity, use, or types of energy consumed; d) requires demonstration of continual energy performance improvement, but does not define levels of energy performance improvement to be achieved; e) can be used independently, or be aligned or integrated with other management systems. Annex A provides guidance for the use of this document. Annex B provides a comparison of this edition with the previous edition.	PROCESS
ITU-T L.1503	Use of **information and communication technology** for climate change adaptation in cities	This Recommendation **is aimed at a broad audience of stakeholders interested in information and communication technologies (ICTs), climate change adaptation, and smart sustainable cities (SSCs), including city decision-makers and planners. Urban stakeholders, including mayors and city planners, are invited to consider novel approaches to sustainability by integrating the use of ICTs in their climate change adaptation strategies and policies**. The following are the key steps: • assess climate change risks and vulnerabilities: • develop an action plan; • identify the role of ICTs and infrastructure in the adaptation plan; • implement adaptation actions; • monitor and evaluate adaptation actions using ICT. Climate change may negatively impact urban ICT infrastructure and the provision of key public services (e.g., health, water supply and sanitation, energy provision, waste management, mobility, urban planning and food security), which are all crucial dimensions for sustainable development and are becoming heavily dependent on ICTs for their operation.	TECHNOLOGICAL/ PROCESS
ASTM E 3136	Standard Guide for Climate Resiliency in Water Resources	1.1 Overview- **Water resources in North America and other areas are subject to various impacts from chronic weather patterns, as well as more frequent extreme weather events**. **These include drought, flooding, changes in stream patterns, increased or decreased run-off, and changes in water quality. Water resources include both man-made and natural reservoirs, rivers, streams, groundwater, and storage ponds.** The infrastructure for water supply, wastewater treatment, fire-fighting and agricultural uses are also subject to chronic weather patterns and more frequent extreme weather related events. This guide will provide an explanation of techniques users may employ to build resiliency and a planning outline for municipalities, states and private industry in order to ensure safe, future, effective availability of water resources. 1.2 Purpose- The purpose of this guide is to provide a series of options that organizations may implement to prepare for the environmental impacts and risks from changing environmental conditions, chronic weather patterns, natural or man-made disasters, and extreme weather events. This guide also encourages consistent management of risks from natural disasters to water resources. The guide presents practices and recommendations based on regions and planning horizons that provide institutional and engineering actions to reduce the physical and financial vulnerabilities attributable to changing environmental conditions. It presents available technologies, institutional controls, and engineering controls that can be implemented by individuals and organizations seeking to increase their adaptive and resiliency capacity. 1.2.1 The guide also provides some high-level options for the planning, selection, implementation, and review of strategies in order to ensure that the approach continues to be environmentally responsible, in the best interest of the public, reasonable, and cost effective. This guide can be used to analyze the effectiveness of a community's strategy. 1.2.2 This guide ties into the ASTM E50 standards series related to environmental risk assessment and management. 1.2.3 The guide does not provide risk assessment, per se, but may help set priorities for a climate resiliency program. 1.3 Safety- This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Adaptation and resiliency measures, however, may be consistent with, and complementary to, safety measures. 1.4 Objectives- The objectives of this guide are to determine the conditions of the community, facility, and property with regard to risks of natural disaster events to water resources and actions that can be taken to manage those risks. 1.4.1 The guide presents information on planning and strategies to respond to extreme natural events such as drought, flood, storms and sea level rise upon water resources. 1.4.2 The guide encourages users to set priorities based upon the relevant region in the United States. For each region, the guide identifies key climate vulnerabilities that would require planning and preparation based on that particular scenario. These could be extrapolated to other regions if there are similar conditions. 1.4.3 The guide encourages the user to develop long term solutions for future risks. 1.5 Limitations of this Guide- Given the different types of organizations that may wish to use this Guide, as well as variations in state and local regulations, it is not possible to address all the relevant circumstances that might apply to a particular facility. This guide uses generalized language and examples for the user. If it is not clear to the user how to apply standards to their specific circumstances, users should seek assistance from qualified professionals. Risks may vary depending on the entity evaluating the risk. This guide does not take a position on the causes or science of extreme weather, natural disasters, or changing environmental conditions. 1.6 The guide uses references and information on the control, management and reduction of impacts from many cited sources. 1.7 Several national and international agencies served as sources of information on existing and anticipated levels and management of climate risks including: the Australian Ministry of Environment; the Federal Emergency Management Agency; the National Oceanographic and Atmospheric Administration; the Securities and Exchange Commission; the US Army Corps of Engineers; the US Department of Agriculture; the US Department of Energy; the US Environmental Protection Agency; and the US Department of Defense. 1.8 This guide recommends reference to current regulatory information about risks culled from various state agencies, such as departments of environmental protection and water resources boards. 1.9 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use. 1.10 This international standard was developed in accordance with internationally recognized principles on standardisation established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.	PROCESS
ISO 14080:2018	Greenhouse gas management and related activities — Framework and principles for methodologies on climate actions	This document gives **guidelines by means of a framework and principles for establishing approaches and processes to:** — identify, assess and revise methodologies; — develop methodologies;	PROCESS

		— manage methodologies. This document is **applicable to climate actions** to address climate change, including adaptation to its impacts and greenhouse gas (GHG) mitigation in support of sustainability. Such actions can be used by or for projects, organizations, jurisdictions, economic sectors, technologies and products, policies, programmes and non-government activities. This document does not create guidance for a specific methodology.	
SANS 21500	Guidance on project management	**Provides guidance for project management and can be used by any type of organization, including public, private or community organizations,** and for **any type of project, irrespective of complexity, size or duration**. Provides high-level description of concepts and processes that are considered to form good practice in project management.	PROCESS
ISO/PRF TS 10020	Quality management systems — Organizational change management — Processes	This document specifies processes that can be used to govern, manage and implement organizational change management for any organization, project or smaller activity. It comprises generic process descriptions that define the organizational change management processes. Supporting informative diagrams describing the processes are also provided. This document is intended for, but not limited to change sponsors, change agents, change team members, project managers, particularly those responsible for governing, managing and implementing organizational change	PROCESS
ISO/AWI 37176	Smart Community Infrastructure-Maturity Assessment Model for Agile Community	This document **provides the assessment domain, assessment criteria and the maturity level for a maturity model to assess the agility of the smart community infrastructure**, to promote the interaction between the residents and the community by satisfying residents' various needs. This document: — sorts out the assessment domain from various aspects associated with residents' daily needs in the community. — designs the assessment criteria to measure the agility degree of the smart community infrastructure. — evaluates the different agility degree of the smart community infrastructure by endowing them with different maturity levels.	IMPACT ASSESSMENT
ISO/AWI 22371	Security and resilience –Urban resilience – Framework, model and guidelines for strategy and implementation	Under development	PROCESS
ISO/AWI TR 37112	Sustainable cities and communities — Good practice case studies in how smart city operating models support effective public-health emergency response	Under development	PROCESS

iii) RELATED

ISO 10005:2018	Quality management — Guidelines for quality plans	**This document gives guidelines for establishing, reviewing, accepting, applying and revising quality plans. This document is applicable to quality plans for any intended output, whether a process, product, service, project or contract, and any type or size of organization. It is applicable whether or not the organization has a management system in conformity with ISO 9001. This document provides guidance and does not specify requirements. It is focused primarily on the provision of outputs and is not a guide to the planning of quality management system development. NOTE To avoid undue repetition of "process, product, service, project or contract", this document uses the term "specific case".**	PROCESS
ISO 10007:2017	Quality management — Guidelines for configuration management	**ISO 10007:2017 provides guidance on the use of configuration management within an organization. It is applicable to the support of products and services from concept to disposal.**	PROCESS
ISO/CD 10009	Quality management — Guidance for quality tools and their application	**This document introduces quality tools which can be used with quality management systems to: a) maintain compliance; b) describe trends and process characteristics; c) focus on areas for improvement. Guidance on their selection and application is provided with the aim of providing a resource to practitioners and promoting the appropriate use of quality tools.**	PROCESS
ISO 10017:2021	Quality management — Guidance on statistical techniques for ISO 9001:2015	**This document gives guidelines for the selection of appropriate statistical techniques that can be useful to an organization, irrespective of size or complexity, in developing, implementing, maintaining and improving a quality management system in conformity with ISO 9001:2015. This document does not provide guidance on how to use the statistical techniques.**	PROCESS
ISO 14001	Environmental management systems — Requirements with guidance for use	**ISO 14001:2015 specifies the requirements for an environmental management system that an organization can use to enhance its environmental performance. ISO 14001:2015 is intended for use by an organization seeking to manage its environmental responsibilities in a systematic manner that contributes to the environmental pillar of sustainability.** **ISO 14001:2015 helps an organization achieve the intended outcomes of its environmental management system, which provide value for the environment, the organization itself and interested parties. Consistent with the organization's environmental policy, the intended outcomes of an environmental management system include:** **· enhancement of environmental performance;** **· fulfilment of compliance obligations;** **· achievement of environmental objectives.** **ISO 14001:2015 is applicable to any organization, regardless of size, type and nature, and applies to the environmental aspects of its activities, products and services that the organization determines it can either control or influence considering a life cycle perspective. ISO 14001:2015 does not state specific environmental performance criteria.** **ISO 14001:2015 can be used in whole or in part to systematically improve environmental management. Claims of conformity to ISO 14001:2015, however, are not acceptable unless all its requirements are incorporated into an organization's environmental management system and fulfilled without exclusion**	PROCESS
ISO 14002-1	Environmental management systems — Guidelines for using ISO 14001 to address environmental aspects and conditions within an environmental topic area — Part 1: General	This document gives general guidelines for **organizations seeking to systematically manage environmental aspects or respond to the effects of changing environmental conditions within one or more environmental topic areas, based on ISO 14001**. This document also constitutes a framework for common elements of subsequent parts of the ISO 14002 series.	PROCESS
ISO/DIS 14002-2	Environmental management systems — Guidelines for using ISO 14001 to address	Under development	PROCESS

	environmental aspects and conditions within an environmental topic area — Part 2: Water		
ISO 14005	Environmental management systems — Guidelines for a flexible approach to phased implementation	This document gives **guidelines for a phased approach to establish, implement, maintain and improve an environmental management system (EMS) that organizations, including small and medium-sized enterprises (SMEs), can adopt to enhance their environmental performance**. The phased approach provides flexibility that allows organizations to develop their EMS at their own pace, over a number of phases, according to their own circumstances. Each phase consists of six consecutive stages. The system's maturity at the end of each phase can be characterized using the five-level maturity matrix provided in Annex A. This document is applicable to any organization regardless of their current environmental performance, the nature of the activities undertaken or the locations at which they occur. The phased approach enables an organization to develop a system that ultimately satisfies the requirements of ISO 14001. The guidance does not cover those elements of specific systems that go beyond ISO 14001 and it is not intended to provide interpretations of the requirements of ISO 14001.	PROCESS
ISO 14006	Environmental management systems — Guidelines for incorporating ecodesign	This document **gives guidelines for assisting organizations in establishing, documenting, implementing, maintaining and continually improving their management of ecodesign as part of an environmental management system (EMS).** This document is intended to be used by organizations that have implemented an EMS in accordance with ISO 14001, but it can also help in integrating ecodesign using other management systems. The guidelines are applicable to any organization regardless of its type, size or product(s) provided. This document is applicable to product-related environmental aspects and activities that an organization can control and those it can influence. This document does not establish specific environmental performance criteria.	PROCESS
ISO 14090:2019	Adaptation to climate change — Principles, requirements and guidelines	**This document specifies principles, requirements and guidelines for adaptation to climate change. This includes the integration of adaptation within or across organizations, understanding impacts and uncertainties and how these can be used to inform decisions**. This document is applicable to **any organization, regardless of size, type and nature, e.g. local, regional, international, business units, conglomerates, industrial sectors, natural resource management units.** This document can support the development of sector-, aspect- or element-specific climate change adaptation standards.	PROCESS
DIN SPEC 35811	Scenario Planning - Guidelines for decision making processes dealing with climate change	DIN SPEC 35811 **will assist (small and medium sized) enterprises from all fields to adapt to future challenges. It is applicable to companies, industries, and private and public sector organizations**. Companies without a strategy department are especially set to benefit from the application. Within a scenario process companies identify future challenges that might shape their business, such as climate change, demographic change, or technological change. They develop possible pictures of the future, based on these, derive potential adaptation measures. In this multistep process, the companies are optionally accompanied by consultants. The process itself can be implemented either individually or within a group of companies. Furthermore, the PAS is related to the ISO 14000 Standard series on environmental management systems, especially DIN EN ISO 14001. DIN SPEC 35811 has been prepared within the research project REGKLAM (Regional Climate Change Adaptation Program for the Dresden model region; FKZ: 01 LR 0802), which was funded by the German Ministry for Research and Education (BMBF).	PROCESS
ISO 9000:2015	Quality management systems — Fundamentals and vocabulary	ISO 9000:2015 describes the fundamental concepts and principles of quality management which are universally applicable to the following: organizations seeking sustained success through the implementation of a quality management system; customers seeking confidence in an organization's ability to consistently provide products and services conforming to their requirements; organizations seeking confidence in their supply chain that their product and service requirements will be met; organizations and interested parties seeking to improve communication through a common understanding of the vocabulary used in quality management; organizations performing conformity assessments against the requirements of ISO 9001; providers of training, assessment or advice in quality management; developers of related standards. ISO 9000:2015 specifies the terms and definitions that apply to all quality management and quality management system standards developed by ISO/TC 176.	TERMONOLOGY
ISO/TS 9002:2016	Quality management systems — Guidelines for the application of ISO 9001:2015	ISO/TS 9002:2016 provides guidance on the intent of the requirements in ISO 9001:2015, with examples of possible steps an organization can take to meet the requirements. It does not add to, subtract from, or in any way modify those requirements. ISO/TS 9002:2016 does not prescribe mandatory approaches to implementation, or provide any preferred method of interpretation.	PROCESS
ISO 9004:2018	Quality management — Quality of an organization — Guidance to achieve sustained success	ISO 9004:2018 gives guidelines for enhancing an organization's ability to achieve sustained success. This guidance is consistent with the quality management principles given in ISO 9000:2015. ISO 9004:2018 provides a self-assessment tool to review the extent to which the organization has adopted the concepts in this document. ISO 9004:2018 is applicable to any organization, regardless of its size, type and activity.	PROCESS
ISO/TS 54001:2019	Quality management systems — Particular requirements for the application of ISO 9001:2015 for electoral organizations at all levels of government	This International Standard specifies requirements for a quality management system when an organization: a) needs to demonstrate its ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements, and b) aims to enhance customer satisfaction through the effective application of the system, including processes for improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements. All the requirements of this International Standard are generic and are intended to be applicable to any organization, regardless of its type or size, or the products and services it provides. NOTE 1 In this International Standard, the terms "product" or "service" only apply to products and services intended for, or required by, a customer. NOTE 2 Statutory and regulatory requirements can be expressed as legal requirements. This document specifies requirements for a quality management system where an electoral organization: — needs to demonstrate its ability to manage elections by secret ballot, to provide reliable, transparent, free and fair results that comply with electoral requirements; — within the established legal framework, aims to enhance the trust and confidence of citizens, candidates, political organizations and other electoral interested parties through the effective implementation of the electoral quality management system, including processes for continual improvement. NOTE 3 Electoral bodies can be constituted to reflect local legal requirements. NOTE 4 In this document, the term "product" only applies to the electoral service provided by an electoral body. This document is applicable to the election period, including pre-election and post-election activities or processes. This document is applicable to all electoral bodies involved in any aspect of the electoral process, whether they are permanent organizations or temporary organizations established in support of a particular election period.	PROCESS

ISO 56000:2020	Innovation management — Fundamentals and vocabulary	1.1 This document provides the vocabulary, fundamental concepts and principles of innovation management and its systematic implementation. It is applicable to: a) organizations implementing an innovation management system or performing innovation management assessments b) organizations that need to improve their ability to effectively manage innovation activities; c) users, customers and other relevant interested parties (e.g. suppliers, partners, funding organizations, investors, universities and public authorities) seeking confidence in the innovation capabilities of an organization; d) organizations and interested parties seeking to improve communication through a common understanding of the vocabulary used in innovation management; e) providers of training in, assessment of, or consultancy for, innovation management and innovation management systems; f) developers of innovation management and related standards. 1.2 This document is intended to be applicable to: a) all types of organizations, regardless of type, sector, maturity-level or size; b) all types of innovations, e.g. product, service, process, model and method, ranging from incremental to radical; c) all types of approaches, e.g. internal and open innovation, user-, market-, technology- and design-driven innovation activities. This document specifies the terms and definitions applicable to all innovation management and innovation management system standards developed by ISO/TC 279.	TERMONOLOGY
ISO/AWI 56001	Innovation management — Innovation management system — Requirements	Under development	PROCESS
ISO 56002:2019	Innovation management — Innovation management system — Guidance	1.1 This document provides guidance for the establishment, implementation, maintenance, and continual improvement of an innovation management system for use in all established organizations. It is applicable to: a) organizations seeking sustained success by developing and demonstrating their ability to effectively manage innovation activities to achieve the intended outcomes; b) users, customers, and other interested parties, seeking confidence in the innovation capabilities of an organization; c) organizations and interested parties seeking to improve communication through a common understanding of what constitutes an innovation management system; d) providers of training in, assessment of, or consultancy for, innovation management and innovation management systems; e) policy makers, aiming for higher effectiveness of support programs targeting the innovation capabilities and competitiveness of organizations and the development of society. 1.2 All the guidance within this document is generic and intended to be applicable to: a) all types of organizations, regardless of type, sector, or size. The focus is on established organizations, with the understanding that both temporary organizations and start-ups can also benefit by applying these guidelines in all or in part; b) all types of innovations, e.g. product, service, process, model, and method, ranging from incremental to radical; c) all types of approaches, e.g. internal and open innovation, user-, market-, technology-, and design-driven innovation activities. It does not describe detailed activities within the organization, but rather provides guidance at a general level. It does not prescribe any requirements or specific tools or methods for innovation activities.	PROCESS
ISO/DIS 56007	Innovation management — Tools and methods for idea management — Guidance	Under development	PROCESS
ISO/CD 56008	Innovation management — tools and methods for innovation operation measurements — Guidance	Under development	PROCESS
ISO/DTS 56010	Innovation management - Illustrative examples of ISO 56000	Under development	PROCESS
ISO/TR 56004:2019	Innovation Management Assessment — Guidance	This document will help the user understand why it is beneficial to carry out an Innovation Management Assessment (IMA), what to assess, how to carry out the IMA, and thus maximize the resulting benefits, which are universally applicable to: — organizations seeking sustained success in their innovation activities; — organizations performing IMAs; — users and other interested parties (e.g. customers, suppliers, partners, funding organizations, universities and public authorities) seeking confidence in an organization's ability to manage innovation effectively; — interested parties seeking to improve communication through a common understanding of Innovation Management (IM), via an assessment; — providers of training, assessment, or advice in IM; — developers of related standards; — academics interested in research related to IMA. Further, this document is intended to be applicable to: — all types of organizations, regardless of sector, age, size, or country; — all approaches to IM regardless of their level of sophistication, and complexity; — all modalities of managing innovation whether centralized or decentralized; — all ways to innovate, e.g. internal, collaborative, open, user-, market- or technology-driven innovation; — all types of innovation such as product, service, process, business model, organizational innovation from incremental to radical.	PROCESS
ISO 56005:2020	Innovation management — Tools and methods for intellectual property management — Guidance	Efficient management of IP is key to support the process of innovation, is essential for organizations' growth and protection, and is their engine for competitiveness. This document proposes guidelines for supporting the role of IP within innovation management. It aims to address the following issues concerning IP management at strategic and operational levels: — Creating an IP strategy to support innovation in an organization; — Establishing systematic IP management within the innovation processes; — Applying consistent IP tools and methods in support of efficient IP management. This document can be used for any type of innovation activities and initiatives.	PROCESS
ISO/AWI 37113	Sustainable Cities and Communities — Management guidelines for public health	The proposed standard will provide guidance to community authorities on how to use smart technologies, smart data and smart ways of working to improve their ability to anticipate, manage and mitigate public health emergencies (PHEs). The standard will show how the principles and good practices for smart city operating models recommended in ISO	PROCESS

	emergency response in smart city operating models	37106 can deliver improved outcomes in PHE management, at every stage of the command-and-control process for emergency management and incident response set out in ISO 22320.	
ISO/TR 37152:2016	Smart community infrastructures — Common framework for development and operation	ISO/TR 37152:2016 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.	PROCESS
ISO 37156:2020	Smart community infrastructures — Guidelines on data exchange and sharing for smart community infrastructures	This document gives guidelines on principles and the framework to use for data exchange and sharing for entities with the authority to develop and operate community infrastructure. The guidelines in this document are applicable to communities of any size that are engaged in data exchange and sharing. The specific practices of data exchange and sharing of community infrastructures will depend on the characteristics of each community. NOTE 1 The concept of smartness is addressed in terms of data exchange and sharing, in accordance with sustainable development and resilience of communities as defined in ISO 37100. NOTE 2 Annex A outlines useful case studies of data exchange and sharing for community infrastructure.	PROCESS
ISO 28564-1	Public information guidance systems — Part 1: Design principles and element requirements for location plans, maps and diagrams	ISO 28564-1:2010 specifies requirements and principles for the design and application of location plans, maps and diagrams used in public areas and workplaces to assist users to understand the environment, locate facilities and determine appropriate routes to reach those facilities. These location plans, maps and diagrams are referred to as location plans in ISO 28564-1:2010. Location plans are intended for use in, for example, shopping centres, stores, hospitals, bus and train stations, airports, sporting and entertainment complexes, urban areas, parks, gardens and countryside, public attractions, museums and office complexes. ISO 28564-1:2010 is not applicable to the design of escape plans, nor does it cover the design of directional and location wayfinding signs.	PROCESS
ISO/TR 6030:2022	Smart community infrastructures – Disaster risk reduction – Survey results and gap analysis	This document identifies existing global smart community infrastructures that enhance disaster risk reduction, the key purposes served by these global examples, gaps in coverage, and the need for standardisation activities, which establishes the basis for the next steps for standardisation. This document is intended to be a basis for the future standardisation of smart community infrastructures for disaster risk reduction through the identification of areas for potential standardisation. This includes, but is not limited to, infrastructures related to energy, waste and water, transportation, information and communication technologies (ICT), and the general built environment. It does not address specifications or requirements already covered by other relevant international standards. This document primarily addresses disasters caused by natural hazards, such as geological and hydrometeorological hazards, and does not focus on human-induced disasters such as terrorism or biological hazards such as pandemics.	PROCESS
UNE 178101-3:2016	Smart Cities. Infrastructures. Public Services Networks. Part 3: Transport networks.	This standard UNE 178101-3:2016 Smart cities. Infrastructures. Public Service Networks. Part 3: Transport Networks. is classified in these ICS categories: 13.020.20 35.240.01	TECHNOLOGICAL
UNE 178101-4:2015	Smart Cities. Infrastructures. Public Services Networks. Part 4: Telecommunication networks.	This standard UNE 178101-4:2015 Smart cities. Infrastructures. Public Service Networks. Part 4: Telecommunication Networks. is classified in these ICS categories: 13.020.20 35.240.01	TECHNOLOGICAL
UNE 178101-5-1:2015	Smart Cities. Infrastructures. Utility Networks. Part 5-1: Energy networks. Electricity.	This standard UNE 178101-5-1:2015 Smart cities. Infrastructures. Public Service Networks. Part 5.1: Energy Networks. Electricity. is classified in these ICS categories: 13.020.20 35.240.01	TECHNOLOGICAL
UNE 178102-1:2015	Smart cities. Infrastructures. Telecommunication systems. Part 1: Multiservice city networks.	This standard UNE 178102-1:2015 Smart cities. Infrastructures. Telecommunication systems. Part 1: Multiservice city networks. is classified in these ICS categories: 13.020.20 35.240.01	TECHNOLOGICAL
UNE 178102-3:2015	Smart cities. Infrastructures. Telecommunication systems. Part 3: Unified Communications Systems.	This standard UNE 178102-3:2015 Smart cities. Infrastructures. Telecommunication systems. Part 3: Unified Communications Systems. is classified in these ICS categories: 13.020.20 35.240.01	TECHNOLOGICAL
UNE 178105:2017	Universal Accessibility in Smart Cities.	This standard UNE 178105:2017 Universal Accessibility in the Smart Cities. is classified in these ICS categories: 13.020.20 35.240.01	TECHNOLOGICAL
UNE 178109:2018	Smart Cities. Smart station and connection to the smart city platform.	This standard UNE 178109:2018 Smart Cities. Smart station and connection to the Smart City platform is classified in these ICS categories: 13.020.20 35.240.01	TECHNOLOGICAL
UNE 178201:2016	Smart cities. Definition, attributes and requirements	This standard UNE 178201:2016 Smart cities. Definition, attributes and requirements is classified in these ICS categories: 03.100.99 13.020.20	TERMONOLOGY
UNE 178202:2016	Smart cities. Management indicators based on city management scorecards.	This standard UNE 178202:2016 Smart cities. Management indicators based on balanced scorecard is classified in these ICS categories: 03.100.99 13.020.20	IMPACT ASSESSMENT

UNE 178204:2021	Smart cities. Semantics applicable to the data and information resulting from the monitoring of the building and its integration in higher living units.	This standard UNE 178204:2021 Smart cities. Semantics applicable to data and information from building monitoring and their integration into higher-level living units is classified in these ICS categories: 35.240.01 13.020.20	TECHNOLOGICAL
UNE 178301:2015	Smart Cities. Open Data.	This standard UNE 178301:2015 Smart Cities. Open Data. is classified in these ICS categories: 35.100.20 35.240.01	TECHNOLOGICAL
UNE 178401:2017	Smart cities. Outdoor lighting. Degrees of functionality, zoning and management architecture.	This standard UNE 178401:2017 Smart cities. Street lighting. Degrees of functionality, zoning and control arquitecture is classified in these ICS categories: 35.240.01 91.160.20	TECHNOLOGICAL
UNE 178402:2015	Smart cities. Management of basic services and water and electricity supply in smart ports.	This standard UNE 178402:2015 Smart cities. Management of basic services and water and electricity supply in smart ports is classified in these ICS categories: 35.240.01 93.140	TECHNOLOGICAL
IEC SRD 63235:2021	Smart city system - Methodology for concepts building	IEC SRD 63235:2021 provides a holistic system of systems approach to provide views, methodology framework, principles, processes, rules, and evaluation criteria for smart city system concepts building. While it does not specify the definitions of a smart city system, it provides a methodology based on system approaches for coordination, cooperation and connectivity of the terminology sources including IEC, ISO and ITU. The methodology fosters a multi-dimensional system of systems view on smart city systems across dimensions, domains and layers along the lifecycle of a smart city system, scenarios and use cases, supporting the sustainable development of smart city system arrangements, activities and artefacts, convergence of people, process and productivity globally.	TECHNOLOGICAL
ISO/IEC 30145-2	Information technology — Smart City ICT reference framework — Part 2: Smart city knowledge management framework	This document specifies a generic knowledge management framework for a smart city, focusing on creating, capturing, sharing, using and managing smart city knowledge. It also gives the key practices which are required to be implemented to safeguard the use of knowledge, such as interoperability of heterogeneous data and governance of multi-sources services within a smart city.	TECHNOLOGICAL
ISO/IEC 30145-3	Information technology — Smart City ICT reference framework — Part 3: Smart city engineering framework	This document describes a framework, structured in layers of ICT technologies, essential for smart cities' operation. This framework also provides the mapping of the ICT techniques to various system entities in order to support the smart city's business, knowledge management, and operational systems from the engineering perspective	TECHNOLOGICAL
CEN/TS 16555-6	Innovation management - Part 6: Creativity management	This Technical Specification provides guidance for managing the process of originating new ideas from which innovations may be developed. It is applicable to all types of organization including manufacturing and services industries, the voluntary sector, governmental and social enterprise but with a particular focus on small- and medium-sized enterprises (SMEs). The guidance in this TS covers issues to be considered by those responsible for managing innovation, in particular during the creative phase, and the sourcing of ideas from within and outside the organization.	PROCESS
PAS 183:2017	Smart cities. Guide to establishing a decision-making framework for sharing data and information services	This PAS gives guidance on establishing a decision-making framework for sharing data and information services in smart cities. It covers: types of data in smart cities; establishing a data sharing culture; data value chain – roles and responsibilities; purposes for data use; assessing data states; defining access rights for data; and data formats/format of transportation. This PAS aims to support the sharing of data and information services within cities. For some cities there will also be a need to establish specific data sharing agreements, particularly where data is being shared by multiple organizations at once. This PAS supports a transparent approach to making decisions and creating specific data sharing agreements in order to fully realise the benefits and value of data and information services in a city. Missing data or misinterpretation of data can lead to the wrong actions being taken by city decision-makers. A decision-making framework for sharing data can help ensure that they have the best overall data on which to base decisions.	PROCESS
PAS 180	Smart cities. Vocabulary	To help build a strong foundation for future standardisation and good practices, PAS 180 provides industry-agreed understanding of smart city terms and definitions to be used in the UK. The PAS defines terms for smart cities, including smart city concepts across different infrastructure and systems' elements and used across all service delivery channels. It covers materials, processes, methodologies and applications. The PAS is intended for city authorities and planners, buyers of smart city services and solutions, as well as product and service providers.	TERMONOLOGY

NbS POLICY AND GOVERNANCE

b. CLOSELY RELATED

UNI 11500	**Societal security - Public private partnerships - Guidelines for establishing partnership agreements**	This International Standard provides generic guidelines **to establish partnership agreements between any organizations to enhance coordination, collaboration and cooperation before**, during and after destabilizing events. This guideline addresses principles, planning and development of partnership agreements with the objective of managing relations among relevant organizations, promoting interoperability, enabling governance and fulfilling of the agreement	PROCESS

CEN/TS 16555-5	Innovation management - Part 5: Collaboration management	This Technical Specification provides guidance for the **management of collaboration and productive interaction between individuals, departments, divisions and third party** organizations engaged in innovation. It applies to all types of organization including manufacturing and services industries, voluntary organizations, governmental and social enterprise but with a particular focus on small and medium-sized enterprises (SMEs).	PROCESS
VDI-MT 2807	Team work - Application in value analysis/value management projects	**Interdisciplinary teamwork has become a fundamental, integrated and essential component of every project in value analysis/value management since decades**. There is a well founded, tested and approved wealth of experience, which is available for team work even beyond the closer area of value analysis or value management. However, a team can only be optimally effective when it operates in a teamwork-suitable environment. Without the holistic implementation in a suitable full range of instruments, teamwork alone will not lead to the desired success. This VDI Standard is universally applicable in all areas of economics, sciences and administration. It supports the managing directors and project leaders of value analysis/value management projects in the overcoming of daily management and project-management tasks and provides information from the above-mentioned practical experience for the practice of teamwork.	PROCESS
DIN SPEC 35810	Stakeholder Engagement - Guidelines for decision making processes dealing with climate change	This DIN SPEC (PAS) provides **guidance and recommendations in stakeholder engagement in climate change decision-making.** This DIN SPEC is applicable to organisations from the public and private sectors, including federal and local governmental agencies, companies, firms, industries, communities and nongovernmental organisations. It is developed in a user-friendly manner, setting out principles and instructions in a straightforward step-by-step guide with which organisations can engage stakeholders in the decision-making process.	PROCESS
ISO 10018:2020	Quality management — Guidance for people engagement	This document gives guidelines for **engaging people in an organization's quality management** system and on enhancing their involvement and competence within it. This document is applicable to any organization, regardless of its size, type or activity.	PROCESS

ii) RELATED

ANSI/API BULLETIN 100-3	Community Engagement Guidelines	These guidelines outline what communities can expect from operators. It is designed to acknowledge challenges and impacts that occur during the industry's presence in a given region. It provides flexible and adaptable strategies, recognizing that application will vary from operator to operator and community to community.	PROCESS
ISO 9001:2015	Quality management systems — Requirements	ISO 9001:2015 specifies requirements for a quality management system when an organization: a) needs to demonstrate its ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements, and b) aims to enhance customer satisfaction through the effective application of the system, including processes for improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements. All the requirements of ISO 9001:2015 are generic and are intended to be applicable to any organization, regardless of its type or size, or the products and services it provides.	PROCESS
ISO 14004	Environmental management systems — General guidelines on implementation	ISO 14004:2016 provides guidance **for an organization on the establishment, implementation, maintenance and improvement of a robust, credible and reliable environmental management system.** The guidance provided is intended for an organization seeking to manage its environmental responsibilities in a systematic manner that contributes to the environmental pillar of sustainability. This International Standard **helps an organization achieve the intended outcomes of its environmental management system,** which provides value for the environment, the organization itself and interested parties. Consistent with the organization's environmental policy, the intended outcomes of an environmental management system include: - enhancement of environmental performance; - fulfillment of compliance obligations; - achievement of environmental objectives. The guidance in this International Standard can help an organization to **enhance its environmental performance, and enables the elements of the environmental management system to be integrated into its core business process.** NOTE While the environmental management system is not intended to manage occupational health and safety issues, these can be included when an organization seeks to implement an integrated environmental and occupational health and safety management system. ISO 14004:2016 is applicable to any organization, regardless of size, type and nature, and applies to the environmental aspects of its activities, products and services that the organization determines it can either control or influence, considering a life cycle perspective. The guidance in this International Standard can be used in whole or in part to systematically improve environmental management. It serves to provide additional explanation of the concepts and requirements. While the guidance in this International Standard is consistent with the ISO 14001 environmental management system model, it is not intended to provide interpretations of the requirements of ISO 14001.	PROCESS
ISO 10006:2017	Quality management — Guidelines for quality management in projects	ISO 10006:2017 gives guidelines for the application of quality management in projects. It is applicable to organizations working on projects of varying complexity, small or large, of short or long duration, being an individual project to being part of a programme or portfolio of projects, in different environments, and irrespective of the kind of product/service or process involved, with the intention of satisfying project interested parties by introducing quality management in projects. This can necessitate some tailoring of the guidance to suit a particular project. ISO 10006:2017 is not a guide to project management itself. Guidance on quality in project management processes is presented in this document. Guidance on project management and related processes is covered in ISO 21500. ISO 10006:2017 addresses the concepts of both "quality management in projects" and "quality management systems in projects". These are distinguished by being addressed separately by the following topics and clauses: - quality management in projects includes: quality management systems in projects (Clause 4); management responsibility in projects (Clause 5); resource management in projects (Clause 6); product/service realization in projects (Clause 7); and measurement, analysis and improvement in projects (Clause 8); - quality management systems in projects includes: project characteristics (4.1); quality management principles in projects (4.2); project quality management processes (4.3); and a quality plan for the project (4.4).	PROCESS
ISO 10015:2019	Quality management — Guidelines for competence management and people development	This document gives guidelines **for an organization to establish, implement, maintain and improve systems for competence management and people development to positively affect outcomes related to the conformity of products and services and the needs and expectations of relevant interested parties.** This document is applicable to all organizations regardless of their type or size. It does not add to, change or otherwise modify requirements for the ISO 9000 family or any other standards.	PROCESS

ISO 56003:2019	Innovation management — Tools and methods for innovation partnership — Guidance	This document provides a guidance for innovation partnerships. It describes the innovation partnership framework (see Clause 4 to Clause 8) and the sample corresponding tools (see Annex A to Annex E) to — decide whether to enter an innovation partnership, — identify, evaluate and select partners, — align the perceptions of value and challenges of the partnership, — manage the partner interactions. The guidance provided by this document is relevant for any type of partnerships and collaborations and it is intended to be applicable to any organizations, regardless of its type, size, product/service provided, such as: a) start-ups collaborating with larger organizations; b) SMEs or larger organizations; c) private sector entities with public or academic entities; d) public, academic or not-for-profit organizations. Innovation partnerships start with a gap analysis, followed by the identification, and engagement, of potential innovation partners and the governance of their interaction. NOTE The essence of an innovation partnership is for all parties to mutually benefit from working together in the context of an opportunity for innovation. This document is not applicable to organizations seeking innovation by merger or acquisition.	PROCESS
ISO/TS 14029:2022	Environmental statements and programmes for products — Mutual recognition of environmental product declarations (EPDs) and footprint communication programmes	This document specifies requirements for mutual recognition arrangements (MRAs) and gives guidance on how to initiate developments on MRAs between environmental product declaration (EPD) and footprint communication programme operators. It addresses administrative and operational duties, through evaluation of such programmes, and how to externally communicate the results of the cooperation as well as plans for future related activities. This document is primarily applicable to MRAs but can also be a basis for bilateral agreements.	PROCESS
ISO/DIS 37170	Smart community infrastructures — Data framework for infrastructure governance based on digital technology in smart cities	Under development	PROCESS

NbS FINANCING AND ECONOMIC ACTIVITIES

ii) CLOSELY RELATED

ISO 14007	Environmental management — Guidelines for determining environmental costs and benefits	This document gives guidelines for organizations on determining the **environmental costs and benefits associated with their environmental aspects.** It addresses the dependencies of an organization on the environment, for example, natural resources, and the context in which the organization operates or is located. Environmental costs and benefits can be expressed quantitatively, in both non-monetary and monetary terms, or qualitatively. This document also provides guidance for organizations when disclosing related information. This document takes an anthropocentric perspective, i.e. looking at changes that affect human wellbeing (utility) including their concern for, and dependence on, nature and ecosystem services. This includes use and non-use values as reflected in the concept of total economic value when environmental costs and benefits are determined in monetary terms. The ways in which the environmental costs and benefits are used after they have been determined are outside the scope of this document. This document is applicable to any organization regardless of size, type and nature.	IMPACT ASSESSMENT
ISO 14008	Monetary valuation of environmental impacts and related environmental aspects	This document specifies **a methodological framework for the monetary valuation of environmental impacts and related environmental aspects**. Environmental impacts include impacts on human health, and on the built and natural environment. Environmental aspects include releases and the use of natural resources. The monetary valuation methods in this document can also be used to better understand organizations' dependencies on the environment. During the planning of the monetary valuation, the intended use of the results is considered but the use itself is outside the scope of this document. In this document, monetary valuation is a way of expressing value in a common unit, for use in comparisons and trade-offs between different environmental issues and between environmental and other issues. The monetary value to be determined includes some or all values reflected in the concept of total economic value. An anthropocentric perspective is taken, which asserts that natural environment has value in so far as it gives utility (well-being) to humans. The monetary values referred to in this document are economic values applied in trade-offs between alternative resource allocations, and not absolute values. This document does not include costing or accounting, although some valuation methods have the term "cost" in their name. This document does not include the development of models linking environmental aspects to environmental impacts. NOTE In this document, what is valued in monetary terms is either environmental impacts or environmental aspects. When valuing environmental impacts of an organization, it is important that links between environmental aspects and environmental impacts are established.	IMPACT ASSESSMENT
ISO 14097:2021	Greenhouse gas management and related activities — Framework including principles and requirements for assessing and reporting investments and financing activities related to climate change	This document specifies a general framework, including **principles, requirements and guidance for assessing, measuring, monitoring and reporting on investments and financing activities in relation to climate change and the transition into a low-carbon economy. The assessment includes the following items:** — **the alignment (or lack thereof) of investment and financing decisions** taken by the financier with low-carbon transition pathways, adaptation pathways, and climate goals; — **the impact of actions through the financier's investment and lending decisions** towards the achievement of climate goals in the real economy, i.e. mitigation (greenhouse gas emissions) and adaptation (resilience); — **the risks to owners of financial assets (e.g. private equities, listed stocks, bonds, loans)** arising from climate change. To support the financier's assessment of the impact of investment and lending decisions, this document provides guidance for the financier on how to: — set targets and determine metrics to be used for tracking progress related to the low-carbon transition pathways of investees;	IMPACT ASSESSMENT

		— determine low-carbon transition and adaptation trajectories of investees; — document the causality or linkage between its climate action and its outputs, outcomes and impacts. This document is applicable to financiers, i.e. investors and lenders. It guides their reporting activities to the following third parties: shareholders, clients, policymakers, financial supervisory authorities and non-governmental organizations.	
ISO 14030-1:2021	Environmental performance evaluation — Green debt instruments — Part 1: Process for green bonds	This document establishes principles, specifies requirements and gives guidelines: for designating bonds which finance eligible projects, assets and supporting expenditures as "green"; for managing and reporting on the use of proceeds; for defining, monitoring and reporting on their environmental impacts; for reporting to interested parties; for validation and verification. This document is applicable to any issuer of bonds.	PROCESS
ISO 14030-2:2021	Environmental performance evaluation — Green debt instruments — Part 2: Process for green loans	This document establishes principles, specifies requirements and gives guidelines: for designating as "green" loans which finance eligible projects, assets and supporting expenditures; for managing and reporting on the use of proceeds; for defining, monitoring and reporting on the environmental impacts; for reporting to interested parties; for validation and verification. This document is applicable to any borrower seeking financing by way of a green loan for eligible green projects, assets and supporting expenditures. It is also applicable to lenders.	PROCESS
ISO/DIS 14093	Mechanism for financing local adaptation to climate change — Performance-based climate resilience grants — Requirements and guidelines	Under development	IMPACT ASSESSMENT

iii) RELATED

ISO 14030-3:2022	Environmental performance evaluation — Green debt instruments — Part 3: Taxonomy	This document defines a taxonomy of eligible investment categories for designation as **green debt instruments, including bonds and loans.** This document categorizes economic sectors and establishes criteria for determining the eligibility of projects, assets and supporting expenditures. It provides guidance on adaptation by sector in Annex A. It provides examples of thresholds and exclusions in Annex B.	TERMONOLOGY
ISO/IEC 30145-1	Information technology — Smart City ICT reference framework — Part 1: Smart city business process framework	This document specifies a **generic business process framework for a smart city focusing solely on smart city-specific processes.** Generic business processes common between smart cities and commercial organizations are be identified but not detailed.	PROCESS
ISO/WD TS 14076	Eco-Technoeconomic Analyses: Principles, requirements and guidelines	This document provides a **framework and guidance for a methodology for performing an eco-technoeconomic analysis** (eTEA) based on commonly accepted best practices. eTEAs are used **to assess and evaluate the economic and environmental impacts of different types of processes when applied in practice**. This document specifies minimum requirements for reporting the results of eco-technoeconomic analyses. This document specifies the minimum requirements for communicating the underlying assumptions, and parameters, and methodologies used in an eco-technoeconomic analysis. This document applies to process systems at any size or scale.	IMPACT ASSESSMENT
ISO 14051:2011	Environmental management — Material flow cost accounting — General framework	ISO 14051:2011 provides a **general framework for material flow cost accounting** (MFCA). Under MFCA, the flows and stocks of materials within an organization are traced and quantified in physical units (e.g. mass, volume) and the costs associated with those material flows are also evaluated. The resulting information can act as a motivator for organizations and managers to seek opportunities to simultaneously generate financial benefits and reduce adverse environmental impacts. MFCA is applicable to any organization that uses materials and energy, regardless of their products, services, size, structure, location, and existing management and accounting systems. MFCA can be extended to other organizations in the supply chain, both upstream and downstream, thus helping to develop an integrated approach to improving material and energy efficiency in the supply chain. This extension can be beneficial because waste generation in an organization is often driven by the nature or quality of materials provided by a supplier, or the specification of the product requested by a customer. By definition, management accounting and environmental management accounting (EMA) focus on providing organizations with information for internal decision-making. MFCA, one of the major tools of EMA, also focuses on information for internal decision-making, and is intended to complement existing environmental management and management accounting practices. Although an organization can choose to include external costs in an MFCA analysis, external costs are outside the scope of ISO 14051:2011. The MFCA framework presented in ISO 14051:2011 includes common terminologies, objective and principles, fundamental elements, and implementation steps. However, detailed calculation procedures or information on techniques for improving material or energy efficiency are outside the scope of ISO 14051:2011. ISO 14051:2011 is not intended for the purpose of third party certification.	IMPACT ASSESSMENT
ISO 14052	Environmental management — Material flow cost accounting — Guidance for practical implementation in a supply chain	ISO 14052:2017 provides guidance for **the practical implementation of material flow cost accounting (MFCA)** in a supply chain. MFCA fundamentally traces the flows and stocks of materials within an organization, quantifies these material flows in physical units (e.g. mass, volume) and evaluates the costs associated with material flows and energy uses. MFCA is applicable to any organization that uses materials and energy, regardless of its products, services, size, structure, location, and existing management and accounting systems. In principle, MFCA can be applied as an environmental management accounting tool in the supply chain, both upstream and downstream, and can help to develop an integrated approach for improving material and energy efficiency in the supply chain. ISO 14052:2017 is based on the principles and general framework for MFCA described in ISO 14051. The MFCA framework presented in this document includes scenarios for improving material and energy efficiency in a supply chain, principles for successful application of MFCA in a supply chain, information sharing, and practical steps for the implementation of MFCA in a supply chain.	IMPACT ASSESSMENT

ISO 14053	Environmental management — Material flow cost accounting — Guidance for phased implementation in organizations	This document gives **practical guidelines for the phased implementation of material flow cost accounting (MFCA)** that organizations, including small and medium-sized enterprises (SMEs), can adopt to enhance their environmental performance and material efficiency. The phased approach provides flexibility that allows organizations to develop their MFCA activities at their own pace, according to their own circumstances. The resulting information can act as a motivator for organizations to seek opportunities to simultaneously generate financial and environmental benefits by reducing material losses and energy consumption. This document is applicable to any organization, regardless of its level of development, the nature of its activities, or the location at which these activities occur. This document provides basic calculation procedures to analyse saving potentials by avoiding material losses. Detailed calculation procedures or information on techniques for improving material or energy efficiency are out of the scope of this document.	IMPACT ASSESSMENT
ISO 10014:2021	Quality management systems — Managing an organization for quality results — Guidance for realizing financial and economic benefits	This document **gives guidelines for realizing financial and economic benefits by applying a top-down structured approach to achieving financial and economic benefits**. The structured approach uses the quality management principles and quality management system described in the ISO 9000 family of management system standards to: a) monitor and manage trends in key performance metrics; b) take improvement action based on the observed metrics. This document is directed specifically to the top management of an organization. This document is applicable to any organization, whether from the public, private or not-for-profit sector, regardless of its business model, revenue, number of employees, diversity of product and service offerings, organizational culture, complexity of processes, place or number of locations. This document complements ISO 9001:2015 and ISO 9004:2018 for performance improvements and provides examples of achievable benefits from the application of concepts in those standards. This document identifies associated practical management methods and tools to assist in realizing the benefits.	PROCESS
ISO/IEC DIS 5087-1	Information technology — City data model — Part 1: Foundation level concepts	Under development	TERMONOLOGY

COMMUNICATION AND AWARENESS RAISING

ii) CLOSELY RELATED

DIN CWA 17302	City Resilience Development - Information Portal; English version CWA 17302:2018	This CWA provides **a list of requirements for how municipalities can equip an information system that facilitates resilience building through collaboration, communication, and engagement.** This marks the functional specification of a Resilience Information Portal. The portal is a platform for communication within a local government, between a local government and its overall stakeholders, and between a local government and citizens. Requirements aim towards a broad-purpose, easy-to-use platform that provides versatility and flexibility. This document is intended to be used by information technology professionals and information technology decision-makers. It provides them with support in planning municipal information technology as well as operative help for the development process. The functional specification does not impose any specific paradigms, technological frameworks or third-party programs. The specification takes into account existing information technology infrastructure and following the recommendations can complement it. The specification provides for significant freedom and room for customization. This facilitates a technological solution that aligns with political decisions, particularly deriving from a local government's information technology strategy.	PROCESS
ISO 14063:2020	Environmental management — Environmental communication — Guidelines and examples	This document **gives guidelines to organizations for general principles, policy, strategy and activities relating to both internal and external environmental communication**. It uses proven and well-established approaches for communication, adapted to the specific conditions that exist in environmental communication. It is applicable to all organizations regardless of their size, type, location, structure, activities, products and services, and whether or not they have an environmental management system in place. It can be used in combination with any of the ISO 14000 family of standards, or on its own. NOTE 1 A reference table to the ISO 14000 family is provided in Annex A. NOTE 2 ISO 14020, ISO 14021, ISO 14024, ISO 14025 and ISO 14026 provide specific environmental communication tools and guidance relating to product labels and declarations.	PROCESS

iv) RELATED

ANSI/APCO 1.112.1	Best Practices for the Use of Social Media by Public Safety Communications	Social media is a common form of communication used by agencies and agency employees. This standard provides guidance on the use of social media for developing specific local procedures (ex: Facebook, Twitter, Instagram, Google+, etc.).	PROCESS
ISO 14016:2020	Environmental management — Guidelines on the assurance of environmental reports	This document gives principles and **guidelines for assuring the environmental information an organization includes in its environmental reports**. This document is applicable to assuring other types of reports in principle provided that special consideration is paid to identifying the competence needed by the assurance provider.	PROCESS
ISO 10013:2021	Quality management systems — Guidance for documented information	This document gives **guidance for the development and maintenance of the documented information necessary to support an effective quality management system, tailored to the specific needs of the organization.** This document can also be used to support other management systems, e.g. environmental or occupational health and safety management systems.	PROCESS

CLEVER Cities

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