

Climateurope2

Framework to support the equitable standardisation of climate services

Deliverable 1.2

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About Climateurope2

Timely delivery and effective use of climate information is fundamental for a green recovery and a resilient, climate neutral Europe, in response to climate change and variability. Climate services address this through the provision of climate information for use in decision-making to manage risks and realize opportunities.

The market and needs for climate information has seen impressive progress in recent years and is expected to grow in the foreseeable future. However, the communities involved in the development and provision of climate services are often unaware of each other and lack interdisciplinary and transdisciplinary knowledge. In addition, quality assurance, relevant standards, and other forms of assurance (such as guidelines, and good practices) for climate services are lagging behind. These are needed to ensure the saliency, credibility, legitimacy, and authoritativeness of climate services, and build two-way trust between supply and demand.

Climateurope2 (hereinafter referred to as CE2) aims to develop future equitable and quality-assured climate services to all sectors of society by:

- Developing standardisation procedures for climate services.
- Supporting an equitable European climate services community.
- Enhancing the uptake of quality-assured climate services to support adaptation and mitigation to climate change and variability.

The project will identify the support and standardisation needs of climate services, including criteria for certification and labelling, as well as the user-driven criteria needed to support climate action. This information will be used to propose a taxonomy of climate services, suggest community-based good practices and guidelines, and propose standards where possible. A large variety of activities to support the communities involved in European climate services will also be organized.

Executive Summary

The Framework (Deliverable 1.2), hereinafter referred to as Framework (for the deliverables, we will use the notation DX.X), presented in this document has the following aims:

- 1) to provide a common understanding of the path for supporting standardisation activity within the climate services community. This will be done through the development of a common understanding of climate services as well as identifying key questions needed to advance on evaluating whether standardisation is needed and desirable. This, in turn, is achieved by:
 - a. providing a basic introduction to standards and standardisation processes,
 - b. developing a shared understanding of the components (data, processes, products and actors) of climate services,
 - c. developing decision trees to navigate key questions to be asked to determine whether standardisation of any given climate component is needed and desirable.
- 2) to facilitate the exchange of knowledge across all relevant communities. This is done in part by defining and mapping key general and specialised terminology that will address overlaps and discrepancies within the interdisciplinary community of CE2 and beyond.
- 3) to facilitate a comprehensive and holistic evaluation of the current activities that are relevant for the development of standards for climate services and climate support (such as those shown in Figure 1).

These aims ensure that the climate services community has access to all the relevant information underlying a standardisation process and the role of standards in developing trust in climate services of quality.

This Framework document is structured as follows. In Section 2, we introduce the components of climate services identified by the project in internal workshops. We then introduce a series of guidance questions in the form of interlinked decision trees which form the backbone of the Framework. Answers to these questions will be provided by the output of Work Packages 2-6 through the annual information reports and summarised in the synthesis reports. Moving forward, we will use the abbreviation 'WPs' to refer to the Work Packages (then, Work Package 1 will be denoted as 'WP1', Work Package 2 as 'WP2', and so on). The rest of the document provides supporting information to navigate the decision trees. In Section 3, we provide a broad introduction to standardisation, processes that are relevant to standardisation and potential harm and benefits of standardisation. We then discuss how these considerations may apply to climate services. In Section 4, we introduce the concept of "equitable standardisation process". The first iteration of this section will be superficial: the aim of the project is to also provide a (climate services) community-based definition of what this means in the context of climate services. In Section 5, we introduce a list of key terms. These key terms are related to the Glossary (D1.3), hereinafter referred to as Glossary, developed by CE2, and, together with Section 3, will provide a key to understanding how to proceed on specific questions of the Framework. Section 6 and Section 7 conclude this document respectively with Frequently Asked Questions (FAQs) and Useful Resources that will be collected throughout the project and may further explicate the Framework.

Keywords

Standardisation, climate services, climate governance, standards, equitability, quality, assurance, certification

1 Introduction

One of the most fundamental challenges ahead for the scaling of climate action is the appropriate and effective use of climate information and policy support for decision making. The recent Intergovernmental Panel on Climate Change (IPCC) Report clearly states the central role that climate services play both in adapting to unavoidable impacts and in transformations towards net zero emissions.¹ The scientific community and a growing community of both public and private climate services providers can be seen as pioneering an emergent operational field, where “operational” is understood in its broader sense as a service to support decision-making for climate as a matter of common concern. At the same time, demands for identifying and reporting climate change risks, creating adaptation plans, risk management strategies, and decarbonization plans are increasing for both public and private organisations. Climate knowledge, which includes relevant scientific data and expertise from specific locations and sectors, and the integration of the contextual details of decision-making through the engagement with stakeholders, is needed by entities such as:

- countries in need to report progress towards their United Nations Framework Convention on Climate Change National Determined Contributions (UNFCCC NDCs) commitments and prepare for climate risk,
- municipalities in need to craft risk management, emission reduction and emergency plans,
- companies in need to climate-proof their value chains and assets or report to financial actors or investors such as the Task Force on Climate-Related Financial Disclosures (TCFD),

among many others. Moreover, a climate resilient future is dependent on the fast and equitable increase of users of climate information and policy support. Thus, climate services are key for managing risks, enabling political accountability, and realizing any potential opportunities posed by a changing climate.

One major problem for the equitable development and uptake of climate services is that there is evidence of unequal quality of many of the existing climate services in the market. There are concerns regarding the quality of data and data processing (such as bias correction techniques, uncertainty quantification and their fitness for purpose), and, consequently, the quality of the delivery and implementation of a given climate service. This raises several fundamental issues:

- misguided climate services can lead to misguided and even harmful climate action;
- lack of trust on the suitability of climate information for a particular purpose, fostered by poor quality services, is a huge deterrent for climate action. This delays the implementation of major policy agreements and strategies such as the Paris Agreement or the European and US Green Deals;²
- the absence of appropriate and quality-assured support for decision-making can endanger vulnerable communities, as well as critical infrastructures and natural resources, and can threaten business opportunities of many industries.

Clearly, some of the causes of problems in quality management and control are related to financing, capacity, or ignorance of climate risks. Nevertheless, standards and quality assurance mechanisms have potential to mitigate some of these issues. However, there are only a handful of standards and guidance

¹ See IPCC (2023), *AR6 Synthesis Report: Climate Change 2023*.

² See, e.g., Arribas et al (2022); Condon (2023); Fiedler et al (2021), p. 87-94; Findlater et al (2021), pp. 731-737.

documents in relation to climate services, such as the World Meteorological Organization (WMO) guidance documents, or climate-related relevant International Organization for Standardization (ISO), European Committee for Standardisation (CEN) or European Committee for Electrotechnical Standardisation (CENELEC) standards. Furthermore, these are limited to some components or aspects of climate services, such as data management. More recently, the UK Climate Resilience Programme has developed a general standard for climate services, but its consideration of the full value chain of climate services and its uptake is unclear so far. It is also unlikely that a single standard can cover the complexity of products and processes climate services represent. An overview of existing standards and standardisation initiatives relevant for climate services is available in the CE2 Landscape (D1.1) - "Current landscape of initiatives and standardisation norms and approaches", hereinafter referred to as Landscape. This document will be updated throughout the lifetime of the project.

Another important point is that the science on climate information has advanced rapidly, but the practice of appropriate implementation of related actions is lagging. Relatedly, it is important to note that the climate services market is fragmented: knowledge and expertise related to the different components of climate services, such as the decision context, the data of different types involved in the service, the ecosystem of actors and co-creation processes involved in a service, as well as the delivery mode of the service and its evaluation³, tend to be siloed and developed independently of one another.

Moreover, large aspects of climate services are simply unregulated. Exploring standardisation needs, gaps and strategies to establish a minimum benchmark to ensure that climate services are fit for purpose and meet the needs of stakeholders in fulfilling climate goals (e.g., the ones set by the policy context in which stakeholders operate) is a necessary condition to enhance the saliency, credibility and legitimacy⁴ of climate information, as well as to ensure the reduction of the fragmentation of the community. This exploration needs to be carried out keeping in mind the possible drawbacks of standardisation, for example tailoring a service to a local context.

Setting quality benchmarks through standards and standardisation processes is quite new to the climate services community.⁵ This community has primarily been self-regulated through scientific processes of quality assurance, such as peer review processes, or partially regulated by intergovernmental organisations like WMO or Copernicus. Furthermore, climate services have not yet fully explored and engaged the complete potential of civic climate activities provided by various segments of society that share the same goals as the climate services themselves.

Standardisation as a key mechanism of climate governance, brings new actors to the table with experience and expertise in developing, running, implementing, and eventually verifying or certifying climate services against widely shared standards and best practices. However, standardisation and related processes also need to take potential trade-offs into account, and whether standardisation excludes any relevant actors – something which should be avoided.

To provide a well-rounded perspective on the issue of standardisation in climate services, and support the equitable standardisation of climate services where and when standardisation is desirable, this document develops an initial Framework that aims at supporting the path to an equitable standardisation of climate services (see Section 1.1). The Framework developed in this document is

³ These components are further defined in Section 2.

⁴ See Cash et al (2003) for a definition of these terms.

⁵ Note that, while it is difficult to define what constitutes a "climate service community", we broadly refer to the ecosystem of actors involved in regulating, developing, delivering, evaluating and taking up climate services.

based on a broad understanding of both the terms standard and standardisation processes. It also takes a broad understanding of climate services, as combinations of data, products and processes, including their social and human dimensions, and taking equity as both an instrumental and an intrinsic value to be protected and promoted in terms of processes and outcomes.

So, the aims of this document are:

- 1) to provide a common understanding of the path for supporting standardisation within the climate services community. Such common understanding is achieved through the development of a common understanding of what climate services are and inquiring about how to best advance standardisation and its desirability. In particular, this is achieved by:
 - a. providing a basic introduction to what are standards and standardisation processes,
 - b. developing a shared understanding of the components (data, processes, products, and actors) of climate services,
 - c. developing decision trees to navigate key questions to be asked to determine whether standardisation of any given climate component is needed and desirable.
- 2) to facilitate the exchange of knowledge across all relevant communities. This is done in part by defining key and specialised terminology that will address overlaps and discrepancies within the interdisciplinary community involved in CE2 and in climate services in general.
- 3) to perform a comprehensive evaluation of the current activities that are relevant for the development of standards for climate services and climate support (such as those shown in Figure 1).

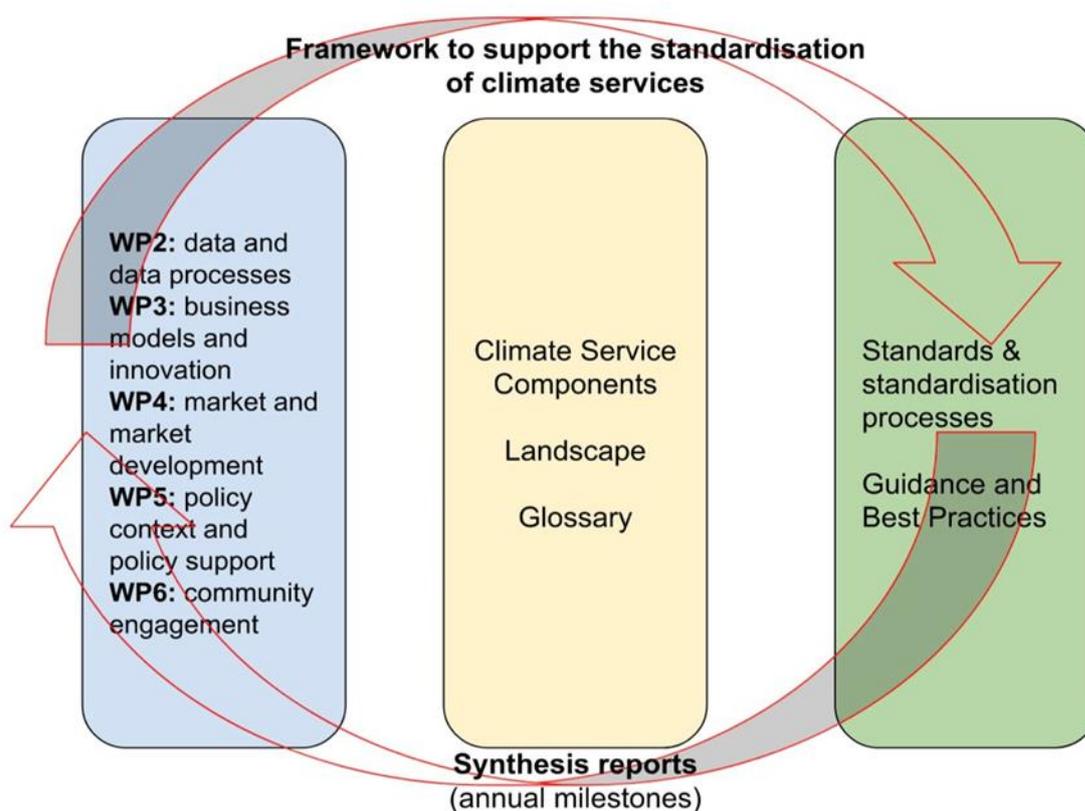


Figure 1: Iterative information flow envisioned by WP1 throughout the project. The Framework, synthesis reports and the middle column indicate the work of WP1. The leftmost column represents the work of WPs 2-6 and the information they collect. The middle column, as well as the top arrow, represent the way in which WP1 contributes to and synthesises the information provided by WPs 2-6. The rightmost column represents one of the key outputs of the joint work of the consortium: the collection of guidance, best practices and standards, as well as the support of standardisation processes where they are needed. The bottom arrow represents the annual milestones aimed at identifying information gaps that can be taken into account by WPs 2-6 for the next iteration of this information flow.

1.1 Scope and objectives of the Framework

CE2 has committed to develop a quality management strategy for climate services based on the requirements, needs, guidelines, good practices and standards identified by the project. Moreover, CE2 aims to identify gaps in existing good practices and standards and to identify and support mechanisms that may fill these gaps. Ultimately, these elements should aim to support an equitable climate services community in Europe and foster an understanding of the minimum requirements for quality-assured climate services.

By taking a bird's-eye view on the production and uptake of climate services and their different contexts, supported by informed knowledge of standardisation processes, the main objectives of the Framework presented here is to:

- 1) help identify what kind of information is required to determine minimum quality-assurance requirements, best practices, guidance, and standards where appropriate, through the decision trees and related terms (see Sections 2, 3, 4 and 5);
- 2) inform the creation of a synthesis report and recommendations on the information needs and gaps through the co-creation of a commonly accepted set of climate services components (see Section 2) and a Template for reporting relevant information for each component (see Appendix);
- 3) provide a description of standards and standardisation processes from a broad, interdisciplinary perspective, which adds to the one provided by the Landscape – the deliverable that identifies ongoing initiatives relevant for standardisation.

Through the integration of information collected by the other WPs, the Framework will also help integrate the multidisciplinary perspectives of the climate services community, thereby reducing the above-mentioned fragmentation of the field. Within CE2, each WP addresses a specific knowledge domain within climate services and will therefore need specific methods and activities to reach the overall aim of the project. Nevertheless, the Framework will provide all of them with a series of steps aimed at the identification of guidelines and good practices and, eventually, if needed, the formulation of a standard for the specific component that has demonstrated a sufficient level of maturity. Through the analytical lens of the Framework, these elements will provide guidance for the quality management of the different components of climate services. Moreover, if the consensus level, maturity and market needs align, we aim to propose an assurance scheme and discuss the possible criteria leading to the development of a certification and labelling approach.

By meeting these objectives, this document offers the reader a set of fundamental arguments for the importance of standardisation of climate services, highlights the role that standards can play in ensuring a minimum threshold of quality, and provides guidance on how to identify components of climate services that are more suitable to standardisation and which ones could be best treated with alternative forms of climate governance. On the other hand, this document is a guidance document for the rest of the CE2 WPs, so that all partners can perform a coherent co-identification of maturity and readiness for standardisation of different components of climate services. Furthermore, this document will help CE2 partners perform a comprehensive harvesting of information about requirements and user demands, as well as the collection of available information on the specific sub-arena addressed by the different WPs.

This document is to be understood as a living document: at specific milestones over the CE2 project lifetime, the Framework will continuously be revised and co-redesigned with a central concern for equity in both process and outcome. In this context, climate services are seen as a bottom-up process that takes the decisions supported by the service and the actual and practical needs of diverse actors, who need to need to mitigate, adapt, manage risks and opportunities, as point of departure. Equity is also concerned with ensuring that standardisation is not forced on aspects or components of climate services that would be governed through different mechanisms.

As an end product, this document will reflect lessons learned from CE2 and will be updated to reflect optimal strategies for increasing the quality, saliency, credibility, and legitimacy of climate services. It will also support the identification of the most and least matured components of climate services and push the mature components towards formal standardisation. A final version of this document will be

integrated in the Final synthesis report (D1.5), which will synthesise the information relevant for standardisation collected by CE2.

The Framework will serve to organise the work of WPs 2-6 as it relates to standardisation processes, guidance, and best practices with the aim of identifying where, when and what standards may be appropriate. The synthesis reports synthesise the information collected through the lens of the Framework, Landscape and Glossary in a way to individuate gaps and possible discrepancies in the community and provide guidance to further equitable standardisation as well as best practices and recommendations for consensus building processes. The Glossary is a deliverable that collects key terminology for the standardisation of climate services and the consensus building processes that are performed, as well as key specialised vocabulary collected by different WPs. The Final synthesis report will serve as a basis for a Strategy and recommendations report (D1.6) that will provide further guidance to support the climate services community through standards, guidance, and best practices beyond the lifetime of CE2.

1.2 Structure of the Framework

This Framework document is organised by breaking climate services into high level components, and for each component (or subcomponent, if more appropriate), the Framework provides guidance on the path to standardisation in the form of decision trees. In particular, the decision trees will provide key questions to address the following points:

- How different WPs contribute to the different components of climate services.
- The components for which standardisation has greater benefits than negative effects (standardisable components).
- For those components that can be standardised, help assess whether they are mature enough to start a standardisation process.
- For mature components, define key actors, whether standards are already available and used (drawing from the ongoing work on the Landscape), whether there are gaps, and/or whether new standards should be developed.
- For non-mature components, ensure that available best practices and guidance are identified in the Landscape, whether there are gaps, and co-identify with the relevant WPs which actions are needed to reach maturity.
- For components that should not be standardised, evaluate whether any other form of guidance/best practice is needed/desired, e.g. whether other forms of governance are suitable.
- Consider attention to the issues emerging between the different components and their interfaces (flow).
- Ensure that any standardisation process/collection of best practices and guidance, and hence standard that is developed, is *equitable*, with the aim of supporting an equitable community of climate services.
- Ensure that when standardisation is desired, but there is no clear path to do so equitably, the standardisation process is paused and replaced with activities that ensure its equity.

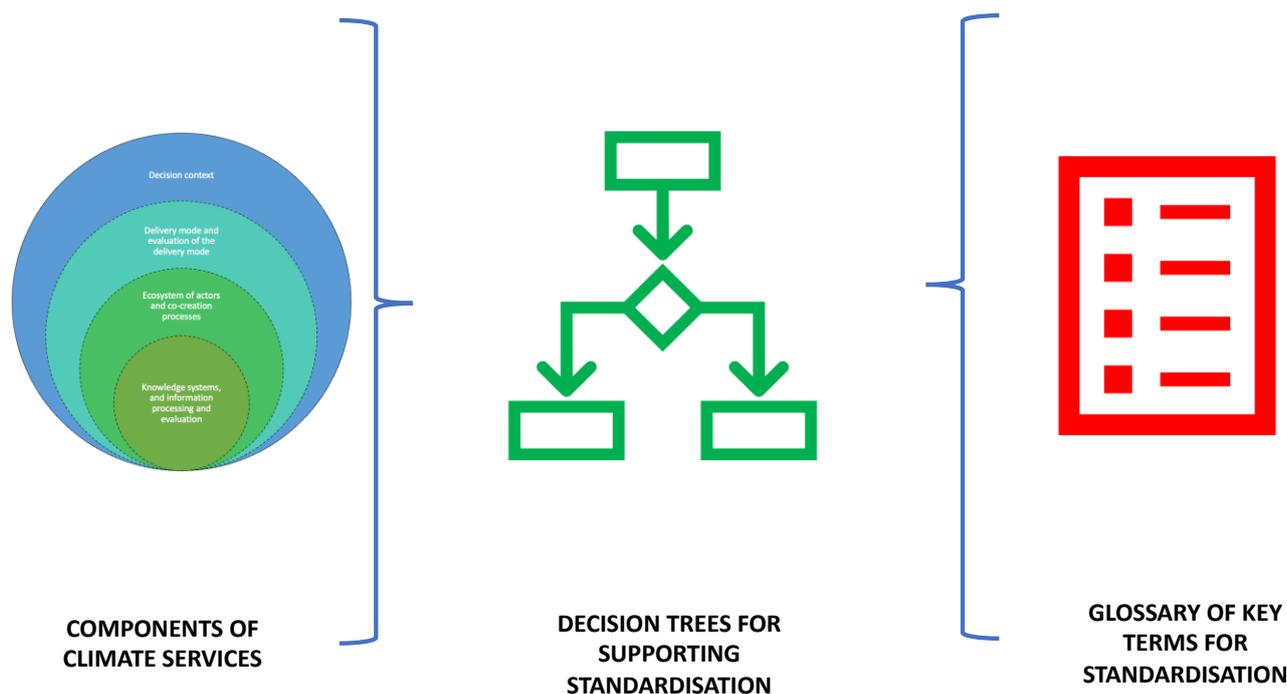


Figure 2: Overview of the elements of the Framework. The components of climate services, the Glossary and the decision trees (see Section 2). The decision trees help navigate the path to standardisation, where appropriate, for different components of climate services within the scope of the different WPs of CE2. The Glossary explicates key terminology relevant for navigating the decision trees, and it fosters communication and mutual understanding across the interdisciplinary members of CE2 and the climate services community at large. The “components” part of this figure is reproduced as a stand-alone figure in Figure 3 below.

To provide this guidance, the Framework, alongside the Landscape, the Glossary, and the Template for information exchange (see Appendix), provides an organized way of collecting information from WPs 2-5, as well as WP6 and WP7 when relevant, and provides key analytical questions to achieve the aims above. These key questions will also be constantly updated throughout the lifetime of CE2. Results will be collected in ongoing synthesis efforts leading to a major synthesis prototype (the Final synthesis report).

This Framework document is structured as follows. In Section 2, we introduce the components of climate services identified by the project in internal workshops. We then introduce a series of guidance questions in the form of interlinked decision trees which form the backbone of the Framework. Answers to these questions will be provided by the output of WPs 2-6 through the annual information reports and summarised in the synthesis reports. The rest of the document provides supporting information to navigate the decision trees. In Section 3, we provide a broad introduction to standardisation, processes that are relevant to standardisation and potential harm and benefits of standardisation. We then discuss how these considerations may apply to climate services. In Section 4, we introduce the concept of “equitable standardisation process”. The first iteration of this section will be superficial: the aim of the project is to also provide a (climate services) community-based definition of what this means in the context of climate services. In Section 5, we introduce a list of key terms. These key terms are related to the Glossary developed by CE2, and, together with Section 3, will provide a key to understanding how

to proceed on specific questions of the Framework. Section 6 and 7 conclude this document respectively with Frequently Asked Questions (FAQs) and Useful Resources that will be collected throughout the project and may further explicate the Framework.

2 Framework core: Components of climate services from a CE2 perspective and decision trees

2.1 Components of climate services

Given the complexity of climate services and their landscape (see D4.1), the CE2 consortium has proposed to break the conceptualisation of climate services into a set of high-level components for which questions about best practices, guidance and standardisation can be addressed individually, but having in mind the ties between these components.

2.1.1 How components were identified

The components of climate services have been identified through a series of three workshops with all the project partners, led by WP1 in January and February 2023. These workshops addressed the questions of the “what”, the “why” and the “how” of standardisation of climate services. In these workshops, it was agreed that identifying the data, processes, products, and actors that make up the key and broad components of climate services is the starting point for developing a framework for supporting standardisation.

The first workshop served as an introduction for CE2 project partners to working together, and helped clarify what approach we should take to standardisation and co-production. The second workshop allowed for some convergence on the key components of climate services. The third workshop focused on how CE2 can support climate services. This involved triangulating discussions on climate service components, standards and standardisation processes, and the work and output within different WPs of CE2, especially WPs 2-5. The main outputs of the workshops relevant for this document are the following:

- There is adequate consensus on what the key components of climate services are.
- There is no consensus on the flow of the components (i.e., how different processes, products and actors are related to one another and the order they follow in a “typical” climate service), apart from the fact that a climate service starts from the users’ demand.
- Different WPs and related tasks all can contribute to providing information about the different components of climate services.

As a consequence, Section 2.1.2 will only list the components of climate services identified in the workshop without discussing their relation to one another. This format will allow for enough flexibility in the Framework to enable different levels of granularity of the analysis of the different WPs. It will also allow for identifying relationships between components and subcomponents using a bottom-up approach, integrating the insights of the different WPs and making relevant connections throughout the course of CE2.

2.1.2 The components of climate services

Components, in this context, refer to the data, processes, products and actors involved in the service context and demand, as well as the design, development, implementation, uptake and evaluation of climate services. The broad components identified by project members so far are listed below, but it is important to note that the order in which the components are listed does not necessarily reflect the order in which these may appear in a climate service. Also, it is critically important to pay attention to the interconnections and interoperability across components. These components are just an attempt to provide some boundaries and at the same time break the complexity of climate services into recognisable sets of data, processes, products and actors. Moreover, throughout the lifetime of the project, CE2 members will work to harmonise this approach with other existing approaches to conceptualising the climate service value chain (see, for example, CE2 D1.4), as well as illustrate these components with examples.

- 1) The decision context:
the decision context refers to the kinds of decisions the climate services support, including its geographical and political context. This includes the policy structure and other forms of governance that require and enable climate services to develop.
- 2) Knowledge systems of different types (quantitative, qualitative, mixed data; local knowledge; etc.) and related selection, evaluation, and translation processes:
this component relates to climate data, but not only. Environmental, social, economic & technical, as well as engineering data and local knowledge to develop and implement local adaptation and mitigation strategies, is relevant here too, as well as all selection, evaluation and translation processes related to this data. Data accessibility, storage and stewardship would also fall under this component.
- 3) Delivery mode and evaluation of the delivery mode:
this component regards how a climate service is delivered, and how this delivery is evaluated at various steps. This should include the tailored aggregation and combination of data and processes to match the decision and context of the service client.
- 4) Ecosystem of actors and co-creation processes:
this component identifies the different actors involved in (co)producing, evaluating, and taking up climate services, as well as the actors that might become relevant because of a particular decision context (see Component 1). This component also addresses the co-production processes that are relevant for different actors and different stages of the climate service development process.

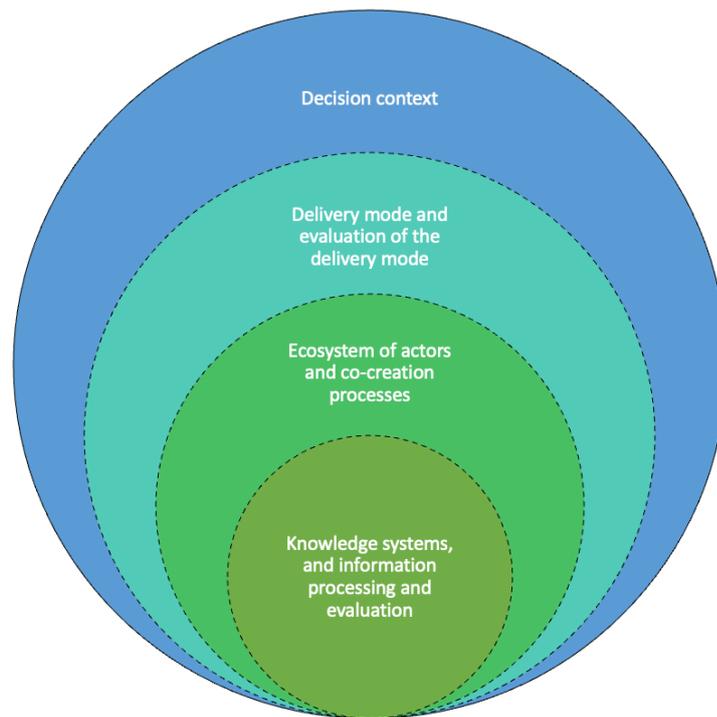


Figure 3: Components of a climate service co-identified by CE2 consortium members. The order of concentric circles does not imply a particular order of the components. However, the dotted lines reflect the fact that these components are not to be considered in isolation but influence each other.

2.2 Guidance for supporting equitable standardisation of climate services and their components.

For each component (or subcomponent) identified, a set of questions are proposed that should be addressed by the information provided by the WPs. The purpose of these questions organized as decision trees is to identify key aspects of climate services that need to be considered to pursue standardisation. In doing so, it mediates information flow between WPs 2-6, identifying gaps within the information collected by the consortium and gaps in standards and standardisation processes.

Given that one of the goals of CE2 is to identify aspects of climate services that are best not standardised, it is important to note that the first identification to be done relates to the types of standards that are best suited for a particular component or the different aspects of such component. Saying something is not standardisable means it is widely considered that such issues are best governed in a different way.

Take, for example, the issue of conservation norms on indigenous lands, especially in settler colonial or former colonial contexts. Here, issues of land governance and social justice intersect and clash with the historical colonial ties of systems of knowledge that shape conservation principles (or key concepts like

“wilderness”).⁶ In this case, forms of governance that aim to protect aspects of the environment may end up excluding indigenous peoples and dismissing their land rights.⁷ So, this example suggests that conservation regulation that may be aimed at protecting a common good (land, biodiversity, etc.) may end up having more harms than positive effects (e.g. excluding indigenous people from using their ancestral lands), and therefore need different types of governance.

This is in fact very common in everyday life, for example, the rules and norms surrounding human relations, for example marriage, partnerships, or parenting. Even though there are laws regulating partners and parents’ behaviour (for example in European countries it is prohibited to hit children or abuse partners), and although there are many different social norms and widely held best practices for gender relations, good parenting or for being a good husband, wife or partner, these are not standardised, nor would any democratic society wish for these human relations to be ruled by formal standards.

Figures 4 and 5 represent two different conceptualisations of the decision trees that support the path to standardising desirable and mature components of climate services. Figure 4 represents different levels of depth regarding standardisation (from Decision tree 0 to Decision tree 3), each subsequent tree building on the information identified in the former. Figure 5 provides a simplified conceptualisation of the information flow of the same decision process. Note that both these conceptualisations are iterative and will be applied from the start on a yearly basis throughout the lifetime of CE2. The reason for including two different conceptualisations of the same process is to provide flexibility in identifying the tool that it most fit for purpose in supporting an equitable standardisation process for those components that can be standardised and are mature enough to undergo the standardisation process. The aim is to converge on one stable version of the decision trees throughout the lifetime of CE2.

The work collected by WPs 2-6 and communicated through the template should allow the user of the decision trees to answer the questions asked in order to identify paths to standardisation and possible barriers. Moreover, when such information is not available or not well enough developed, the decision trees suggest further liaising with the WPs, in order to align goals and information transfer to support the successful implementation of CE2. Note, also, that the collaboration with the different WPs on the information transfer is likely to lead to the modification of these decision trees in order to make them more fit for purpose, and these decision trees are intended to be applied to components of interest on a regular basis.

There are important contextual and additional factors to take into account when considering the decision trees. For example, the Framework applies to components or subcomponents of climate services, so every time one starts the decision tree, the choice of component or subcomponent will influence how the questions will be answered (Figure 5 makes this choice more explicit). These components are also dependent on the type of climate service of which the component is part – and, importantly, components such as knowledge systems, the ecosystem of actors and co-creation processes, the delivery mode and evaluation of the delivery mode are all related to the component of the decision context.

Other important matters regard ownership of the questions raised in the decision trees (who is in charge of answering these questions for any particular component/subcomponent?) and the criteria for

⁶ See Denevan (2016), pp. 381-398.

⁷ See Domínguez & Luoma (2020).

answering particular questions (e.g., how do we decide whether a component is mature enough? What are minimum criteria for quality of a climate service component?). These are questions related to equity and inclusion (see Section 4) and how they interact with standardisation processes (see Section 3). In particular, questions of ownership should focus on the aim of this project to support an equitable climate services community, which means paying particular attention to those members of the community who may not be able to participate in existing decision-making processes and climate service governance mechanisms. These actors will need to be included in developing groups of experts in charge of answering these questions. For the lifetime of CE2, however, the decision trees will be tested with a smaller group of actors, both within CE2 and, at a later stage, within the climate services community. These tests will lead to further refinements of the decision trees. Ultimately, however, the decision trees should be owned and used by the climate services community at large.

Similarly, criteria for answering these questions should be co-developed by the climate services community. As is the case for the Framework, these criteria will be developed in stages, first as a co-production activity within the CE2 consortium, and subsequently with the wider climate services community through the platform (D7.5) developed by the consortium, which is a web application built to provide an interactive and user-friendly repository of project results (good practices, recommendations, vocabularies, etc.) with a community engagement component. These criteria will also need to consider what is meant by equitability in the context of climate services, a topic that is currently still being developed within the context of WP1 and the Glossary and will be included in future updated versions of this Framework.

Finally, it is important to note that these decision trees are part of an iterative process, that needs to consider that climate services are a growing and rapidly changing sector. Moreover, standards set by standardisation bodies such as ISO, CEN, German Institute for Standardization (DIN), British Standards Institution (BSI), etc., undergo periodic evaluation and updating processes, and this needs to be taken into consideration when answering questions about whether a particular standard is up to date. The answers might in fact depend on the stage of the life cycle of the standard, and engagement with the relevant standardisation committees might be necessary to provide adequate assessments.

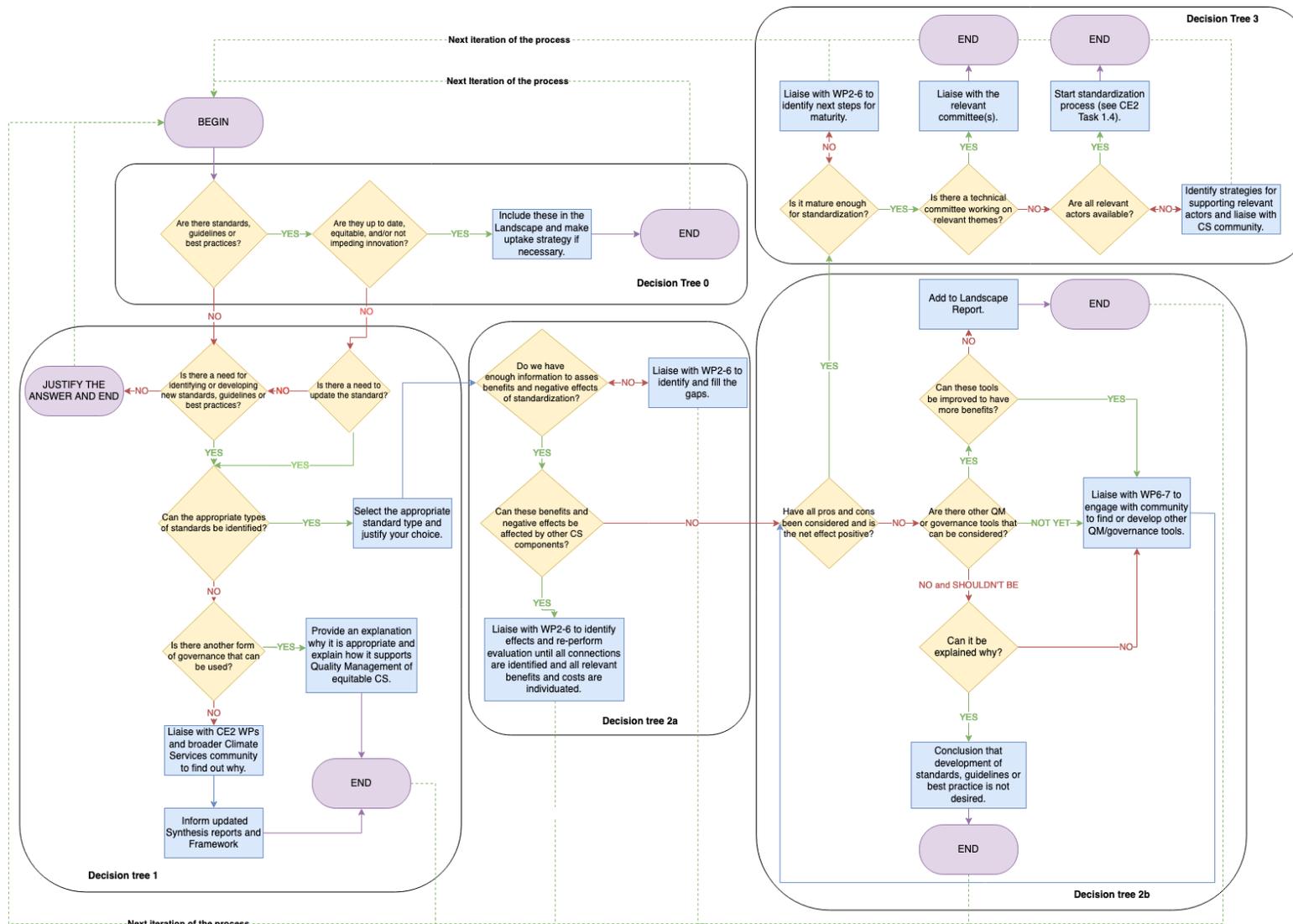


Figure 4: First conceptualisation of the decision trees to support an equitable standardisation of the components of climate services. Note that this is not the final version of the decision trees, and it will be updated throughout the lifetime of CE2. Abbreviations: Climate Services (CS); Quality Management (QM); Climateurope2 (CE2).

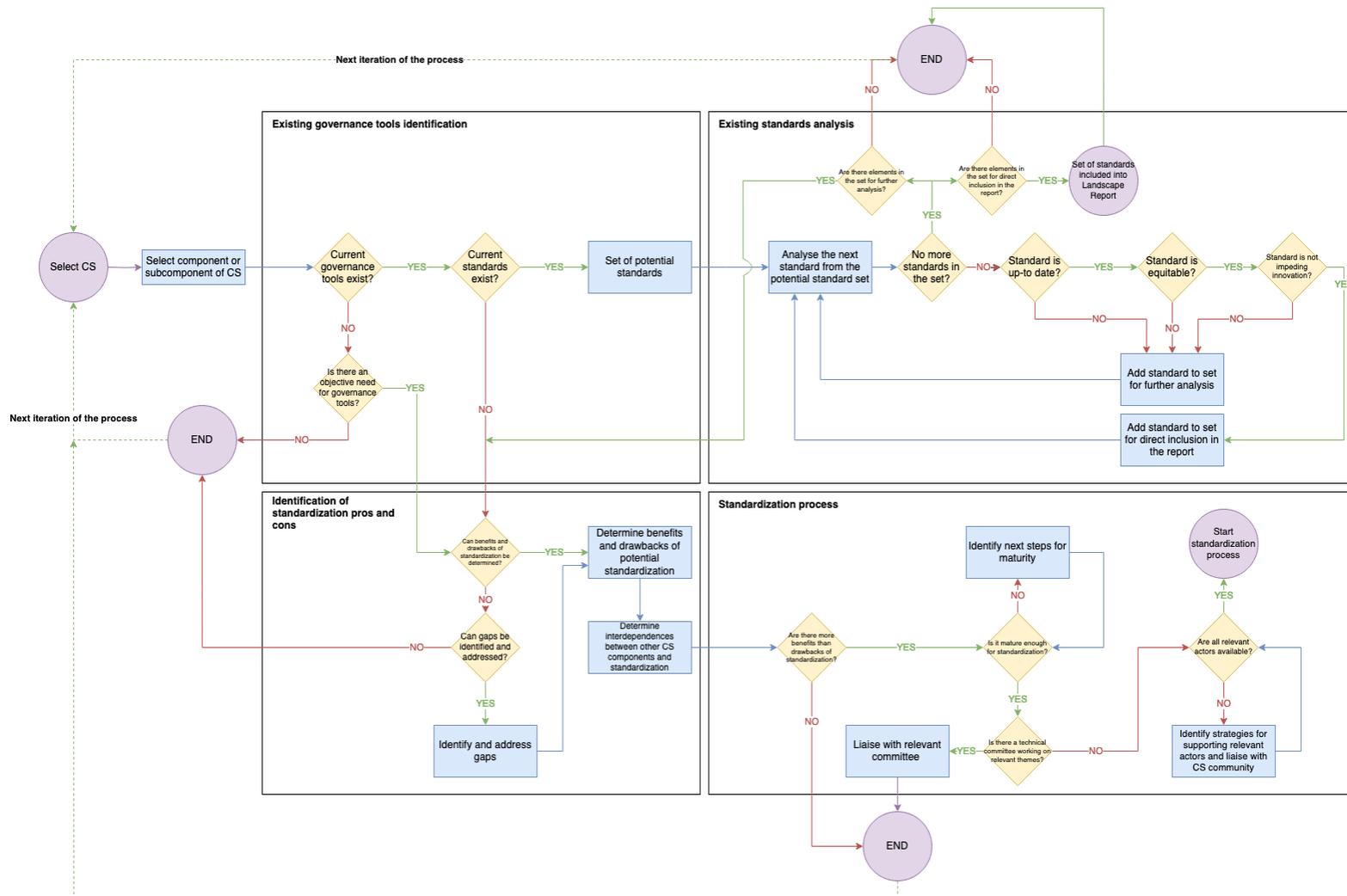


Figure 5: Second conceptualisation of the decision trees to support an equitable standardisation of the component of climate services. Note that this is not the final version of the decision trees, and it will be updated throughout the lifetime of CE2. Abbreviations as in Figure 4.

3 What is standardisation?

3.1 Standardisation and standards as a form of governance

Standardisation is ubiquitous in contemporary societies. We are surrounded by standards and norms for how things should be, should work or are best developed and implemented. There are standards for just about everything: for assuring the safety of products, for protecting and restoring the environment, for ensuring the wellbeing of people, for regulating finance or supply chain flows, building technical infrastructure, ensuring corporate responsibility, or for measuring Greenhouse gas (GHG) emissions.⁸ The vast majority of standards are voluntary norms rather than enforceable laws. Still, their widespread use makes standards difficult to avoid because they form an integral part of establishing a common understanding among parties that enter into a legal voluntary or social engagement. Also, reporting and demonstrating compliance with widely agreed norms is the everyday task of most public and private organisations. Standardisation is often considered a form of governance: standards are rules, although rules that emerge from, and are often enforced by, private actors or independent parties with delegated authority from regulators. Standardisation organisations refer to institutions led by private, governmental or hybrid (i.e. both public and private) actors, which play a role in regulating economic activities and the deployment of technologies in society.

Governance is mainly concerned with realizing public goals, through the process of intentionally steering a particular constituency of actors, towards specified goals and is regarded as authoritative.⁹ We refer to standards as a form of governance because these rules are centrally concerned with public goods such as safety, environmental protection or, as it is the case in climate services, with the goal of achieving resilient and carbon neutral societies.

At the same time, standards are political because the way in which they are constructed and applied transforms the practices in which they become embedded and because standardisation is a “dynamic process of change” as standards can create configurations of things and people, prescribe behaviour, but also values and norms, and can also redefine issues. For example, research on the development of standards in the medical field exploring the development of DMS-III – The Diagnostic and Statistical Manual of Mental Disorders – led to deep and substantive change in the classification of psychiatric disorders.¹⁰ The role of experts is key, and the legitimacy and authoritativeness is derived from a consensus building process amongst experts in a particular field.

Standards only exist because we use them, and because we benefit from using them. If they did not bring value, their justification for existing would no longer apply.¹¹

Standards come in different forms and shapes, from formal standards resulting from specialized organisations processes, such as National Standards Bodies, the ISO or its European counterpart (CEN-

⁸ See St.Clair & Aalbu (2016).

⁹ See Büthe & Mattli (2011); Ansell & Torfing (2022).

¹⁰ See Timmermans (2010).

¹¹ See Danish Standards Foundation (2015), *A world built on standards: A textbook for higher education*.

CENELEC), to industry norms emerging from consortia of industries (such as food safety standards) or guidance issued from political or finance organisations such as the EU Taxonomy for Environmental, Social, and Governance (ESG) or The Climate Risk Reporting Guidelines of the Task Force on Climate-Related Financial Disclosures (TCFD).

3.2 What are standards?

There is no agreed definition of standards, and one may find different descriptions in dictionaries.¹² Nevertheless, we can define standards as “rules established by expert bodies prescribing, *de jure* or *de facto*, the quality or performance of a given practice, procedure, or product.”¹³ In the context of CE2, we think it is best to understand standards for the type of outcomes they may lead to and the type of problems they may help to solve.

As such, standards are measurements, descriptions, sets of requirements, conventions or design specifications aimed at inducing conformity of practice or behaviours. Standards help to ensure product functionality, compatibility or interoperability. They also define terminologies, create shared vocabularies and methodologies so that products, processes, or services can be widely understood and compared.

At a general level, standards are voluntary rather than mandatory benchmarks of a minimum quality. They are also usually market-driven, built by consensus, and approved by a legitimate body. Standards and their precursors (e.g., guidance documents and recommended practices) harmonize processes, procedures, and designs, enhance transparency and traceability, and provide the basis for independent, third-party verification. Standards are best seen as establishing rules that can be universally understood and widely adopted through legitimate processes coordinated by legitimate actors, and eventually verified and certified also by legitimate and, most importantly, independent actors.

At the same time, standardisation processes also inform and often accelerate or lead to regulatory developments.¹⁴ There is a relationship between standards and legislation. On the one hand, standards can simply be agenda-setting rules, while in some cases standards become precursors of formalized requirements by governments or intergovernmental organisations and even become enshrined in laws. Standard setting processes and actors could have, in some cases, considerable power. When widely accepted and adopted, standards can easily become an exclusionary system protecting certain interests or even serve as lock-in for old technologies.¹⁵ But governments and intergovernmental organisations support standardisation processes and standards primarily because of their capacity to harmonize, benchmark, improve and speed up innovation and the formation of well-functioning markets. Nevertheless, standards must be the result of equitable consensus-building processes and their outputs must in themselves be seen as equitable tools even though often this means eliminating existing practices.

¹² See Danish Standards Foundation (2015), *A world built on standards: A textbook for higher education* for a summary of definitions of the term standard by different standardisation bodies.

¹³ See Bütthe & Mattli (2011).

¹⁴ See Bütthe & Mattli (2011).

¹⁵ See Brown et al (2022); Bütthe (2010), pp. 1-38.

The European Standardisation Strategy is an example of how standards are part of governance mechanisms, in this case EU governance. The primary goal of the EU's revised Standardisation Strategy is to support the EU single market aiming to leverage the EU standardisation system to deliver on the twin green and digital transitions and support the resilience of the single market.¹⁶

The EU's ambitions towards a climate neutral, resilient and circular economy cannot be delivered without European standards on testing methods, management systems or interoperability solutions. In the global race for digital leadership, the ability to shape international standards for digital products, processes and services as global benchmarks is essential for the EU's competitiveness. In short, the EU's policy ambitions on a resilient, green and digital economy will fall short if the accompanying standards are defined by other regions in the world.¹⁷

We can position efforts to support the standardisation of climate services in this context of the twin transition, but also as a key element of the EU's climate governance mechanisms. Standards often emerge in situations where more traditional models of governance are either lacking or are difficult to enforce. One could argue this is perhaps the situation of climate services. There is a strong need for many different actors to collectively act on mitigation and adaptation efforts, but the multi-layered climate governance system lacks coordination to establish and enforce a minimum benchmark for quality of the information guiding climate action. In fact, studies already point out that private alternatives have flourished in the past in the environmental area, including self-regulation, corporate social responsibility or public-private partnerships, precisely because of the absence of an effective national and intergovernmental regime.¹⁸ At the same time, is it unlikely that we will see a scaled-up market for climate services in the absence of appropriate and well recognized standards resulting from a consensus-building process that involves all relevant actors. These are two extremes and CE2 aims to investigate these topics in a balanced manner. Given that it is most likely the case that certain components of climate services are not suitable for standardisation, it is important not only to understand that standardisation is a form of governance but also that, as efforts mature, standardisation of climate services would need to be integrated into wider climate governance mechanisms through appropriate strategies and roadmap initiatives.

3.3 Standardisation processes and different types of standards

Standardisation is a multistakeholder consensus process aimed at building uniformity and interoperability and to create benchmarks. However, standardisation processes are very different for different subjects, driven by diverse types of institutional settings and depending on the type of standards or guidelines they aim to develop. Standards can be developed within very different institutional settings, by public or private actors. These lead to different types of rulemaking. The processes of developing standards are critical for their legitimacy, their equitability, and for their potential uptake. It is also important to note that quality assurance is also achieved through guidance documents, recommended practices or protocols which have not yet fully mature into formal standards but can be considered precursors to a formal standard. The fundamental issue is that these guidance or recommendations are widely accepted by the community of actors to whom it applies, thus authoritativeness is a key characteristic.

¹⁶ See European Commission (2022), *EU Standardisation Strategy*.

¹⁷ See European Commission (2022), *EU Standardisation Strategy*.

¹⁸ See Bernstein & Cashore (2007), pp. 347-371.

Standards can be produced and operated at international, transnational or national levels. Most private standards operate at a transnational level. The difference between the international and transnational level captures the nature of most private standards organisations such as the National Standards Bodies of European countries or CEN-CENELEC at the EU level, in contrast to international agreements such as the Kyoto Protocol or the Paris Agreement, which are agreements amongst governments of UNFCCC countries.

In our earlier work, we simplified the complex landscape of standard setters and provided a typology of four modes of global rulemaking, distinguishing between public and private rulemaking processes, as well as market and non-market based (see Figure 6).

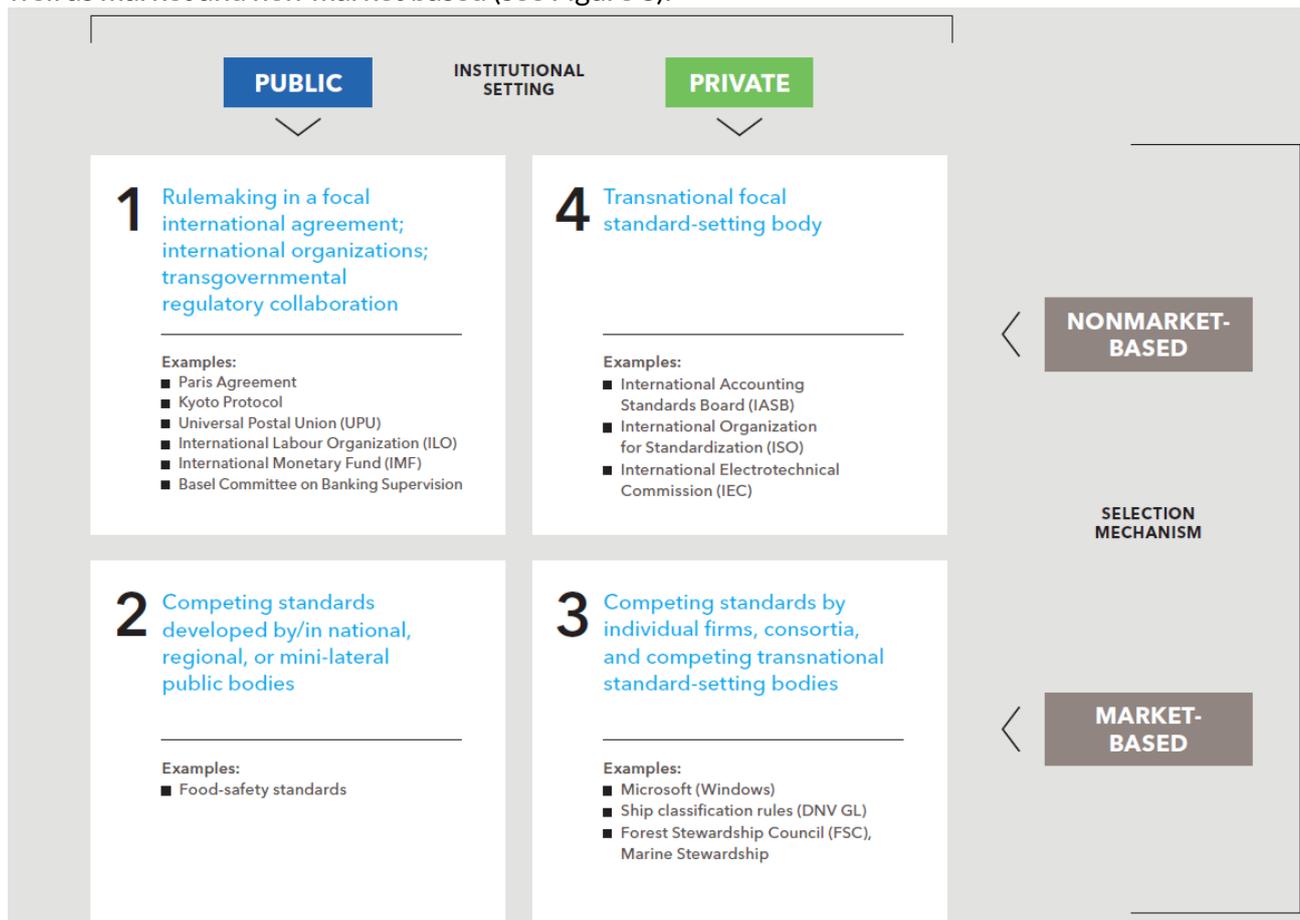


Figure 6: Global Rulemaking.¹⁹

For the purposes of climate services—and in the context of CE2—it is important to note that current initiatives tend to fall into the non-market-based type of standardisation processes. These are led by private focal standard-setting bodies, such as ISO, the International Electrotechnical Commission (IEC), CEN-CENELEC, or the International Accounting Standards Board (IASB). Also, many intergovernmental bodies have existing agreements with transnational standardisation organisations. For example, WMO existing guidance documents on weather, hydrology or air pollution data will fall into the international category, as clarified in the existing agreements WMO has with ISO.²⁰

¹⁹ Reproduced with permission from St. Clair & Aalbu (2016).

²⁰ See International Organization for Standardization ISO (2008), *ISO strengthens partnership with World Meteorological Organization*.

Nevertheless, these agreements also mean that intergovernmental organisations, such as UN bodies, can de facto become standardisation bodies. For example, the International Maritime Organisation (IMO) is considered the global standard-setting authority for the safety, security, and environmental performance of international shipping.²¹ WMO is considered a standardisation body in the fields of meteorology, hydrology, climatology and related environmental disciplines.

Nevertheless, the large majority of international standards today are developed by focal standard-setting bodies and, although they are formally just voluntary, in fact many become mandatory, either through market pressure or through references to specific standards in national laws.²² Also, as is the case with the standardisation efforts for adaptation to climate change, at the European level many of the efforts in CEN-CENELEC and National Standards Bodies follow formal standardisation requests from the European Commission. At the same time, given CE2 aims to provide guidance for the standardisation of climate services for mitigation in addition to adaptation, this guidance should take into consideration the existing GHG emissions trading standards, from the EU Emissions Trading System (EU ETS) to the national ETS systems.

Building formal standards takes time. These processes are long (taking several years), but initial sets of requirements are often identified in the shape of precursors to formal standards such as a guidance documents and recommended practices or best practices, eventually leading to a formalized standardisation process involving these organisations. Precursors to formal standards tend to be the norm if they are widely accepted, legitimate, and used until final formal standards are achieved. Equally important, standards also become obsolete or in need of updates.

Lastly, it is key to understand that standards are not written by standardisation bodies by themselves. The paragraph below describes very well how these processes work in practice:

Many people have the impression that standards are written by the standardisation organisations themselves. This is a significant misunderstanding of the core values of the standardisation system; i.e. the involvement, consensus and influence of all interested parties. Standards are the distilled wisdom of people with expertise in their subject matter who know the needs of the organisations they represent – people such as manufacturers, sellers, buyers, customers, researchers, trade associations, users, regulators, etc. The role of the standardisation organisations is to ensure that the standardisation system works and that all relevant stakeholders come to a common agreement on what is the best standard for a particular need.²³

Competence in standard-setting and identifying the relevant stakeholders are thus critical for the successful standardisation of something. It will be a determining factor in the standardisation of climate services.

3.3.1 On the importance to distinguish different types of standards

²¹ See International Maritime Organization IOM, *Introduction to IMO*.

²² See Murphy & Yates (2009).

²³ See Danish Standards Foundation (2015), *A world built on standards: A textbook for higher education* for a summary of definitions of the term standard by different standardisation bodies, p.8.

There are many different ways to classify standards, depending on the types of tasks they need to perform and the subject matter under standardisation. For example, they can be classified according to requirements:

- Dimension systems (e.g., paper formats, threads, classification systems).
- Performance (e.g., breaking strength, energy performance, safety, ergonomics, noise).
- Methods/testing (e.g., test schemes, chemical analysis, documentation of performance).
- Management systems (e.g., quality, risk, energy, or environmental management).
- Symbols (e.g., pictograms, symbols for machines).
- Terminology (e.g., definitions of main terms within different fields).
- Products (e.g., toys, electrical equipment, construction products).
- “Basic” standards (e.g., SI 9 units²⁴).

To simplify the work of CE2 ahead, we can broadly make a three-pronged distinction between design or technical standards, performance, and procedural standards. Each of these types of standards are created through different processes of rulemaking and often lead to diverse levels of strictness in terms of implementation, validation, and assurance mechanisms for compliance:

- 1) **design or technical standards** that set **structural specifications** (e.g., data quality),
- 2) **performance standards** that set **outcome specifications** (e.g., energy efficiency); and
- 3) **procedural standards** that set **specifications for processes** (e.g., sustainability, or management systems standards).

The logic behind these distinctions is that the fit of the standard type with whatever is being standardised is crucial for the success of the standardisation process and the applicability of the standard. It is thus important for CE2 to keep these distinctions in mind, as for example some components of climate services are best suited for technical or design standards, such as for example those related to climate data or modelling. Performance standards would be more appropriate when attempting to identify the delivery mode, business model, or implementation of a climate service. On the other hand, the component that deals with the knowledge, stakeholders and co-design processes with users may be best served from the perspective of a procedural standard or guidance. Distinguishing standards by these three broad types is also important because they have very different relations to the goal of equitability (see Section 4).

Given CE2 also works in producing a Glossary, we aim to collect terminology as part of that task and thus we do not add terminology standards as an additional category.

3.4 Benefits and potential harms of standardisation

²⁴ See Danish Standards Foundation (2015), *A world built on standards: A textbook for higher education* for a summary of definitions of the term standard by different standardisation bodies, p.8.

Standardisation is key for innovation, even if excessively demanding benchmarks and strict rules can hinder it. In the technological field, the advantages of standardisation are very well investigated. For example, they facilitate both invention of new products and services and enhance the exploitation of innovation results (see Figure 7). But huge concerns have emerged in The Information Age due to the fear of, for example, the market power accumulated by computer giants selling proprietary mainframes that could not communicate with other systems or be linked to other types of software leading to substantive competition problems.²⁵

So, considering the power differential amongst actors is key when different actors have different levels of resources (e.g., competence and finance) to allow their participation and engagement in standard-setting processes. In an unequal playing field, such as climate change impacts, this lack of competence and financial resources is a key concern, especially when considering that climate service standards need to support an equitable climate service community.

	Invention-Support...	Exploitation-Support...
... through Standards	<ul style="list-style-type: none"> • Exceeding the requirements of standards • Efficient and target-oriented innovation • Stimulating innovation through updates of standards and new standards 	<ul style="list-style-type: none"> • Business model innovation (e.g. laboratories)
... through the Standardisation process	<ul style="list-style-type: none"> • Stimulating innovation from participation in standardization process (ideas/insights from customers, competitors and other stakeholders) 	<ul style="list-style-type: none"> • Innovation communication • Absorption of innovation during standardization process

Figure 7: Benefits of standards and standardisation processes for innovation.²⁶

Another well documented benefit of the standardisation of technologies, is that standards serve to provide clear and organized pathways from scientific discoveries to the production of proprietary products, generating markets, enhancing the competitiveness of nations, and at the same time serving to reduce risks and level the playing field.

²⁵ See Hawkins & Blind (2017), pp. 1-18.

²⁶ See Brown et al (2022).

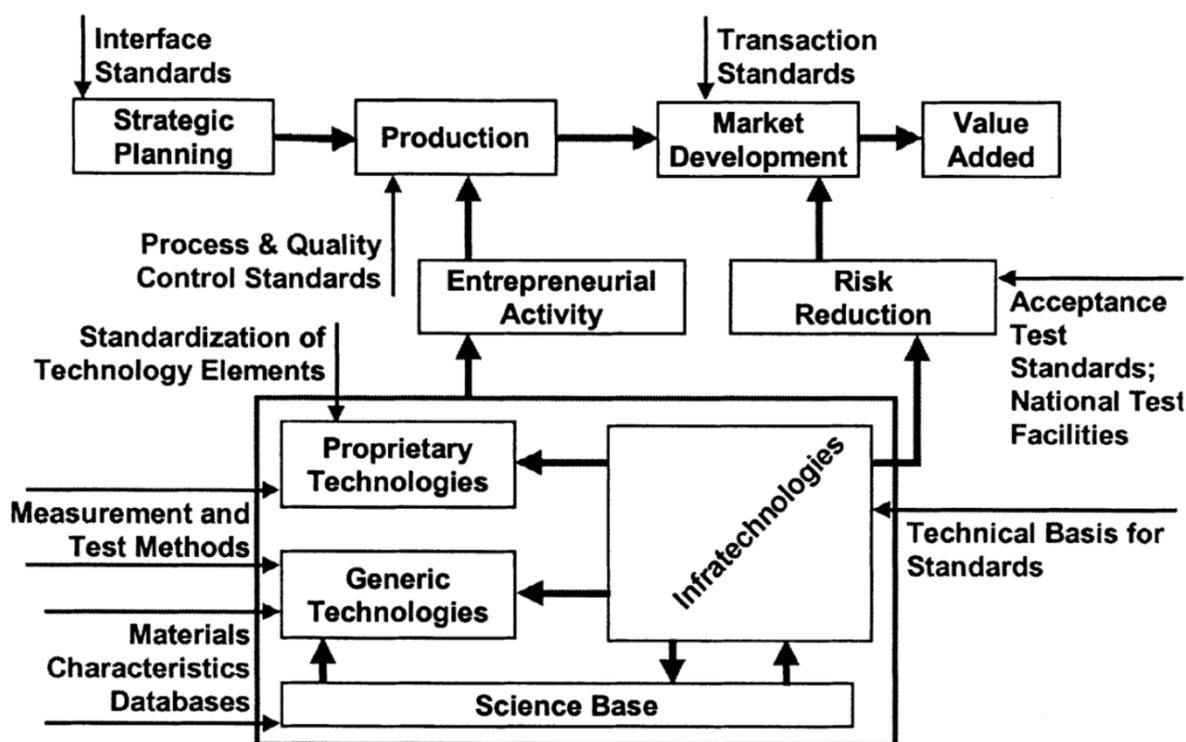


Figure 8: Role of standards in technology-based markets.²⁷

These interactions between scientific discovery, innovation activities and entrepreneurial activities and the achievement of public goods, such as risk reduction, is illustrated in Figure 8. But these clear benefits tend to apply to technological products and are often related to the creation of technical standards, which only marginally covers the types of standards that may be relevant for climate services.

There can be downsides to standards, such as lock in of technological development or the prioritization of some issues over others. Standardisation processes can also leave key stakeholders and knowledge holders behind or create too high a set of demands for actors to be capable and able to implement them. Often, the usability of standards is a direct result of how well or not standardisation processes have managed to limit potential negative consequences of their applicability and uptake.

Another limitation of standards is that standards can become obsolete. Most standardisation processes prepare for updates in their planning, and some required ongoing revisions, which can be costly and time consuming.

In the case of climate services, the task at hand is about standardising a complex set of products and processes with diverse types of components in their value chain and requiring the participation of members of the climate service community. This community is currently quite fragmented. CE2 needs to identify, through ongoing project work and use cases, what exactly are the limits of standardisation, which components may be best treated through different ways to establish quality benchmarks etc.

²⁷ See Tassey (2000), pp. 587-602.

4 Equitable standardisation: Why and how

The complexities related to climate action have always led to placing considerations of equity at the centre of climate governance. The same applies to standardisation efforts in relation to climate services: in this context equity of climate service standardisation processes and of climate service standardisation outcomes must be placed at the centre. As mentioned, different types of standards lead to different ways to tackle equitability. For example, design and performance standards for climate services can quickly result in a demand for “higher” levels of competence and as such are not as suitable to communities or in contexts where information technologies infrastructures are weak, or inappropriate, or there is no capability to run them. On the other hand, a procedural standard might allow more flexibility and adaptation to specific local conditions of concrete decision-making contexts as long as the spirit of the standard is achieved.

4.1 Why equity

Equality is the state of being equal, especially in status, rights, opportunities or outcomes. Equity, on the other hand, aims to ensure the fair treatment, access, equality of opportunity and advancement for everyone while also attempting to identify and remove the barriers that have prevented some groups from fully participating. In the context of climate services, we can say that different actors will begin from different starting points regarding different relevant areas of expertise, e.g., technical knowledge about climate change, local knowledge about current environmental or other management practices, how to engage in co-production, etc., as well different socio-economic backgrounds that might intersect with these different knowledge areas. So, an equitable standardisation process of the different components of climate services must ensure that eventually all stakeholders have the capabilities to equally engage with standardisation processes for climate services. At the same time, standardisation processes must ensure that all relevant actors’ needs and requirements are taken into account and that they are supported with tools tailored to their needs. This same logic applies to the outcomes of standardisation: the standards or guidance produced must be salient and fit for the purpose of all stakeholders. Ultimately, the end result shall be standards, best practices, and guidance that support an equitable climate services community.

4.2 Equity in governance of climate services

Equity in the context of governance is still an emerging field of research and action with much complexity. For example, influential nations like the USA have resisted the inclusion of equity and justice in climate governance documents.²⁸ This use of power exacerbates the need for an explicit inclusion of equity issues in the context of governance of climate-related fields such as climate services. In particular, its explicit inclusion can:

- Force governance to address issues of human wellbeing.
- Illuminate policy analysis and political dynamics in an already structurally unequal field.
- Enable addressing relevant trade-offs in the interests of various stakeholders, improving the legitimacy of interactions.²⁹

²⁸ See Klinsky et al (2017), pp. 170-173.

²⁹ See Klinsky et al (2017), pp. 170-173.

Such characteristics are therefore fundamental to support the legitimacy of climate services. However, researchers, in particular in the context of climate change adaptation, do not have a coherent and well-developed approach to evaluating the equity of climate change (adaptation) decisions.³⁰ This situation provides both a challenge and an opportunity for CE2 to develop a novel and much needed shared understanding of equity in climate service governance.

4.3 Equity in standardisation processes

Standardisation processes are intrinsically consensus-building processes where relevant actors of the community come together and develop the standard through a series of iterative steps (see Section 2.2). In order to be equitable, standardisation processes need to enshrine the type of mechanisms that ensure equitability, i.e., allow stakeholders with different capabilities and accessibility constraints to engage with the process if their presence is needed and/or conducive to developing a standard that benefits all relevant parties. It is also noted that how decisions are made, what decisions to take and who decides whose presence is needed, is also a matter for equitability concerns. Ultimately, we wish to not only produce standardisation processes and standards that are equitable but also that contribute to an equitable climate services community. The implications of this for the ongoing activities of CE2 is work in progress. Workshops on terms relevant to equitability of climate service standards and standardisation processes are currently being held, with the most recent occurring on 31 May 2023. The insights of these glossary workshops, as well as co-produced definitions (or common understanding of the terms), will be included in future iterations of this document.

³⁰ See Coggins et al (2021).

5 Glossary

This section provides an introductory link to the Glossary of CE2, which documents the consensus scoping and consensus-building process for key terms that are important for the harmonization of the communication between consortium members and for the understanding of key aspects of the decision trees. The Glossary also collects specialised vocabulary from different areas of expertise relevant for climate services and their standardisation and/or quality control. For these terms, no consensus scoping or consensus building processes have been developed but it is important to include them for completeness and further reference.

5.1 Key terms

The terms listed below are key terms that are necessary for understanding key nodes in the decision trees of the Framework. These terms have been individuated as key terms by the consortium members in a series of workshops (see the Glossary). The definitions of these terms are being co-produced through an IPCC glossary style consensus-building process throughout the duration of CE2. While they do not aim to replicate existing definitions, they are fundamental for understanding the inter and transdisciplinary perspectives of CE2 and its approach to climate services standardisation, the identification of best practices, and the development of guidance.

Key terms:

- Standard.
- Standardisation body.
- Standardisation process.
- Climate service.
- Maturity of climate service.
- Equitable standardisation of climate services.
- Equitable climate service community.
- Best practice.

These terms will be developed within the context of the Glossary and this section will provide a summary of the consensus (or lack thereof) of key terms as it emerges throughout the CE2 project. For example, by developing a common understanding of what “maturity” means in the context of standardisation of climate services, the consortium will be able to co-develop criteria for assessing maturity. It is expected that a sketch of these criteria will be co-developed in year 2 of the CE2 project.

5.2 Specialised vocabulary

Specialised vocabulary will be collected by the WPs 2-5 and listed here (for more details, see the Glossary). Where possible, overlaps, similarities and contradictions between specialised vocabulary will be highlighted. The aim of this specialised vocabulary is to promote collaboration and effective communication across different specialties, sectors and disciplines, with the ultimate goal of removing barriers to co-production and communication, improving the quality and effectiveness of the service.

6 FAQ

This section will contain Frequently Asked Questions (FAQ) that may arise in the context of standardising climate services and will be populated throughout the lifetime of the CE2 project.

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Appendix

Appendix 1: Template of annual information report for synthesis.

Please note that the below template was completed in May 2023 and does not reflect some of the most recent changes, such as the change in the “data of different types” component. Also note that the template, like the Framework, Glossary and Landscape will be updated throughout the lifetime of CE2

The logo for Climateurope2 is displayed on a rectangular background with a horizontal gradient. The gradient starts with a dark blue on the left, transitions through light blue and green, and ends with a pale yellow on the right. The text "Climateurope2" is centered in a white, bold, sans-serif font.

Climateurope2

Template annual information report for synthesis

Version 0.2 – May 2023

1 The vision of CE2 Synthesis

- 1) A key deliverable of the CE2 work is a synthesis report, to be delivered towards the end of the project by WP1 (D 1.4: Final synthesis report with updates on Landscape, Framework, and Glossary/month 52). Nevertheless, throughout the project, there are three milestones that require ongoing versions of this synthesis at months 15, 27 and 39 named “consortium synthesis reports.” The aims of the synthesis reports is to identify gaps and provide guidance on information flow across WPs so that all components of climate services are covered; support the capacity building activities of WP7; support a rolling of recommendations and an ongoing dialogue with standardisation and certification bodies, stakeholders and the European Commission in preparation of task 1.4 (“Setting the ground for standardising climate services”) and engagement activities with policy-makers in WP6 and WP7. To facilitate this process, WPs 2 through 5 must deliver an “annual information report for synthesis” during months 12, 24, 36, and 48.
- 2) We have chosen to start the process of generating a synthesis report by first envisioning a potential final outcome, its format, shape and optimal content. This vision is based on an iterative process of co-creation across the WPs in CE2 and through the annual exchange of information, key messages, and ongoing results. We note that the synthesis, as presented in the proposal, also updates versions of the other key deliverables in WP1: the Landscape; the Glossary; the Framework for Standardisation. However, we aim to produce a synthesis product with added value and potentially with a practical suitability going forward beyond the project period. A description of the CE2 Synthesis Prototype can be found “here”. [insert hyperlink TBC]

This document provides a guideline to generate the annual information report for synthesis. Both the prototype and this template should be considered live documents, to be refined, modified and altered as we all jointly move forward in our work. Figure 1 provides a visualization of the information flow envisioned throughout the project by WP1.

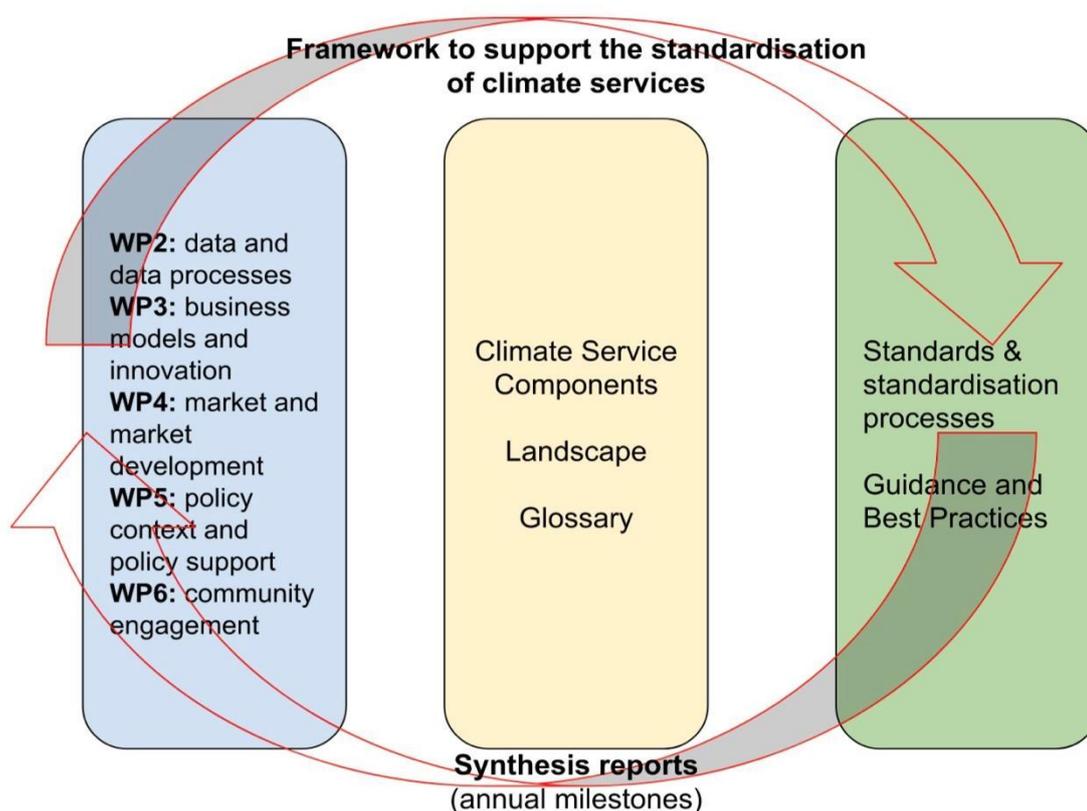


Fig. 1: This figure represents the information flow envisioned by WP1 throughout the project. The Framework will serve to organise the work of WP2-6 as it relates to standardisation processes, guidance and best practice with the aim of identifying where, when and what standards may be appropriate. The synthesis reports synthesise the information collected through the lens of the Framework, Landscape and Glossary in a way to individuate gaps and possible discrepancies in the field/community and provide guidance to further equitable standardisation as well as best practices. The Final synthesis report will serve as a basis for a strategy and recommendation report that will provide further guidance to support the climate service community through standards, guidance and best practices (D1.6).

1.1 Structure of the Template

We took as point of departure the initial version of the climate change components co-created during a series of workshops held in January and February 2023. The Components, in this context, refer to the processes, products and actors involved in the design, development, implementation, and uptake of climate services. The components identified by project members so far are the following:

- 1) **The decision context:**
 The decision context refers to the kinds of decisions the climate services support, as well as their geographical and political context. This includes the policy structure that requires/enables climate services to develop, as well as other forms of governance that are relevant for climate services.
- 2) **Data of different types (quantitative, qualitative, mixed) and related selection, evaluation, and translation processes:**

This component relates but is not limited to climate data. Social, economic & technical / engineering data to develop and implement local adaptation and mitigation strategies is relevant here too, as well as all selection, evaluation, and translation processes related to this data. Data accessibility, storage and stewardship would also fall under this component. It is important to also highlight the different ways in which different types of data interrelated with other components.

3) **Delivery mode and evaluation of the delivery mode:**

This component refers to how a climate service is delivered, and how this delivery is evaluated at its various steps. This should include the tailored aggregation and combination of data to match the context of the service client or the business model (if applicable).

4) **Stakeholders & knowledge holders and co-creation processes:**

This component identifies the different actors involved in (co)producing, evaluating, and taking up climate services, as well as the actors that might become relevant because of a particular decision context (see component 1). This component also addresses the co-production processes that are relevant for different actors and different stages of the climate service development process.

As has been discussed and agreed by workshop participants, we envision all WPs addressing some of these components more specifically but having some information relevant to other components as well. This will be particularly helpful in identifying possible tensions between different approaches to climate services and hence be particularly important for an effective standardisation process (and uptake of the standard). **Primarily we aim to capture standardisation-relevant content, not climate services content per se.**

Also, it is important to attend to the interfaces and interconnections between these four main components of climate services. In order to more clearly identify ties and tensions between components and perspectives, **we also request that you cross reference as much as possible throughout the document, e.g., any relations between processes of different components.**

We also understand that some of the questions in this template may not be relevant or that you would be unable to provide a specific concept. We ask nevertheless you provide us with any insights, however tentative these may be. The next iterations of this template will incorporate the lessons learned during the first yearly reporting cycle and the crafting of the first iteration of the Synthesis.

2 Information structure around climate services components

In the tables below, the first row indicates the component. The left column indicates themes relevant for each component (there are the same for each), and the right column has instructions for providing information, as well as guidance questions in parentheses. Note that some of the requested information may seem to be repeated. This is to capture nuances (if any) and context dependency of information. If you think that the information has already been provided in other parts of the document, please cross-reference. Please note that it is important also to attend to the interconnections across components.

2.1 Decision context

Decision context	
Brief description	Give a brief description of what this component is within the context of your work.
Processes	(what are the main processes and associated methods?) You may want to create a hierarchical list that links processes to multiple methods
Actors	(who are the main actors that are relevant for this component? – note that some of the actors might be repeated across components, this is not an issue)
Lessons from failures	If you have any examples of ‘failure stories’, please share them here
Lessons learned	Please share any lessons that you have identified that pertain to this component
Gaps	Please share any observed gaps in good practices, processes and actors (who should be involved, but hasn’t been involved so far)
Standardisation	Please list any standards, guidance and conventions that you have identified to be relevant for this component, for assessing the standardisation maturity of this component
Good practices	(given what you shared above, what are the well-known, good practices that are applied in this context?)
Values	What value will standardisation bring to this component?
Criteria	What would be the criteria for minimum level of quality for this component?
Specialised terminology	What specialised terminology helps us understand this component from your perspective and provide definitions if available?

2.2. Selection, evaluation and translation of data (Quantitative, qualitative, mixed..)

Data of different types (quantitative, qualitative, mixed) and related selection, evaluation and translation processes	
Brief description	Give a brief description of what this component is within the context of your work
Processes	(what are the main processes and associated methods?) You may want to create a hierarchical list that links processes to multiple methods
Actors	(who are the main actors that are relevant for this component? – note that some of the actors might be repeated across components, this is not an issue)
Failure stories	If you have any examples of ‘failure stories’ please share them here
Lessons learned	Please share any lessons that you have identified that pertain to this component
Gaps	Please share any observed gaps in good practices, processes and actors (who should be involved, but haven’t been involved so far)
Standardisation	Please list any standards, guidance and conventions that you have identified to be relevant for this component, for assessing the standardisation maturity of this component
Good practices	(given what you shared above, what are the well-known, good practices that are applied in this context?)
Values	What value will standardisation bring to this component?
Criteria	What would be the criteria for minimum level of quality for this component?
Specialised terminology	What specialised terminology helps us understand this component from your perspective and provide definitions if available?

2.3. Delivery Mode and Evaluation

Delivery mode and evaluation of the delivery mode

Brief description	Give a brief description of what this component is within the context of your work.
Processes	(what are the main processes and associated methods?) You may want to create a hierarchical list that links processes to multiple methods
Actors	(who are the main actors that are relevant for this component? – note that some of the actors might be repeated across components, this is not an issue)
Failure stories	If you have any examples of ‘failure stories’ please share them here
Lessons learned	Please share any lessons that you have identified that pertain to this component
Gaps	Please share any observed gaps in good practices, processes and actors (who should be involved, but haven’t been involved so far)
Standardisation	Please list any standards, guidance and conventions that you have identified to be relevant for this component, for assessing the standardisation maturity of this component
Good practices	(given what you shared above, what are the well-known, good practices that are applied in this context?)
Values	What value will standardisation bring to this component?
Criteria	What would be the criteria for minimum level of quality for this component?
Specialised terminology	What specialised terminology helps us understand this component from your perspective and provide definitions if available?

2.4. Stake & knowledge holders and co-creation processes

Ecosystem of actors and co-creation processes	
Brief description	Give a brief description of what this component is within the context of your work.
Processes	(what are the main processes and associated methods?) You may want to create a hierarchical list that links processes to multiple methods

Actors	(who are the main actors that are relevant for this component? – note that some of the actors might be repeated across components, this is not an issue)
Failure stories	If you have any examples of ‘failure stories’ please share them here
Lessons learned	Please share any lessons that you have identified that pertain to this component
Gaps	Please share any observed gaps in good practices, processes and actors (who should be involved, but haven’t been involved so far)
Standardisation	Please list any standards, guidance and conventions that you have identified to be relevant for this component, for assessing the standardisation maturity of this component
Good practices	(given what you shared above, what are the well-known, good practices that are applied in this context?)
Values	What value will standardisation bring to this component?
Criteria	What would be the criteria for minimum level of quality for this component?
Specialised terminology	What specialised terminology helps us understand this component from your perspective and provide definitions if available?

3.Key Messages

Key messages	What are the key messages that you think emerge from your work so far? Each message is a main sentence, plus a short explanatory paragraph
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4.Reflections on maturity for standardisation

Your reflections on maturity	For any of the components and subcomponents discussed above, please share any reflections you may have on their maturity for standardisation
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5. Equitability

Your reflections on equitability	Equitability and concerns for power relations are central concerns in standardisation process, in particular in the context of climate change. For any of the components and subcomponents discussed above, please share any reflections you may have on how they may account for the equitability of standardisation processes and in relation to the climate service community (both in negative and positive ways).
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