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D1.2 Cross-cutting analysis of drivers of the demand for climate services and barriers

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Project abstract

PROTECT aims at levering innovation procurement to unlock the climate service (CS) market's potential to support urgent climate adaptation and mitigation. The project will allow public and private organisations to build up and integrate their knowledge and skills about climate change, environmental observation (EO) and innovation procurement, notably enabling public authorities to shift to a proactive governance model, using innovative public procurement approaches to increase value and climate impact for money. It shall increase access of CS SME providers across Europe to public procurement markets and shape solutions that best address public demand, both specific and systemic. The initial focus will be on five encompassing application domains (Utilities, Green cities, Health, Land use & Marine environment, Security) and their contributions to the areas of sustainability in Horizon Europe's Cluster 6. The project will source and assess existing and high-potential CS solutions and technologies that use EO data. It will engage with an extensive and varied community of procurers, inform the definition and aggregation of their needs and functional requirements for CS, explaining, fostering and supporting a 'buying with impact' approach. Clearer, less fragmented demand shall guide and support R&D for future CS. PROTECT will prepare the operational ground for one or more joint, cross-border or coordinated pre-commercial procurement (PCP) processes and identify short-term actions so that Public Procurement of Innovative Solutions (PPI) can be activated towards or right after the project's end. At the policy level, it will provide decision-makers for procurement, climate and policy, at EU, national, regional and local levels, with practical recommendations and guidelines to boost the use of innovation procurement for climate action.

Keywords

Climate services, cross-analysis, EO, pre-commercial procurement

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List of abbreviations

Acronym	Definition
AFOLU	Agriculture, Forestry, and Other Land Use
AI	Artificial intelligence
ANAC	Autorità Nazionale Anticorruzione
API	Application Programming Interface
AT	Austria
AV	Aerospace Valley
AVI	Agència Valenciana de la Innovació
BAM	Federal Institute for Materials Research and Testing
BE	Belgium
BFD	Federal Financial Directorate
BG	Bulgaria
BMWK	Federal Ministry for Economic Affairs and Climate Action (Germany)
BV	Besloten vennootschap (business structure with legal personality- NL)
CAP	Common Agricultural Policy
CBP	Central Purchasing Body
CDTI	Centro para el Desarrollo Tecnologico e Industrial (Spain)
CFP	Common Fisheries Policy
CKIC	EIT Climate-KIC
CLS	Collecte Localisation Satellites (company)
CMS-FOR	Central Procurement Body for the Federal Services (BE)
COAR	Government Administration Service Centre (PL)
CPB	Central Purchasing Body
CPO	Central Purchasing Organisation
CPV	Common Procurement Vocabulary
CS	Climate service
CY	Cyprus

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Acronym	Definition
CZ	Czechia
DCMR	Environmental Protection Agency (NL)
DE	Germany
DG-REGIO	Commission's Directorate-General for Regional and Urban Policy
DK	Denmark
DRM	Disaster risk management
EAFIP	European Assistance For Innovation Procurement
EC	European Commission
ECSS	European Cooperation for Space Standardization
EE	Estonia
EIT	European Institute of Technology
EL	Greece
EO	EO
ES	Spain
ESA	European Space Agency
ETA	Research and Technological Development (EL)
EU	European Union
EUSPA	European Union Agency for the Space Programme
FAST	Functional Analysis System Technique
FI	Finland
FR	France
GAIN	Agencia Gallega de Innovación (ES)
GDPR	General Data Protection Regulatio
HR	Human resources
HU	Hungary
IACS	Instituto Aragonés de Ciencias de la Salud (ES)
ICT	Information and communications technology

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Acronym	Definition
IE	Ireland
IIAMA	Research Institute of Water and Environmental Engineering
IPCC	Intergovernmental Panel on Climate Change
IPR	Intellectual property right
IT	Italy
IUU	Illegal, unreported and unregulated fishing
KEINO	Competence Centre for Sustainable and Innovative Public Procurement (FI)
KIC	Knowledge and innovation community
LCSP	Ley de Contratos del Sector Público (ES)
LT	Lithuania
LU	Luxembourg
LULC	Land Use Land Cover
LV	Latvia
LVPA	Lithuanian Business Support Agency
MEAE	Ministry of Economic Affairs and Employment (FI)
MITA	Agency for Science, Innovation and Technology (LT)
MS	Member State
MT	Malta
NCBR	National Centre for Research and Development (PL)
NL	Netherlands
OCPI	Innovative Public Procurement Office (ES)
OCSE	Organization for Security and Co-Operation in Europe
OMC	Open Market Consultation
PACA	Provence-Alpes-Côte d'Azur
PARP	Polish Agency for Entrepreneurship Development
PCP	Pre-commercial procurement
PIO	Programme for Innovation Procurement (BE)

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Acronym	Definition
PL	Poland
PP	Public Procurement
PPI	Public Procurement of Innovative Solutions
PPL	Public Procurement Law (PL)
PPO	Public Procurement Office
PT	Portugal
RO	Romania
SE	Sweden
SI	Slovenia
SK	Slovakia
SME	Small and medium-sized enterprise
SOTA	State of the art
STIB-MIVB	Brussels Intercommunal Transport Company
SYKE	Finnish Environment Institute
TEG	Technical Expert Group
TRL	Technology readiness level
TRO	Temporary Restraining Ordinary Procedure (GR)
UAS	Unmanned Aerial Systems
UGAP	Union of Public Purchasing Groups (FR)
UVO	Public Procurement Office (SK)
VOB	Vertragsordnung für Bauleistungen (DE)
VOL	Vergabe- und Vertragsordnung für Leistungen (DE)
VSD	Value Stream Design
VSM	Value Stream Mapping
WFD	EU Water Framework Directive
WG	Working group

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Executive summary

EU's Roadmap for climate services defines climate services as the: "*transformation of climate-related data — together with other relevant information — into customised products such as projections, forecasts, information, trends, economic analysis, assessments (including technology assessment), counselling on best practices, development and evaluation of solutions and any other service in relation to climate that may be of use for the society at large. As such, these services include data, information and knowledge that support adaptation, mitigation and disaster risk management (DRM).*"

The broadness of this definition and the large number of instances it includes, partially explains why the market of climate services, despite steadily growing, remains an immature and fragmented one. In fact, the large numbers of stakeholders, services, and interests at play, may at times make it seem almost artificial to talk about a singular "climate services market". And nonetheless, climate services do share common traits and tackle common problematics such as climate change mitigation and adaptation, as well as disaster risk management.

This document looks into the climate services market, in particular at the drivers and barriers of the demand, and how these interact and influence each other in various dimensions, such as climate and procurement policies, perception of climate risks, existing market solutions and other elements.

The intersections of the above aspects, once identified, can be used to assess the state-of-play of the market, and foresee where the existing demand could meet with a technically feasible offer, in order to create the possibility for innovative climate change mitigation/adaptation solutions through the means of pre-commercial procurement, in particular:

- The analysis of EU policies in the 5 PROTECT domains (Chapter 2) shows that there are numerous areas where Innovation Procurement can enable access to innovative solutions to tackle unmet challenges related to climate legislation, regulations and policies at the EU, regional and local levels. While these are more numerous in some PROTECT domains (e.g. Energy and utilities) and less so in others (e.g. Marine and coastal environment), this can be used as an indicator to assess the overall need/potential contribution of Innovation procurement in the specific domains, but should also be considered in the time and political context (for instance, the policy analysis took place in late 2021-early 2022 when the EU was putting in place many energy-related policy, both stemming from the Green Deal, but also in times when, due to the Russian invasion in Ukraine, Europe was redefining its energy independence. This may to an extent explain the prevalence of policies considered as relevant in this specific domain).
- The analysis of climate challenges in European regions (Chapter 3) shows countless regions experience similar climate challenges. This however is not sufficient to identify regions that share common climate needs, and that may be, for instance, interested in taking part in the same Innovation procurement. However, it is easier to pinpoint this common climate needs, when the focus is no longer on a single climate challenge but on all climate risks on a certain

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territory and their interaction, attesting for common intention to solve the same complex and systemic issues.

- The analysis of the EO-based CS in the five selected application domains (Chapter 4) shows that there are numerous services already on the market and even more to come, as it will be seen in the graphs showcasing the increased numbers of the CS identified between the 2 mapping stages. By looking at the application domains, while a big amount of the CS are having applicability in the Agriculture, forestry and other land uses application domain, the results are indicating that CS developed for other application domains such as Energy and Utilities are emerging as well. On the other hand, from geographical point of view it can be observed that while the Western countries are leading by far the development of the EO-based CS, services are emerging as well across several countries from the European Union which are being supported throughout various initiatives by the European Commission and by the European Space Agency, as well as national ones.
- The cross-cutting analysis of the results of works contained in the document was used as a base to develop a methodology and provide some examples of cases where there is need of PCP (Chapter 5). These include Challenges presented by water scarcity, Supporting the transition towards green energy, Waste management and related storage issues, Flooding in coastal areas, Illegal waste dumping, Detecting climate vulnerability in agriculture and planning resilience. More showcases can be identified in similar manner using the information contained in the herein document and its annexes.

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1. Scope and structure of the document

D1.2 Cross-cutting analysis of drivers of the demand for climate services and barriers looks at the outcomes of different project tasks contained herein, in an attempt to combine them into an integrated analysis framework. The aim is to identify drivers of the demand, and eventually use the outcomes and correlations emerging from the cross-analysis of the tasks into the future development of the PROTECT project, such as, for instance, for identifying possible procurers interested in certain types of climate services, priority climate services to structure a pre-commercial procurement around, or others.

This methodology relies on and combines several analyses, which structure the document:

The EU climate policy framework has been analysed (T1.1) in order to identify legislative acts that may favour the deployment of pre-commercial procurement for the development of EO-based climate services. This is the subject of **Chapter 2 (Analysis of) European policies susceptible to drive the demand for climate services and pre-commercial procurement**.

In **Chapter 3 (Analysis of) climate challenges in European regions**, the adaptation strategies of European regions across several pre-identified Member States have been used as a starting point towards identifying the main issues that require climate services deployment at scale, and could potentially allow for mapping regional and other stakeholders and grouping them around common priority climate risks (T1.1), especially as long as the mean to address these risks can come from a solution developed through pre-commercial procurement.

Building on what has already been developed in *D1.1 Updated database of EU existing and upcoming CS classified with relevant taxonomy*, **Chapter 4 Sourcing and analysis of climate services, technologies, and providers in the five selected application domains** provides an overview of the supply side of the EO-based climate services market and the existing off-the-shelf solutions (T1.3). This helps to shed light on the current gaps between the demand for EO-based climate services and the existing offer. Gaps which may in some cases be bridged by solutions developed through the means of pre-commercial-procurement.

Chapter 5 Cross-analysis of climate services and barriers builds towards a state-of-play of the intersection of climate services, EO, climate risks, and pre-commercial procurement. It aims at drawing potential paths and identifying spaces where needs and opportunities would meet and where innovation procurement could bring relevant formats to optimise the match between supply and demand. How these findings can be used further in PROTECT is then discussed at the end of the chapter and of the deliverable.

Supporting materials used in the cross-analysis are included in the Annexes. Notably the report on **Innovation procurement enabling legal and policy framework** looks into the national legislations of pre-selected Member States with regards to pre-commercial procurement (T1.4), to identify which countries (and the procurers based therein) can engage in the practice with the most ease - while providing guidelines to all procurers as to what they should be warry of in the process. And the **Analysis of common needs of public procurers in the five domains using value methodologies** delves into developing and implementing a methodology for pre-identifying potential needs for EO-based climate services (T1.5) that may be the subject matter of a potential pre-commercial procurement.

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2. European policies susceptible to drive the demand for climate services and pre-commercial procurement

2.1 Scope

The objective of this chapter is to present the findings of the comprehensive desktop research carried out within the framework of T1.1 on existing EU climate legislations and policies, with the primary goal of pinpointing areas where there is an emerging demand and necessity for Innovation Procurement. The research was conducted on the five priority domains of PROTECT:

- Energy and utilities
- Sustainable urban communities
- Marine and coastal environment
- Agriculture, forestry, and other land use
- Civil security and protection

This research is particularly relevant as European policies could significantly contribute to shaping the demand for EO-based climate services and pre-commercial procurement. The research mainly focused on three types of policy instruments: regulations, directives and communications. These policy instruments were selected based on their relevance within the European Union's policy system.

Over recent years, the European Union has introduced numerous policies aimed at reducing greenhouse gas emissions and mitigating the impacts of climate change. These policies have generated a need for innovative solutions and services to help achieve climate objectives and adapt to the consequences of a shifting climate.

One crucial area where European policies are stimulating demand for climate services is EO. The European Union is at the forefront of EO, with numerous programmes and initiatives centred on enhancing our comprehension of the planet's systems and monitoring the impacts of climate change. Through initiatives such as Copernicus, the European Union generates extensive EO data, opening doors for innovation in data processing, analysis, and visualisation. The uptake of EO data has also been supported by different policy instruments as well as several European projects which facilitate the integration of EO data into several application domains, and EO data has proven useful in various climate service applications.

Pre-commercial procurement can facilitate the development of novel EO and other products and services that utilise this data to tackle environmental challenges, ranging from predicting natural disasters to assessing the well-being of ecosystems.

This research is therefore focused on recent and current EU policies that are relevant to the fields of climate services and EO. By examining these policies and their implications, we can identify potential opportunities and gaps in the market where Innovation Procurement can play a critical role in fostering the growth of climate services and enabling the development of cutting-edge solutions to address climate change challenges.

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2.2 Methodology

The aim of this section is to illustrate the methodology used to conduct the research and its relevance to pre-commercial procurement in the field of climate services and EO. To identify the most impactful areas where pre-commercial procurement can generate innovative solutions to address unmet challenges, a comprehensive desktop research was conducted to map European-level policies that are relevant to Innovation Procurement. **For the purpose of said research, a policy was deemed to be relevant for PCP (and, in particular for PROTECT), when the policy was deemed capable of stimulating the development of novel EO-based climate services in one of the 5 PROTECT domains.** The selected policies were then analysed based on their typology, objectives, and relevance to the project, with a focus on identifying areas where pre-commercial procurement could be useful in the field of EO and climate services.

The mapping of different policy instruments was captured within a table characterising each policy element starting with the name of the policy instrument, followed by a summary of the assessed policy. The table also offered information about the type of policy instrument (communication, directive, regulation or other), the application domain to which it can be associated with and its geographical scope. The final elements of the table provided information about the, identified key performance indicators linked to the policy instrument as well its enforcement date and, relevance to the project (low, medium, and high). The table is available as Annex I.

2.3 Results

Following an extensive review of more than 100 policy instruments, a subset of 50 elements has been chosen for in-depth analysis within the scope of this task. The preliminary examination of the diverse policy instruments showed that the *Energy and utilities* domain had the highest number of policies, directives, and communications reflected in the policy map. This was followed by the *Sustainable urban communities* and the *Agriculture, forestry, and other land use* domains. The C*ivil security and protection*, along with the M*arine and coastal environment* domains, were found to have the least representation in the policy assessment.

The research conducted successfully identified measurable key performance indicators (KPIs) for each policy instrument. These KPIs serve as concrete targets for specific policy instruments, requiring action by member states to meet their requirements. Notably, the identified KPIs also highlight areas where pre-commercial procurement of climate services could play a significant role in supporting the process of achieving these indicators.

The larger representation of policy instruments dealing with Energy and utilities in this research can be explained by the following factors:

- **Emissions from energy production** - Energy production is a major contributor to greenhouse gas emissions, which are the primary drivers of climate change. Burning fossil fuels for energy, such as coal, oil, and natural gas, releases carbon dioxide (CO2) into the atmosphere, contributing to global warming. As a result, policies that focus on reducing greenhouse gas emissions from the energy sector are considered crucial in mitigating climate change.
- **Energy security and independence** - European countries have historically been reliant on imported fossil fuels for their energy needs. To enhance energy security and reduce dependence on external energy sources, European countries have prioritised policies that promote renewable energy sources, energy efficiency, and domestic energy production. These policies aim to decrease reliance on fossil fuels and increase self-sufficiency in energy production, thereby reducing the geopolitical risks associated with energy imports.
- **Renewable energy potential** - Europe has significant renewable energy potential, including solar, wind, hydropower, and bioenergy resources. European countries have recognised the potential of these renewable energy sources to reduce greenhouse gas emissions and have

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implemented policies to promote their deployment. These policies include feed-in tariffs, renewable portfolio standards, and other incentives to promote renewable energy development.

- **Global leadership and international commitments** - European countries have been at the forefront of global efforts to combat climate change and have made commitments under international agreements such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. As part of these commitments, European countries have implemented policies aimed at reducing greenhouse gas emissions, with a particular focus on the energy sector.
- **Economic opportunities** - European countries have recognised the economic opportunities associated with the transition to a low-carbon economy. Policies promoting renewable energy and energy efficiency have been seen as drivers of economic growth, innovation, and job creation. As a result, European countries have implemented policies that not only address climate change but also foster economic development.

The assessment of European policies further highlighted a range of policy instruments that are applicable to the five priority domains of the project. In the subsequent section, we will provide a concise overview of some of the key transversal instruments that offer significant opportunities for advancing the pre-commercial procurement of climate services.

European Green Deal - The European Green Deal, as defined by the European Commission, is a comprehensive and ambitious plan that sets out the strategic vision of the European Union (EU) for achieving climate neutrality by 2050 and promoting sustainable economic growth. It encompasses a wide range of policy areas, including but not limited to energy, transport, agriculture, circular economy, biodiversity, and more. The European Green Deal aims to transform Europe into a greener, more sustainable, and climate-resilient continent by promoting the efficient use of resources, reducing greenhouse gas emissions, protecting the environment, and fostering sustainable innovation and economic development, while ensuring a just and inclusive transition for all stakeholders.

European Climate Law - The European Climate Law is a regulation that sets binding targets for the European Union to achieve climate neutrality by 2050. It establishes the legal foundation for the EU's commitment to combat climate change and implement the objectives of the European Green Deal. The European Climate Law enshrines the EU's target of reducing net greenhouse gas emissions to at least 55% below 1990 levels by 2030, and achieving climate neutrality - i.e., balancing greenhouse gas emissions with removals - by 2050. It also establishes a framework for regular monitoring, reporting, and review of the EU's progress towards these targets, and provides a mechanism for adjusting the targets in light of scientific, technological, and socio-economic developments. The European Climate Law serves as a key policy instrument to drive the EU's efforts in addressing the urgent global challenge of climate change and transitioning towards a sustainable, low-carbon future.

Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information (recast) - is a legislative act issued by the European Union that aims to promote the availability and re-use of public sector information as open data. The Directive replaces and recasts the previous Directive 2003/98/EC on the re-use of public sector information, with the goal of modernizing and harmonizing the legal framework for open data across EU member states. The Directive establishes principles for the re-use of public sector information, such as the presumption that public sector information should be made available for re-use as open data, unless exceptions apply. It sets out rules for non-discriminatory access, transparency, and fair competition in the re-use of public sector information and promotes the use of standard licenses and formats to facilitate interoperability and reusability of data.

The wide-ranging diversity, extensive scope, and intricate granularity of the policy instruments identified in the policy map pose challenges when trying to pinpoint specific areas where pre-commercial procurement of climate services is more likely to occur.

However, the abundance of policy instruments in the energy sector indicates that member states must actively develop and seek technological solutions to meet the targets and indicators outlined in the policies. This context offers significant opportunities for exploring the development of such solutions through innovative approaches such as the pre-commercial procurement of climate services.

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In the Agriculture, forestry, and other land use domain, policies like the Farm to Fork strategy aim to reduce greenhouse gas emissions in agriculture, fisheries, and aquaculture by over 50% by 2030. These policies provide a strong incentive for adopting and integrating more sustainable and efficient agricultural practices. The use of EO based solutions supporting farmers in crop monitoring, yield prediction, land use and land cover mapping, precision agriculture and many other applications can be enhanced by the co-developing approach offered by the pre-commercial procurement of climate services. Within the *Sustainable urban communities* domain, several policies have identified the necessity for more ambitious targets and actions in sub-sectors such as circular economy, mobility, air quality, and health.

In the domain of *Marine and coastal environment*, the exercise has identified relevant policies, including the *Common Fisheries Policy* (CFP), which has established harmonised provisions to ensure the sustainability of fisheries and aquaculture in EU waters. Pursuing pre-commercial procurement solutions can be an effective tool to support the CFP, as this policy emphasises the importance of adaptive management, involving regular updates and adjustments to management measures based on new information and changing environmental conditions. Climate services developed through PCP can contribute to adaptive management by providing EO-based real-time or near-real-time data and forecasts on climate-related variables such as sea surface temperature, ocean acidification, and changes in marine biodiversity. This information enables policymakers to make timely adjustments to fishing quotas, gear regulations, and other management measures, accounting for climate-related changes and ensuring the sustainability of fish stocks.

Finally, the *Civil security and protection* domain was sparsely represented on the policy map, which could be attributed to its cross-sectoral nature, with relevant elements often being mapped under other domains such as *Energy and utilities* or *Sustainable urban communities*. However, the limited entries on the policy map do not imply the insignificance of this domain in any way. In fact, climate services developed through PCP can provide advanced warning and risk assessment of climate-related hazards, such as extreme weather events, flooding, wildfires, and other natural disasters. These services can utilise predictive models, remote sensing data, and real-time monitoring to provide timely and accurate information on potential hazards, their severity, and their impacts. This information can help civil security and protection agencies to better understand and prepare for climate-related risks, take proactive measures to mitigate their impacts, and ensure the safety and well-being of communities and infrastructure.

2.4 Conclusions

The main conclusion of the research on European policies and their potential for influencing the pre-commercial procurement of EO-based climate services, is that there are numerous areas where Innovation Procurement can enable access to innovative solutions to tackle unmet challenges related to climate legislation, regulations and policies at the EU, regional and local levels.

Indeed, the procurement of EO climate services is an essential tool for supporting the implementation of EU climate policies. EO provides critical data and information on a wide range of climate-related variables, including greenhouse gas emissions, atmospheric composition, sea level rise, and climate change impacts.

Innovation procurement can play a key role in enabling access to innovative solutions that leverage EO climate services to address unmet challenges related to climate policy implementation. For example, Innovation Procurement can enable the development of new tools and applications that use EO data to improve climate monitoring, modelling, and forecasting, as well as to support decision-making and risk management in areas such as disaster response, water resource management, and energy systems.

Innovation procurement can also support the development of new business models and service delivery models that leverage EO climate services to enable more sustainable practices in areas such as agriculture, forestry, and urban planning.

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3. Analysis of climate challenges in European regions

3.1 Scope

This section presents a snapshot mapping of the main climate issues at regional level in several European Member States and across PROTECT's five application domains, with a focus on adaptation and resilience challenges, whereas the previous section took a stronger (but not exclusive) climate change mitigation focus, not least due to the weight of the Energy sector. It is also based on comprehensive desktop research carried out within the framework on T1.1. The countries included in this mapping have been chosen in agreement with the whole consortium and notably with the partner leading on the innovation procurement analysis. While it does not exclude any of the other countries potentially eligible for a PCP, this allows initial focus on a smaller set of countries which show promising potential to apply innovation procurement and PCP to climate services. **These are: Belgium, Finland, France, Germany, Greece, Italy, Lithuania, the Netherlands, Poland, Slovakia and Spain**. The spatial resolution adopted for this mapping is that of EU Territories in the sense of the Smart Specialisation Platform. The mapping restricts itself to those climate challenges that are directly relevant to at least one of the five application domains. Cross-reference is made to country-level priorities as identified in national adaptation strategies and plans.

The mapping is available as Annex II.

3.2 Methodology

Due to the current lack of unified and comprehensive terminologies, norms and indicators to identify the main climate challenges facing European regions, measures of their relative scale and impact, and classify them in order of priority, providing even a quick and simplified snapshot of these climate challenges requires to deal with a range of sources that diverge in format, content and intent, to the point where drawing comparisons between regions can be difficult and subject to multiple interpretation biases. This is much more marked for adaptation and resilience challenges, which form the bulk of the mapping as opposed to the mitigation challenges. In that sense, the mapping exercise is somewhat 'impure' by construction.

In this mapping, we draw whenever available on documents and syntheses published either by regional authorities and regional public bodies or on scientific reports that inform regional adaptation and resilience strategies and action plans. The overarching logic is that the main challenges are identified here from a combination of academic research on their reality and intensity at national and regional scales and the perception that each region, represented by its public governance, has of the most pressing or significant challenges. For some regions, other surveys have been made by consultancies and other private organisations, but these were deemed less appropriate to that logic.

It is worth noting that the way regions present their main challenges in official documents is widely variable. Some documents consist mostly of scientific data deriving e.g., from IPCC WP1 reports: these tend to be more comprehensive and quantitative while saying little about how the regions hierarchize the range of challenges described. In such cases, we allow ourselves a margin of interpretation to identify which of the challenges described seemed to be the most prominent in each regional context, confirming this interpretation with complementary documents when available. At the other end of the spectrum, some documents largely skip the data and facts and focus primarily on the actions prioritized by the regions in their climate adaptation or mitigation plans. In such cases, we look for scientific reports that provide data and facts and apply the official documents as filters to identify which of the challenges

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described by scientific communities are effectively perceived as priority by public authorities. (Many regions opt for combinations of the two approaches.)

The degree of detail and granularity provided in such official documents also varies a lot, for instance in terms of geographic scale, of sectoral focus, of emphasis on very specific challenges that are being addressed through dedicated action lines. In this mapping, we opt for a relatively low degree of detail and granularity and seek similar formulations for largely common challenges, mainly to keep the mapping within workable dimensions and to help spot similar challenges across regions. While we are aware that this choice entails loss of information, the rationale is that once possible cases for PCPs have been identified, the documents referenced will still allow to bring back finer elements for analysis and deeper comparison for each of those cases. However, we do not attempt to achieve a very homogeneous level of detail and specificity across all regions, as we consider that variations between regions reflect to some extent the way they approached the variety of their respective climate challenges. Moreover, some of the regions are still in the process of deciding on their priority topics for climate action, meaning that the snapshot provided here is only temporary; we must accept this as a fact. In a few countries, official documents relevant for this mapping exercise have not been identified at the level of regions: in such situations, we have worked on national documents and retain the elements that are relevant for each region. We also acknowledge that in some cases, EU territories in the sense of the Smart Specialisation platform do not correspond to levels of political decision. The choice of this spatial resolution is meant to facilitate further links with Smart Specialisation Strategies (S3), also considering that NUTS1 and NUTS2 levels both pose similar problems.

The mapping takes the lens of PROTECT's five application domains. This is rather straightforward for regions where official documents are (partly) structured by sector and theme, which often correspond to one domain or part of one domain. When a sector or theme spans more than one application domain, we list the corresponding challenge in each of the relevant domains. More broadly, if, for instance, a chapter of the official document deals with water challenges, we may reference these under several of PROTECT's application domains (e.g. AFOLU, Marine and Coastal, Critical Infrastructures) as relevant, even when the corresponding chapters in the document do not mention water again. When regions do not present their climate challenges by sector, more work is required to reference each challenge under the relevant application domain(s). (It should be kept in mind that a number of climate challenges do not pertain to any of the five application domains and may thus be left out of this mapping, despite being fully relevant to climate action in a particular region.)

Finally, we apply another lens of country-level priority areas for climate adaptation and resilience. Here as well, the way such priorities are identified in national adaptation strategies and plans differs a lot from one country to another, as does the number of such priorities. For this mapping, we base ourselves on syntheses provided by Climate-ADAPT, complemented, when necessary, by direct use of official documents from national adaptation strategies and plans. These national priorities are indicated in column H of the mapping, each priority being designated by an abbreviation of one or more letters in square brackets. (Please note that the abbreviations are country specific – the same abbreviation may not correspond to the same priority or field in two different countries.) For each challenge identified at the regional level, a reference is then added to every national priority to which the challenge is closely related. The aim of this cross-referencing is to connect national and regional scales and to provide gateways that can facilitate linking main regional climate challenges with supportive national policies and regulations down the line. (*NB*. Ultramarine regions are not referenced in subsection 3.3 below but they are included in the mapping in Annex II.)

3.3 Results

Energy and Utilities

Several challenges are widely shared across Europe. Increased frequency of droughts and of heatwaves is a concern from Lithuania and Poland to Spain, from Belgium to France, Germany, Greece and Italy, with consequences both on water quality and quantity and indirectly on other economic sectors, e.g. energy production (water scarcity in highly industrialised regions of western Germany and in Marche, impact of hotter waters in parts of Belgium, France, Italy, Lithuania). More broadly, hydrogeological instability threatens regional water balance and availability, from southern Germany to southern Italy. The multiplication of extreme events – flooding, either extreme rainfall or sea level rise, threatens to disrupt energy production in Germany, Lithuania, Poland; frost is mentioned as a disrupting factor in some Polish regions, but also in Tuscany (affecting water provision), as can be tree falls resulting from storms e.g. in Finland. Increase in other more specific risks ranges from water pollution, landfill flooding and fires (Lithuania) to peak flood discharges (northern Germany) or consequences of ocean acidification on infrastructures (western France). Besides energy and water, extreme events as well as longer term processes such as soil shrinking and swelling also threaten railways and roads (e.g. in some French regions). Systemic risks such as coupled issues on water availability or quality and energy production are amplified in densely populated areas such as the Berlin and Paris regions. Cascading effects are expected as energy demand rises (e.g. during heatwaves, in Italy but also in less hot countries such as the Netherlands or Slovakia), water reserves are put under growing strain, and the effects of suboptimal insulation and energy efficiency of buildings across Europe are aggravated by climate change.

Sustainable urban communities

Cities are affected by many the challenges linked to other application domains, often at more acute levels due to the concentration of population and economic activities. Classic examples are heatwaves, who are generally expected to rise in frequency, duration and intensity, and urban heat islands mostly in meridional regions. Heatwaves are mentioned in almost every region of the mapping. Being characterised in comparison with average local temperatures, they remain globally hotter in more southern regions; however, they also come on top of climate challenges in regions that are generally cooler (from the northeast of France to the southern half of Finland) as local populations are much less used to dealing with abnormally high temperatures, both biologically and in terms of housing design, insulation and equipment. In many cases, e.g., in Spain and in parts of Italy, heatwaves and degradation of air quality (as well as increase in allergens such as pollens, often linked to northbound migration of vegetal species, and in infectious diseases gaining ground) are coupled and amplify each other's negative impact on human health. Droughts, water quality and quantity concerns appear wherever they also affect energy and utilities: they have been a major challenge in the southern half of Europe for many years, where they are often linked with water scarcity including drinking water, but they are now also concerning countries such as Belgium, the Netherlands, the south of Germany. One other frequently recurring challenge is the growing risk of flooding in urban areas, coming from heavy rainfall or from river overflow, marine submersion or sea level rise, often aggravated by soil degradation, itself amplified by droughts. Almost every province in Belgium and in the Netherlands is affected, as are some Greek, Italian, Polish and inland French regions. Swelling and shrinking soils are also an increasingly common consequence of hydrogeological instability, for instance in southern France and in Italy: they primarily affect agriculture and land use but also create vulnerability for building foundations in urban areas, and sometimes landslide risks.

Marine and coastal environment

With the exception of Slovakia, all countries addressed by this mapping have coastal regions. Risks of erosion are increasing (northern Germany, northern and southern Italy, Spanish Atlantic and Mediterranean coast), with quality degradation of coastal waters (French Atlantic and Mediterranean

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coast), shrinking natural areas (Netherlands, Normandy) including beaches (e.g. Asturias, Provence Côte d'Azur), lagoons (Occitania), coastal sediment stocks (Nouvelle-Aquitaine). Flooding risks are mentioned in almost all coastal regions, associated with sea level rise (French Mediterranean coastline, Liguria, Andalusia, Balearic Islands, but also northern Germany and Poland, Asturias, Friuli Venezia Giulia), marine submersion (North and Baltic seas, Cantabria, Liguria, Provence Côte d'Azur), extreme rainfall, thunderstorms and gales (Poland, Cantabria), combinations of those factors (e.g. northern Germany, northern Spain, Netherlands, Lithuania, French Atlantic coast), general hydrogeological instability (western and eastern Italy) combined with more frequent droughts and change in rainfall regime (e.g. Liguria). Coastal water issues include increased saltwater intrusions, risks of salinization and freshwater & drinking water shortages (western France, Emilia-Romagna, Spain, the Netherlands…), decreased water quality (Lithuania, Tuscany, bathing water quality in the Netherlands), stress on the aquatic ecology notably due to high water temperatures, sea acidification (northern Germany, Canarias, Galicia, Murcia with reduced capacity of carbon storage), toxic algae (Catalonia, Italian lakes). Fishing and aquaculture are also affected (Galicia, northern Italy, France), sometimes with mixed effects linked to e.g. migration of species or jellyfish proliferation. Effects of climate change are also seen inland: higher risks of land subsidence and of peat oxidation (northern Netherlands), of landslides (Pomerania), biodiversity loss, affected endorheic ecosystems, eutrophication of water bodies, damaged ecosystem services (Asturias, Emilia-Romagna, Galicia, Bremen), but also potential threats on inland waterway transport (e.g. Antwerp, Bremen). Systemic issues are highlighted, such as the increasing tension between urbanisation and vulnerable natural environments or the challenge of high emissions from major ports.

Agriculture, Forestry and other Land use (AFOLU)

Climate challenges and risks for AFOLU are rather more extensively documented than other application domains in regional climate reports.

Drought and water related issues are threats found in the largest number of regions. More frequent and longer periods of drought are notably expected in Germany (Baden-Württemberg, Brandenburg, Saxony, Thuringia), northern and southern Italy, across the Netherlands and Spain (Andalusia, Castilla-Mancha, Canarias, Catalonia, Extremadura, Galicia); they are often coupled with water quality and quantity concerns (Brussels region and several Flemish regions, Emilia-Romagna, Lombardy, Apulia, Aragon, most regions across France, Lithuania), causing competition for water between urban and agricultural use (e.g. Sardinia), stress in natural ecosystems, agriculture and forestry (north-western Germany, Balearic Islands), risks of desertification (Basilicata, Calabria, Emilia-Romagna, and Sicily). Closely related is the issue of water scarcity and associated threats of lower water recharge and decrease in aquifer levels (e.g. PACA, Apulia, Piedmont, Balearic Islands, the Netherlands), risks on pastures and fodder (Poland) and vegetation areas (e.g. Thuringia). Precipitations are expected to overall decrease in a few regions such as Bratislava and western Slovakia, with reduced river flows (e.g. Pays de la Loire), higher transpiration and water stress (Murcia, Navarra, Île-de-France). Impacts shall be aggravated as more frequent or abundant irrigation should be required in the agricultural sector (e.g. North Rhine-Westphalia, Tuscany, Aosta Valley, Galicia), while water shortages are expected to create negative impact on industrial and agricultural production (e.g. Bremen).

Soils will also be affected. Erosion, increased soil vulnerability and degradation will happen across the continent (e.g. Île-de-France, Saarland, Saxony, Thuringia, Mecklenburg-Vorpommern with stronger winds, Lombardy, Marche, Lithuania, Slovakia, Andalusia, Castilla-Leon, Valencian Community, Asturias…), possibly provoking run-off and mudflows (Normandy), landslide risks (Åland, Lappi, Lower Saxony) and desertification (Galicia). Swelling and shrinking soils should notably affect much of France (Île-de-France, Bourgogne Franche-Comté, Auvergne Rhône-Alpes, Nouvelle-Aquitaine, Occitania, PACA); soil degradation may trigger various negative effects such as impairment or loss of soil functions (Bremen), decrease of soil moisture (Lazio) with desiccation and salinization of soil in Slovak low lands; risks of land subsidence and peat oxidation will increase (northern Netherlands), combining with increasing soil consumption (e.g. Abruzzo, Campania, Emilia-Romagna). Thermal stress will further increase in southern regions such as Canary Islands, Catalonia, Extremadura, Castilla-La Mancha. As

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mentioned above, coastal regions will be affected by higher risks of salinization (e.g. northern Netherlands), sea water intrusions combined with the risk of sea level rise (e.g. Andalusia).

More frequent or intense extreme events shall also impact land use, often in combinations (floodings, droughts, heavy rains, storms) from southwestern (Emilia Romagna, Lombardy, Aragon) to north-eastern Europe (Lithuania, Poland). Flooding risk will increase notably in agricultural areas (e.g. Åland, Lappi, Île-de-France, Thuringia, Sardinia, Veneto, Canary Islands…), amplified by destructive storms (e.g. east of France), more intense rainfall episodes (Friuli-Venezia Giulia, Tuscany) and globally increased precipitation (e.g. northern Slovakia). These events are often causing faster surface run-off, less soil hydration and erosion (e.g. Poland). Another fast-increasing risk, as abundantly seen in the summer of 2022, concerns forest fires and wildfires, for instance in Wallonia, Antwerp province, in the southern half of Finland, northern and central Italian regions as well as Sicily, in most French regions, across Germany from Saarland to Bavaria or Berlin, several Greek regions, Spain from the south to central inland regions up to Catalonia. In the Netherlands, extreme events combined with the risk of longer wet periods will be affecting harvests, while mountainous regions may see an increase in torrents and avalanches (e.g. Bavaria).

Climate change will hit productivity. Agricultural yield may decrease in very different contexts (Centre-Val de Loire, Saarland, Berlin, Hessen, Mecklenburg-Vorpommern, Emilia Romagna, Liguria, Marche, Sardinia, Tuscany, the Netherlands, Castilla-Leon, Murcia…), linked with higher evaporation (southern Spain), shorter crop maturation due to higher average temperatures (Galicia), higher risk of loss of nutritional value (Sardinia). Plants and animals may reach their adaptation limits (e.g. Hessen, Saxony). Impacts on agriculture will often depend on species. A risk on fruit ad vine already observed with increasing frequency is linked to frost risk during flowering, which can trigger earlier harvests (e.g. PACA). Other challenges come from thinner snow cover (alpine Italian regions), higher volatility of snow cover and vegetation periods (Lithuania), negative consequences on permafrost (Trentino Alto Adige). Generally, there are fears of more inadequacy of precipitation cycles to seasonal agricultural needs (e.g. in Poland). Forests shall suffer as well with degradation risks (e.g. PACA, Saarland), high vulnerability of species to droughts and parasites (Wallonia, Grand Est, Île-de-France, Pays de la Loire); in contrast, forests are expected to extend further in Lappi, which may provoke albedo reduction. Higher risks of infectious diseases, pests, fungi, also invasive species are foreseen everywhere, linked or not to the migration of species (e.g. Grand Est, Galicia, Bavaria, North Rhine-Westphalia, Saxony, Thuringia, northern Italy, regions across Spain – Aragon, Asturias, Canary Islands, Extremadura, Navarra, Valencian Community); longer wet periods and modified climate patterns will probably increase diseases, mosquitoes and pests (the Netherlands). Other negative developments concern eutrophication in the summer (e.g. Saarland), increased oxidation by ozone and high concentrations of ozone and air pollutants in dry seasons that can also affect plant growth (Île-de-France, Saarland), risks on pasture lands (PACA), even threats to reindeer husbandry (Lappi – the rest of Finland expects mixed or overall slightly positive effects of climate change).

Biodiversity threats are also more and more emphasised (Antwerp, Brussels, most French regions and half of Spanish regions including Canary Islands, Lower Saxony, Emilia Romagna, Liguria, Aosta Valley…); more broadly, biodiversity displacement and change, migration of alien species, combined with other phenomena such as tropicalisation, might have more mixed impacts (Bavaria, North Rhine-Westphalia, Saxony, Thuringia, Friuli Veneto Giulia, Piedmont, Murcia, Poland…). Other expected changes whose effects have yet to be further assessed include changes in seasonal rhythms, modification of flowering cycles (e.g. Centre-Val de Loire), potentially longer and more productive agricultural seasons as well as timber production expected to increase but more vulnerable to the extreme weather events (Aosta Valley), extension of the growing period and vegetation cycles (eastern Slovakia, Poland).

Civil security and protection

A large part of the risks mentioned for the other four application domains also translate into challenges for civil security and protection. Some are very widely shared across countries and regions, notably

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those related to flooding risks and a range of others, separately or in combination: heavy rainfall, storms and hailstorms, sea level rise, groundwater rise, river overflow, marine submersion, landslides, mudflows, avalanches… affecting land use, urbanised areas and built environments, critical infrastructures, energy and water production, transportation and mobility; to severe droughts and acute water scarcity; to forest fires; to increasingly intense, frequent and longer heatwaves, which can also trigger cascading effects and disrupt key value chains; to swelling and shrinking soils.

Other widespread risks pertain to human health. In particular, problems are anticipated with increasing dissemination and often migration of pollens and other allergens (e.g. Centre-Val de Loire, Île-de-France, PACA, Thuringia, the Netherlands, Andalusia, Canary Islands, Castilla-La Mancha, Navarra, Valencian Community, Murcia); of infectious bacteria (e.g. Finland, Auvergne Rhône-Alpes, Bourgogne Franche-Comté, Corsica, Grand Est, Île-de-France, Normandy, Occitania, PACA, Bremen, the Netherlands, Aragon, Castilla-La Mancha, Catalonia, Navarra, Valencian Community, Extremadura, Murcia); with ozone and other air pollution risks (e.g. Auvergne Rhône-Alpes, Île-de-France, Normandy, Occitania); with heat-related illnesses (e.g. Brandenburg, Bremen, and more generally regions where local populations are not yet physically prepared nor equipped to face impacts of intense heatwaves).

3.4 Conclusions

Within the limitations and the caveats indicated in previous sections, this mapping provides some valuable insights. While many of the challenges encountered here are present to some extent in all or most of the regions, they do not always appear among the main risks and threats highlighted by the referenced documents. In that sense, what is not mentioned for a given region and application domain can be as interesting as what is mentioned. It is not based on robust and universally agreed metrics and indicators in the way an equivalent mapping on mitigation issues could be, but it incorporates some perspective from (mainly public) actors on how they perceive the importance and urgency of those challenges within their respective regional contexts. This, in turn, informs strategic priorities for regional authorities and, directly or indirectly, the speed and level at which demand for climate services is likely to develop at those scales in a foreseeable future.

Another interesting perspective is given by taking the angle of application domains and types of risks. While stakeholders and, in particular, public procurers may be aware to a degree of the main climate risks affecting their own regions, seeing which other regions across Europe also view similar risks as priorities can enable new connections and create opportunities to exchange knowledge and open questions. Such connections, which are quite often not very intuitive in geographic terms, can allow clusters of regions to shape demand that is both more consistently formulated and possibly richer and more comprehensive, while also exploring how generically similar challenges can call either for similar or for quite different approaches and combinations of solutions, depending on each regional context.

This is also a way to help individual users that are confronted to specific needs in positioning those needs more clearly within, or in connection with the landscape of climate adaptation and resilience challenges in their regions (and in other regions with comparable challenges). It shall facilitate the aggregation of specific user needs at organisation or community levels, while ensuring that the way aggregated demand is formulated, and sets of solutions are identified and co-designed in dialogue with the climate service market, will then contribute more effectively to addressing priority adaptation and resilience challenges at regional level, better integrating systemic interactions and interdependencies between those challenges.

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4. Sourcing and analysis of EO-based CS in the five selected application domains – final results

4.1 Background and context

As previously discussed at length in *D1.1 Updated database of EU existing and upcoming climate services classified with relevant taxonomy,* T1.3 aimed to source and analyse the European market of CS in the five selected application domains. The aim is to produce comprehensive state of the art of CS supply by mapping 200 providers and services through 4 main parameters:

i. Technology Readiness Level (TRL):

- Operational technologies and solutions (>TRL7).
- Solutions at a low technology maturity level (TRL5 and 6) with high prospects of being commercialised in the medium term (4 years).
- Solutions at a very low maturity level (<TRL 4) presenting important technological barriers that could be lifted in the medium term with R&D investments.

ii. Type of CS (taxonomy)

iii. Technology used

iv. Application domains they apply to

The CS mapping has been divided in two stages as it follows:

The first stage has been conducted between the 27th of October – 15th of December 2022 and its main focus was on desk research. Final results of this stage are presented later in the deliverable.

Due to uncertainties regarding the accuracy of the technical details from the desk research in order to feed the community of procurers with market information (T2.3), prepare the ground for State-Of-The-Art (SOTA) analysis (T3.2) and support the fine-tuning of a first list of providers to invite to the OMC (T3.3), the consortium has decided to conduct a second stage of the mapping.

The second stage has been conducted between 13th of February – 20th of March 2023 and its main focus was on consultations and direct contact of the providers identified in the first stage, in order to verify the state of the CS services identified in the first stage. The final results of this stage are presented in this deliverable.

The objective of this overview is on the one hand to provide to the public authorities' community a snapshot of the EU market of the CS selected in the 5 application domains, and on the other hand, to identify CS with a TRL up to 6 which could be a good fit for the future PCP process.

4.2 Methodology

Climate service mapping

As mentioned below, three distinct methodologies were used to source and analyse CS, technologies, and suppliers on the market with in five main application domains:

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- **Desk Research** is a type of research that is based on the material published in reports and similar documents that are available in public libraries, websites, data obtained from surveys already carried out, etc.
- **Survey Research** is the collection of information from a sample of individuals through their responses to questions.
- **Consultation** is a one-to-one meeting between two parties with the scope of getting more accurate information.

The following subsections will provide further details on how the techniques have been applied.

Desk Research

Aerospace Valley had selected a consultant from TerraWatch Space company who has prior experience mapping EO-based CS providers and detailed understanding of the EO industry. The desk research process conducted by the consultant was similar to the process mentioned in D1.1, but focused on identifying relevant CS providers with appropriate offerings relevant to this project:

- Identification: This involved the identification of the list of relevant climate service providers operating in the five application domains, extracted from both the internally maintained database of TerraWatch Space as well as sourced from ESA Phi Lab portfolio, ESA BIC Networks, Space Climate Observatory among others.
- Analysis: The second step involved conducting a high-level analysis of the service offering of the selected providers, to make sure only those with a specific focus on climate are selected for the data collection phase with the Survey Research as described in the next section.

Survey Research

In the first stage of the mapping, the following steps were taken in the survey research procedure carried out by the AV, by the consultant, and by the PROTECT consortium partners as described in the D1.1:

1. **Creation:** This step has been based on the main 4 parameters:
   - TRL level :

- Operational technologies and solutions (>TRL7).
- Solutions at a low technology maturity level (TRL5 and 6) with high prospects of being commercialised in the medium term (4 years).
- Solutions at a very low maturity level (<TRL 4) presenting important technological barriers that could be lifted in the medium term with R&D investments.

   - Type of CS (taxonomy)
   - Technology used
   - Application domains they apply to

As mentioned in *D1.1 Updated database of EU existing and upcoming climate services classified with relevant taxonomy*, EU Survey is the instrument that has been used to present the survey during the distribution phase. Back then, the poll went through several revisions and was evaluated by all consortium members before it was made public. TRLs have been assigned to solutions based on application areas, CS (taxonomy) type, data and technology employed.

After consultations with the consortium regarding the type of information needed for the next tasks through this survey, it has been decided to include also the city-related information which will be used in order to display the CS in the future e-catalogue. At the same time, some of the questions have not been treated in this deliverable because they constitute a base for the upcoming Orientation Papers. The survey's structure and content can be seen in Annex III.

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4.3 Dissemination:

In the first stage of the mapping, the dissemination actions were undertaken between 27th of October and 15th of December 2022. In the second stage case, the dissemination actions took place between the 13th of February and the 20th of March 2023.

Even though the KPIs of the identification of 200 CS providers have been already met in the first stage of the mapping, AV together with TerraWatch Space had the goal of gathering 200 CS which could be involved in the PROTECT project.

In this stage, AV had two different strategies for the dissemination of the survey:

- **The "top-down" approach** which has been used for the first stage of the mapping as well. This approach was mainly starting with contacting the big space stakeholders across European Union, the ESA BICs Network and space tech accelerators/clusters in order to reach out to as many providers as possible. A list of all the multipliers which have been contacted can be seen in Annex IV.
- **The "bottom-up" approach** which in the first stage of the mapping has been used mainly by TerraWatch Space. In the frame of the second stage, AV has supported TerraWatch Space in this action due to the initially short time-frame of the expected outcomes. Therefore, the providers identified through the desk research in the first stage of the mapping have been contacted via email or LinkedIn in order to introduce them to the PROTECT project. The information was disseminated via the AV website, emails, and sharing with the AV and PROTECT partners network, as well as via social media profiles, particularly LinkedIn. Whenever necessary, AV has given assistance to providers in filling out the survey. For a better monitoring of the dissemination, a central database of prospective providers contacted throughout dissemination has been constructed and is reported in Annex V.

Due to the support of various multipliers or due to the desk research which has focused as well on identifying suitable providers which were already a part of other very well-known projects or initiatives, PROTECT project identified a total of 55 providers this way and it can be observed below:

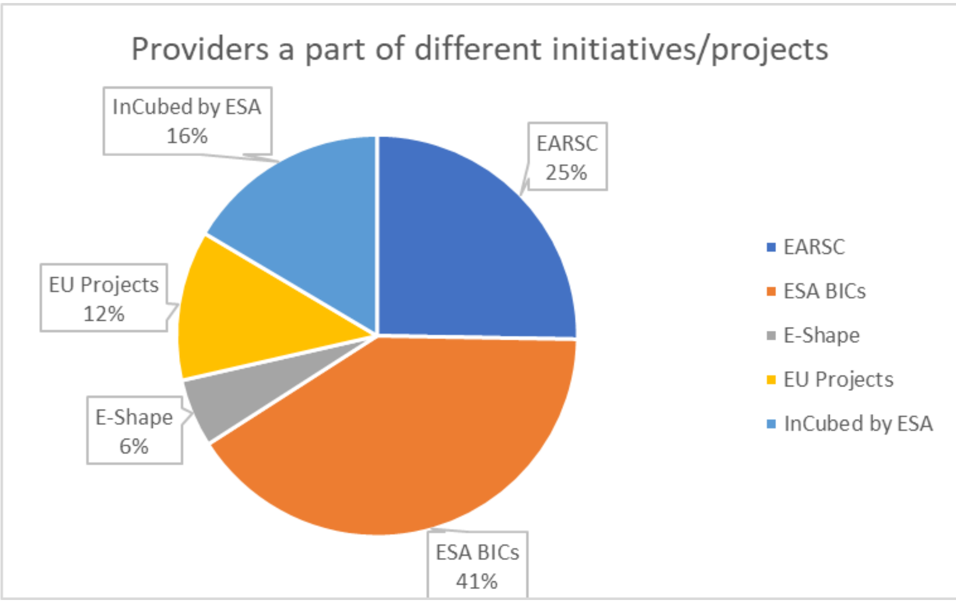

FIGURE 1 ANALYSIS OF THE PROJECTS/INITIATIVES PROVIDERS PARTICIPATE IN

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4.4 Consultations

Considering that in the first stage of the mapping, the consultations were used only for verifying assumptions and gather further information about the technicalities of the CS, in the second stage of the mapping the consultations were a bit different.

AV and TerraWatch Space had used the consultations as a complementary methodology to the dissemination. These consultations were needed to provide an overview and guidelines regarding the objectives and the expectations of PROTECT. A total of at least 100 consultations took place through LinkedIn, email and teleconferences, between the 13h of February and the 20th of March 2023, resulting in the addition of 30-40 CS to the mapping.

4.5 Results

- Total Number of contributions through Survey: 143
- Total Number of CS collected through Survey: 167 (from 115 companies/organisations)
- Number of CS sustainable for PROTECT: 164
- Number of CS collected through Survey first stage: 80
- Number of CS collected through Survey second stage: 87
- Number of Countries of Origination of the CS: 17

The following section highlights the expected outcomes of the mapping. A complete mapping of the climate service providers is provided in Annex VI Climate Services mapping. This Annex will be delivered separately to the European Commission due to the sensitive information regarding the technical aspects of the CS. This has been decided due to the following reasons:

1. Deliverable D1.2 is a public document, and it might give the opportunity of the CS providers' competitors to have an insight of the technical details.
2. No formal consent of publishing these types of information in a public way has currently been asked from the providers.
3. Due to highly sensitive information, in the Annex will be mentioned only the names of the providers and the country.

Data collected from CS providers through the survey models were analysed based on the three criteria:

1. Whether the CS was a commercial service offering with sufficient efforts invested into its development
2. Whether the CS fit the requirements of the scope of the project
3. Whether the identified CS continued to remain in operation with serving customers

Responses from each CS provider were verified to make sure the details they had provided were valid by checking the company websites or other means, following which the suitability for each CS has been defined.

Type of Enterprises Analysed

The EU SME definition rules have been used to reach a high granularity level of analysis and to be able to correlate it with TRL levels to assess the potential time to market of CS assessed.

1. **Micro Enterprises** are small businesses employing less than 10 employees;
2. **Small Enterprises** are businesses employing between 10 and 49 employees;
3. **Medium-sized Enterprises** are businesses employing between 50 and 249 employees;
4. **Large Enterprises** are businesses employing more than 250 employees;
5. **Public Organizations** are owned and operated by the government, as well as being funded through the government in the form of taxes;
6. **Others** included private universities and other research organisations.

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TRLs Analysed

The following table provides the definition for the TRLs (between 1 and 9) used to analyse and classify the mapped climate services.

TRL	Definition
1	Preliminary algorithmic stage. Publication of research results.
2	Individual algorithms or functions are prototyped.
3	Prototype of the main functionalities of the integrated system.
4	Alpha version. Preliminary release of non-mature software version; distributed to a community at an early stage of the software development life-cycle; that implements the main functionality of the software and by which preliminary verification and validation activities are archived.
5	Beta version. Preliminary release of non-mature software version; distributed to a community at an early stage of the software life-cycle, that implements the complete functionality of the software and by which preliminary verification and validation activities are archived.
6	Ready for use in an operational or production context, including user support, as a building block or a tool.
7	Demonstrator. Building block and tailored generic software product qualified for a particular purpose.
8	System qualified and ready to be applied in an operational environment.
9	Has been applied in the execution of an operational environment

FIGURE 2 DEFINITION FOR THE TECHNOLOGY READINESS LEVELS

Types of Technologies by Climate Services

When talking about CS mapping, the main focus of PROTECT project has been EO-based services in the five application domains. CS which show synergies between EO and other technologies have been included, as long as the primary technology used was the EO one. The analyzed types of technologies are:

- Satellites are objects which has been sent into space in order to collect information.
- Drones are robotic aircrafts that are controlled remotely by a pilot or by an onboard computer.
- Aircrafts are vehicles (such as an airplane or balloon) for traveling through the air.
- Ground sensors IoT are devices that can detect external information (humidity, temperature, soil content etc.), replacing it with a signal that humans and machines can distinguish.
- Artificial Intelligence (AI)/ Machine Learning (ML) is the capability of a computer system to mimic human functions such as learning and problem-solving; through AI, a computer system

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uses maths and logic to simulate the reasoning that people use to learn from new information and decisions

• Others is the sum of other types of technologies and data used in complementarity with EO (ex: In-situ, High Altitude Platform Station (HAPS), citizen observations, crowd sourcing).

Climate Services by Country

Of the 167 climate services analysed, France (61), Germany (24) and Netherlands (24) made up over half of the mapping, while Spain (16), Italy (9) and Luxembourg (9) also had a substantial share of the overall distribution. CS providers also originated from other countries within the EU including from Belgium (4), Finland (4), Czech Republic (4) and Austria (3). Within the mapping, there were 2 CS providers from Ireland and Portugal and one each from Lithuania, Hungary, Greece, Latvia and Slovenia.

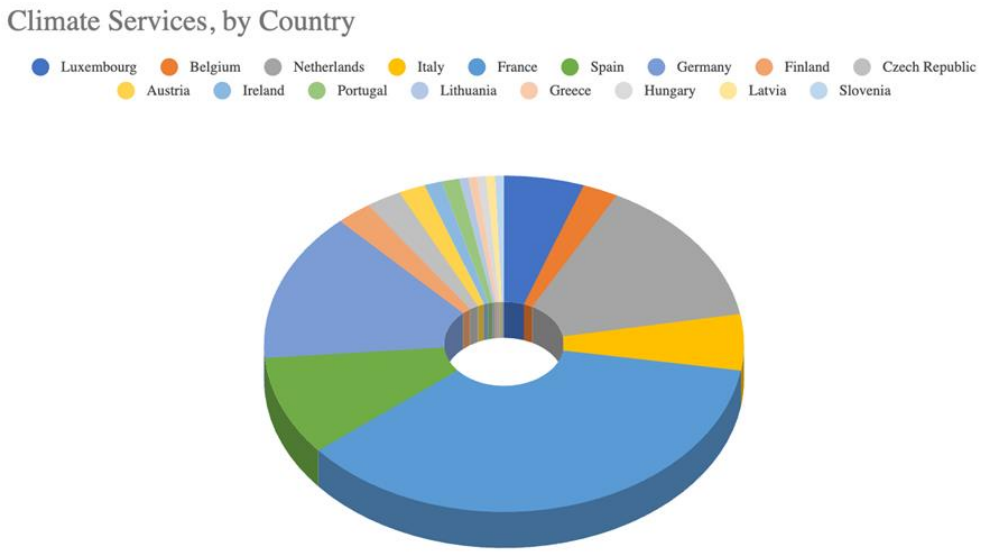

FIGURE 3 CLIMATE SERVICES BY COUNTRY

As a comparison between the two stages of the mapping, it has been noted an increase in the number among the countries providing CS from 12 to 17 (Finland, Ireland, Lithuania, Slovenia and Greece). At the same time, the number of CS per country increased as showed below:

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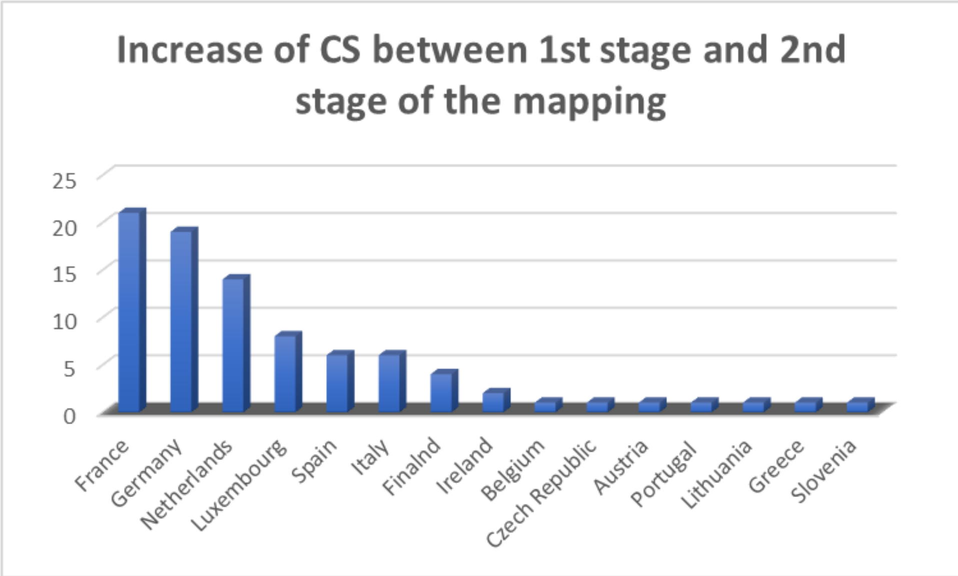

FIGURE 4 INCREASE OF CS PER COUNTRY BETWEEN 1ST STAGE AND 2ND STAGE OF THE MAPPING

Climate Services by Type of Enterprises

About one-third of the overall CS providers were identified as Small Enterprises, while almost a half of them were marked as Micro Enterprises. About 26 providers belonged to the categories of Large Enterprises and Medium-Sized Enterprises, while the rest were identified as Public Organisations or belonged to other categories of organisations such as research institutes and non-profits.

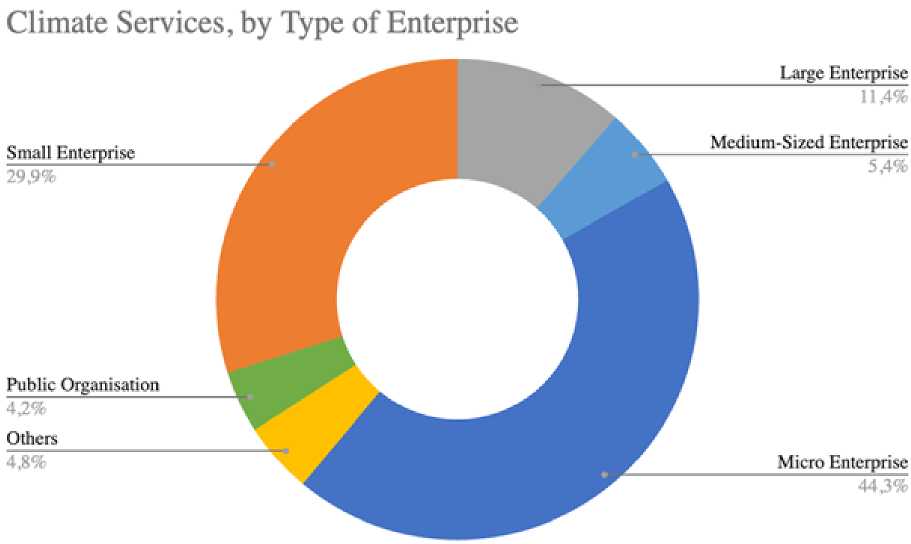

FIGURE 5 CS BY TYPE OF ENTERPRISE

Climate Services by Application Domain

Within the mapping of CS providers classified by their application domain, it was found that the '*Agriculture, forestry and other land use*' category had the highest share taking up over half of the overall share, while those operating in the application domain of '*Sustainable urban communities*' was the second highest making up about 20 percent of the mapping. The remaining three application domains

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of '*Energy and utilities'*, '*Civil security and protection*' and *'Marine and coastal environment'* had an almost equal number of CS providers, totalling up to 20, 20 and 18 respectively.

In the disseminated survey, the "Civil security and protection" application domain was referred to as "Security and civil protection", and this is reflected in showcasing results of the survey below. This, however, does not affect other tasks.

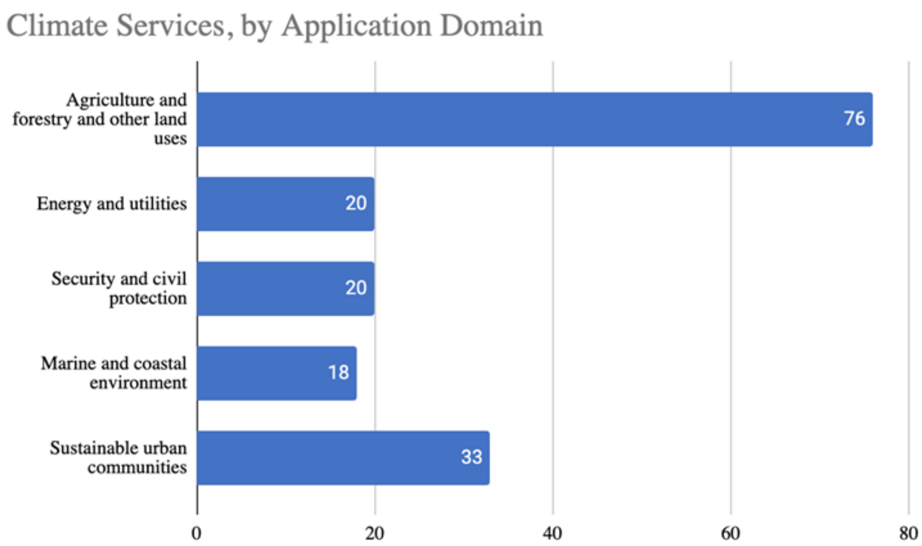

FIGURE 6 CS BY APPLICATION DOMAIN

Even though the dominant application domains remain the same since the first stage of the mapping, in the figure below it can be noticed an increase in the number of CS for the remaining application domains:

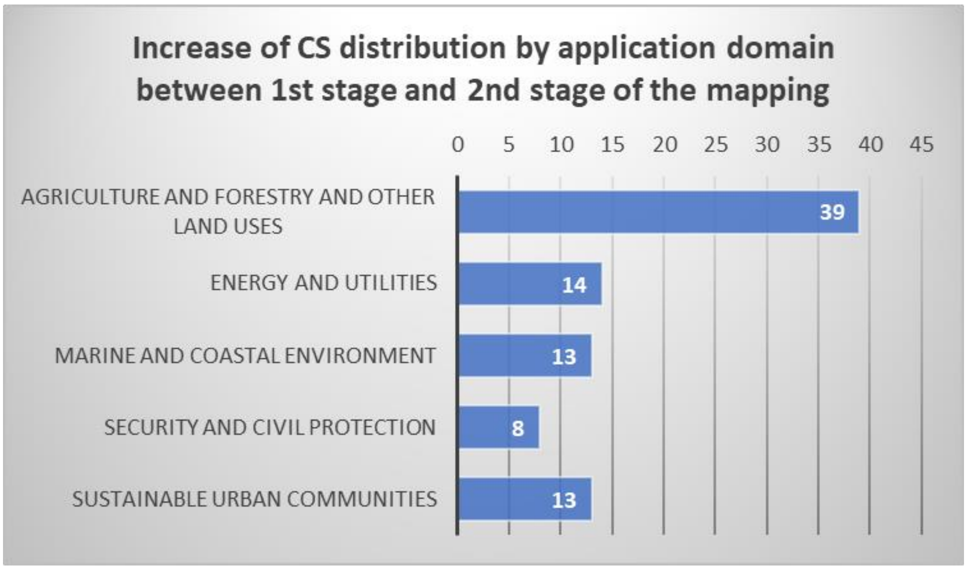

FIGURE 7 INCREASE OF CS PER APPLICATION DOMAIN BETWEEN 1ST STAGE AND 2ND STAGE OF THE MAPPING

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Climate Services by TRL

CS with TRLs of 8 and 9 had the highest count in the mapping with over 50 percent of the total followed by those with TRLs between 5 and 7. Those with “low” TRLs between 1 and 4 amounted to 28, making them the lowest share of the mapped CS providers. One reason for the presence of CS providers with high TRL could be due to the growing demand from commercial customers across all five application domains.

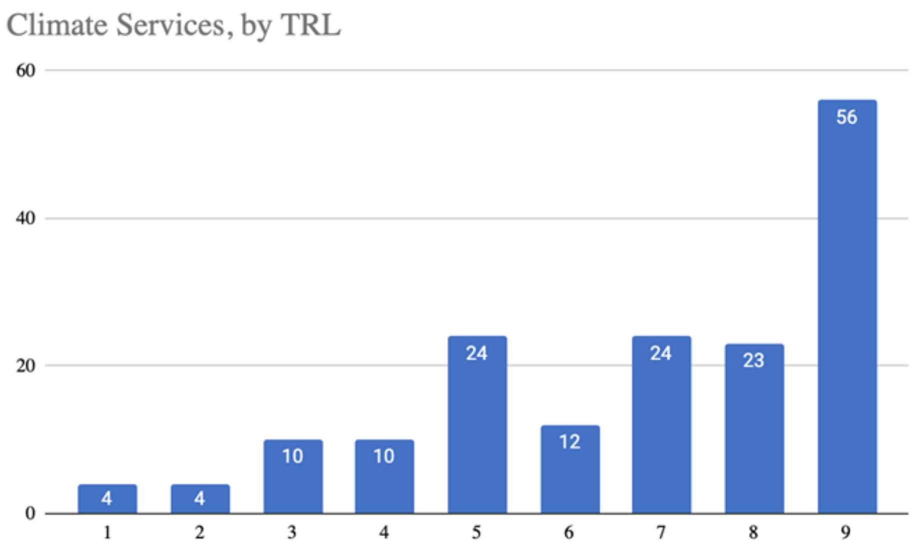

FIGURE 8 CS BY TRL

Due to more support received in the dissemination of the second stage of the mapping, PROTECT has been able to reach out to more CS with low TRL than in the previous stage. Therefore, as a result it has been noticed in the range of TRL 1-9 an increased which almost doubled, if not more, in some case. A representative figure of the increase can be seen below:

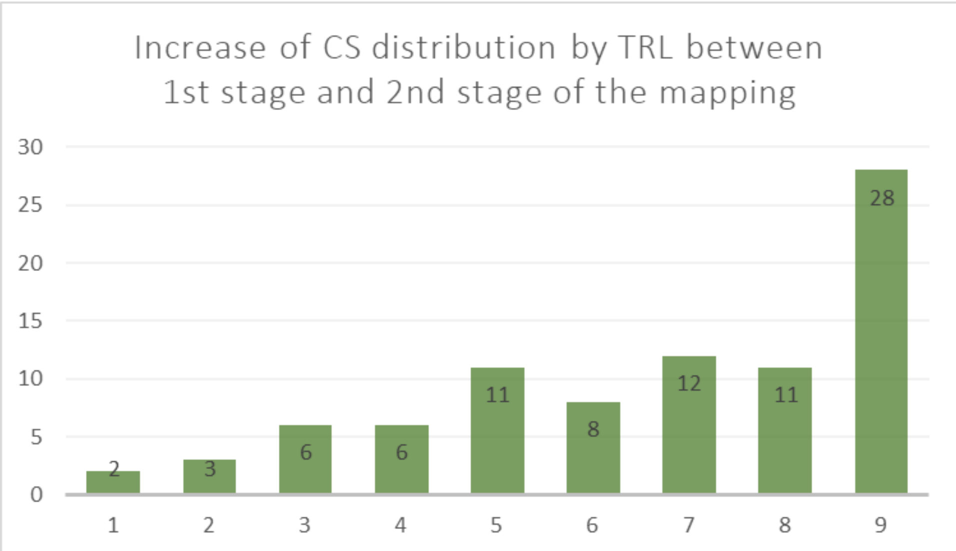

FIGURE 9 INCREASE OF CS PER TRL BETWEEN 1ST STAGE AND 2ND STAGE OF THE MAPPING

Climate Services by Technology Used

1. Over 1 in 3 of climate services used artificial intelligence as one of their core technologies.
2. Nearly 80% of the climate services identified and analysed used a source of data from satellites as a fundamental part of their applications.

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3. Over 75% of the services analysed utilised data from the Sentinel missions and/or made use of the one of the Copernicus Services to derive their insights

Analysis of the Geographical Distribution of the Climate Services, by Application Domain

France, Germany, Netherlands, Italy and Spain have the highest share of climate services in the 'Agriculture, forestry and other land use' domain. This is potentially a result of the internal demand for such services as well as the maturity of the agricultural and forestry sectors within these countries. Being the application domain with the highest share of CS mapped in this exercise, CS in the 'Agriculture, forestry and other land use' were also identified in Member States such as Austria, Czech Republic, Finland, Greece, Ireland, Latvia, Lithuania and Portugal.

CS from the 'Sustainable urban communities' were also almost equally spread across various Member States, while 'Security and civil protection' and 'Sustainable urban communities" 'Energy and utilities' were identified in at least 5 Member States.

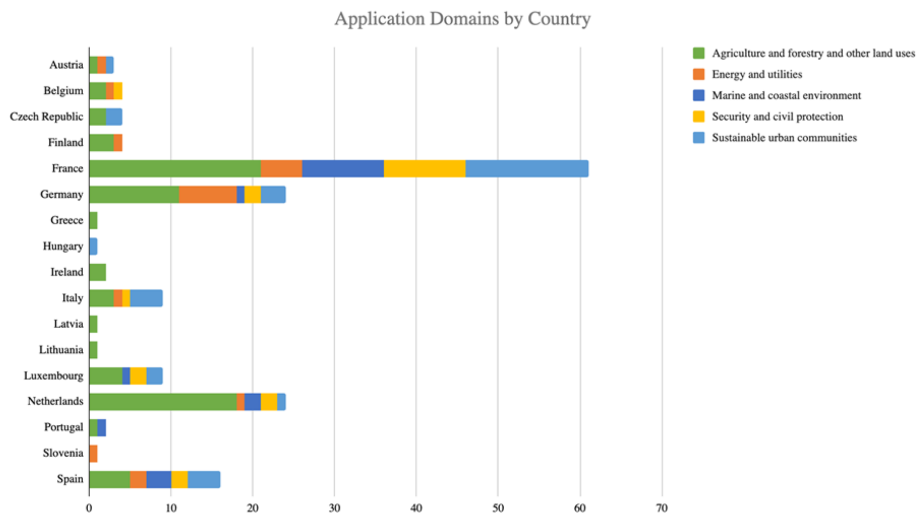

FIGURE 10 GEOGRAPHICAL DISTRIBUTION OF THE CS BY APPLICATION DOMAIN

Analysis of the Geographical Distribution of the Climate Services, by TRL

The chart below presents the distribution of CS across low TRL between 1 and 4 (in green), mid-TRL including 5 and 6 (in amber) and high TRLs between 7 and 9 (in blue), across the selected countries. Some countries, such as Austria, France, Germany, Netherlands, Portugal and Spain have an equal share of low TRL and mid-TRL CS, showing the presence of providers with varying maturity of service offerings.

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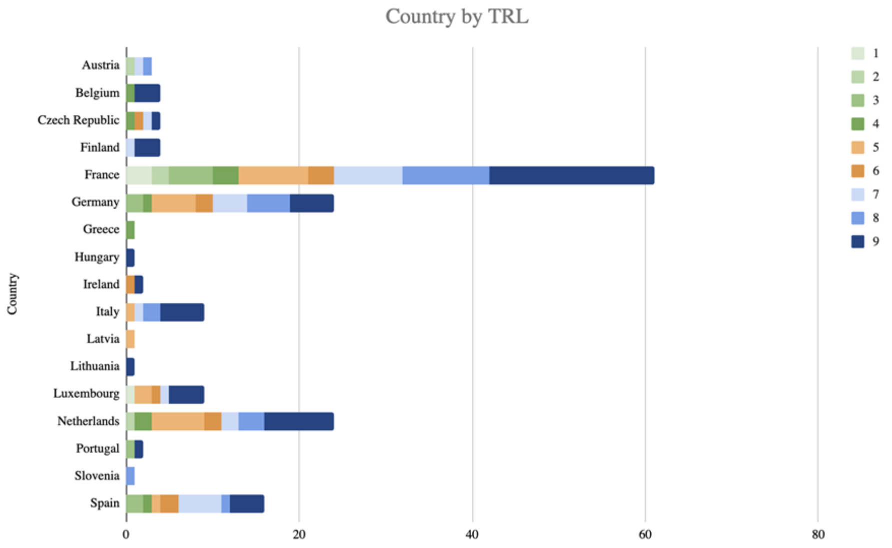

FIGURE 11 GEOGRAPHICAL DISTRIBUTION OF THE CS BY TRL

Conclusions and further steps

As it can be seen in the previous chapter, the mapping of the EO-based CS showcased impressive results. Even though, the scope of a PCP is CS with TRL between3 and 8, the mapping had a double goal as it follows:

1. To identify as many CS as possible on the market to have a support for the State-of-the-Art analysis which will be conducted in the upcoming activities. This had the solely purpose of being able to provide a good overview to the public authorities in order to finetune their needs. Therefore, one of the focuses were technologies with high TRL.
2. To identify CS holding a TRL between 1 to 8 to be able to give an overview to the public authorities regarding what is coming up on the market and to understand how these services could be improved in order to tackle their needs.

At the same time, in the upcoming activities in the frame of the project, one will be to select 4 challenges for further steps. One of the main important criteria in this selection, besides the will of involvement from the public authorities, is to see if there could be solutions which could tackle those needs under development or if they are already in the market, as it will be showcased in the Chapter 7 of this deliverable. Thereby, the importance of having different solutions with various TRLs is crucial in the upcoming steps.

In conclusion, the EO-based CS market is actively expanding, including in the space emerging countries from the Easter Europe throughout several initiatives supported by European Commissions, European Space Agency, but also by national public and private initiaves.

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5. Cross-analysis of climate services and barriers

5.1 Outcomes and conclusions of the cross-analysis

Various types of analyses have been considered in the document so far. They all look at different aspects of climate services and pre-commercial procurement, with the aim of providing clear potential paths and identifying spaces where needs and opportunities would meet and where innovation procurement could bring relevant formats to optimise the match between supply and demand.

At this stage of the project, comparing the outcomes from Tasks 1.1, 1.3 and 1.5 shows broad consistency across scales between priority needs that could be addressed through, or supported by climate services. However, it also confirms that each level – European Union policies, national strategies and plans, main challenges and risks as highlighted in regional documents and surveys, challenges identified by individual procurers – brings up complementary perspectives that reflect different perimeters and levers for action.

Notably, the granularity exhibited in the desktop research on regional challenges is less detailed than some of the needs that emerged in the workshops as a result of direct interaction with stakeholders, e.g., waste fires or climate impacts associated with illegal dumping. While some of the documents that fed into the table of climate challenges per region contain more specific elements than can be found in that table, they generally remain more generic than the above-mentioned needs. Information collected in the T1.3 work to source and analyse climate services, technologies and providers, can be quite precise as some of the providers are focusing on niches, both in terms of technology and of envisioned customer segments, but their potential applications frequently – and understandably – span wider scopes than those needs.

A few showcases have been considered below. They are based on intersections between findings from the various tasks, combined with desktop research and expert knowledge within the consortium.

The following showcases have exemplative, and non-restrictive scope. They serve as examples of how findings from the various tasks can be crossed in the search for potential PCP topics. Examples other than these showcases can be similarly drawn using the findings, as published in the annexes of this document. All of these initial findings are subject to further rounds of validation. At the same time, the showcases in the following pages are the most complete instances coming out of this initial cross-analysis, in terms of looking at whether, based on the available information, the following criteria are met, simultaneously and to the highest possible extent of overlap:

(i) there is a clear (abstract) climate challenge perceived by a number of potential procurers, as per the analysis in T1.1.2

(ii) there is a (specific) need for a climate service (expressed by a potential procurer in T1.5 or perceived by the consortium, based on their expertise)

(iii) there is room for climate services using EO beyond those available off-the-shelf today and analysed in T1.3 (as otherwise, there would be no need of PCP) and potential providers which may be interested in participating in the PCP

(iv) the above criteria intersect and point to a precise (narrow or broad) topic or intersections of topics prone to be (after further validations) subject of PCP, or -at the very least- to draw potential procurers together around their interest and willingness to discuss the topic.

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Showcase title (T1.5)	**Challenges presented by water scarcity**
Domain (cross-analysis)	Energy and utilities (also AFOLU, Sustainable urban communities, Marine and coastal)
Explanation (T1.5)	Droughts can put stress in the provision of water for different uses, such as irrigation, drinking water. This can be felt in terms of water quantity but also of deterioration of the water quality. The depletion of water sources (e.g. less water in the rivers due to lack of melting ice from mountains) may be overcome by connecting the supply and demand of sweet water with data from the whole water cycle with insights - including for sectors that are not always connected (e.g., on sewage system water and the requirements of treated water for farming) and a common language/taxonomy.
Concerned climate challenges (T1.1.2)	Drought and water related issues are threats found in the largest number of regions. More frequent and longer periods of drought are notably expected in Germany (Baden-Württemberg, Brandenburg, Saxony, Thuringia), northern and southern Italy, across the Netherlands and Spain (Andalusia, Castilla-Mancha, Canarias, Catalonia, Extremadura, Galicia); they are often coupled with water quality and quantity concerns (Brussels region and several Flemish regions, Emilia-Romagna, Lombardy, Apulia, Aragon, most regions across France, Lithuania), causing competition for water between urban and agricultural use (e.g. Sardinia), stress in natural ecosystems, agriculture and forestry (north-western Germany, Balearic Islands), risks of desertification (Basilicata, Calabria, Emilia-Romagna, Sicily). Closely related is the issue of water scarcity and associated threats of lower water recharge and decrease in aquifer levels (e.g. PACA, Apulia, Piedmont, Balearic Islands, the Netherlands), risks on pastures and fodder (Poland) and vegetation areas (e.g. Thuringia). Increased frequency of droughts and of heatwaves is a concern from Lithuania and Poland to Spain, from Belgium to France, Germany Italy, and Greece with consequences both on water quality and quantity and indirectly on other economic sectors, e.g. energy production (water scarcity in highly industrialised regions of western Germany and in Marche, impact of hotter waters in parts of Belgium, France, Italy, Lithuania). More broadly, hydrogeological instability threatens regional water balance and availability, from southern Germany to southern Italy. General hydrogeological instability (western and eastern Italy) can also be combined with more frequent droughts and change in rainfall regime (e.g. Liguria). For coastal regions, coastal water issues include increased saltwater intrusions, risks of salinization and freshwater & drinking water shortages (western France, Emilia-Romagna, Spain, the Netherlands…), decreased water quality (Lithuania, Tuscany, bathing water quality in the Netherlands), stress on the aquatic ecology notably due to high water temperatures, sea acidification (northern Germany, Canarias, Galicia, Murcia with reduced capacity of carbon storage), toxic algae (Catalonia, Italian lakes)."
Possible scopes (cross-analysis)	- need for finer management of scarce water resources across levels of quality as much as between competing uses (incl. effects on energy production, on agriculture, on aquatic ecology) - competition between urban, agricultural and other use of water - need for quicker and more agile access to shared data to inform consistent decision-making across user segments
Relevant EU legislation (T1.1.1)	The EU Water Framework Directive 2000 (WFD) is arguably the most important, far-reaching, water legislation ever to emerge from the EU. It was transposed into law in EU Member States by the end of 2003. In addition to chemical water quality targets, ecological objectives have been set for each water body. A key aim of the WFD is for all water bodies to achieve ‘good ecological and chemical status’. The original target for achieving good status was 2015, but further deadlines have been set for 2021 and 2027.

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Showcase title (T1.5)	**Challenges presented by water scarcity**
Companies offering EO-based CS in similar domains (T1.3)	EOMAP, FutureWater, InSitu-Systems, MEOSS, Nelen & Schuurmans, Research Institute of Water and Environmental Engineering (IIAMA), Arpae SIMC Emilia-Romagna, BlackShore, constellr GmbH, Foundation for Climate Research, MURMURATION, TERRANIS, VisioTerra, vorteX.io, Water Insight
Possible topics for PCP (cross-analysis)	**Finer management of scarce water resources across levels of quality as much as between competing uses (e.g. in mixed urban / agricultural areas)**

Showcase title (cross-analysis)	**Supporting the transition towards green energy**
Domain (cross-analysis)	Energy and utilities (also: Sustainable urban communities, Marine and coastal, Civil security and protection)
Explanation (cross-analysis)	Europe is aiming at leading the way towards renewables for the purposes of both increased sustainability and geopolitical independence. Many climate services exist and more can be developed around renewable energy (solar, wind and others). As energy storage is still a critical point to maximise the energy efficiency of renewables, EO data can be extremely valuable in forecasting energy peaks, as well as more broadly, for planning and monitoring purposes.
Concerned climate challenges (T1.1.2)	Several challenges are widely shared across Europe. Increased frequency of droughts and of heatwaves is a concern from Lithuania and Poland to Spain, from Belgium to France, Germany, Italy and Greece, with consequences both on water quality and quantity and indirectly on other economic sectors, e.g. energy production (water scarcity in highly industrialised regions of western Germany and Marche, impact of hotter waters in parts of Belgium, France, Italy, Lithuania). More broadly, hydrogeological instability threatens regional water balance and availability, from southern Germany to southern Italy. The multiplication of extreme events – flooding, either extreme rainfall or sea level rise, threatens to disrupt energy production in Germany, Lithuania, Poland; frost is mentioned as a disrupting factor in some Polish regions, but also in Tuscany (affecting water provision), as can be tree falls resulting from storms e.g. in Finland. Increase in other more specific risks ranges from water pollution, landfill flooding and fires (Lithuania) to peak flood discharges (northern Germany) or consequences of ocean acidification on infrastructures (western France). Systemic risks such as coupled issues on water availability or quality and energy production are amplified in densely populated areas such as the Berlin and Paris regions. Cascading effects are expected as energy demand rises (e.g. during heatwaves, in Italy but also in less hot countries such as the Netherlands or Slovakia), water reserves are put under growing strain, and the effects of suboptimal insulation and energy efficiency of buildings across Europe are aggravated by climate change.
Possible scopes (cross-analysis)	- need for more integrated forecasting capabilities (including between different energy sources) - need for a more agile system for water-based energy due to draughts
Relevant EU legislation (T1.1.1)	**2030 climate & energy framework** The 2030 framework proposes new targets and measures to make the EU's economy and energy system more competitive, secure and sustainable. It includes targets for reducing greenhouse gas emissions and increasing use of renewable energies and proposes a new governance system and performance indicators. **Renewable energy targets** The energy sector is responsible for more than 75% of the EU's greenhouse gas emissions. Increasing the share of renewable energy across the different sectors of the economy is therefore a key building block to reach the EU's

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	energy and climate objectives: (I) cutting greenhouse gas emissions by at least 55% (compared to 1990) by 2030 and (II) becoming a climate neutral continent by 2050 **The Clean energy for all Europeans package** The Clean energy for all rules will bring considerable benefits for consumers, the environment, and for the economy. By coordinating these changes at EU level, the legislation also underlines EU leadership in tackling global warming and makes an important contribution to the EU's long-term strategy of achieving carbon neutrality (net-zero emissions) by 2050.
Companies offering EO-based CS in similar domains (T1.3)	SARWind EOMAP Foundation for Climate Research geopredict HD Rain Hydroclimat SUEZ EAU France – Center Rivages Pro Tech Ticinum Aerospace Srl
Possible topics for PCP (cross-analysis)	**integrating data to address coupled issues on water availability or quality (incl. temperature) and energy production (focus on clean energy?)**

Showcase title (T1.5)	**Waste management and related storage issues**
Domain (cross-analysis)	Sustainable urban communities (also: Energy and utilities, Civil security and protection, AFOLU)
Explanation (cross-analysis)	Due to their complexity and importance, waste management systems could seek at tacking issues coming from climate and non-climate factors. Thermal monitoring and predicting waste fire can help avoid the spontaneous ignition in waste storages. Certain conditions (like the level of humidity, air temperature, hight of the pile of waste, etc.) are conducive to spontaneous waste ignition. This causes bad air quality and if not controlled on time it could cause material and/or human damage and loses.
Concerned climate challenges (T1.1.2)	Waste management appears little in the mapping, partly because associated climate challenges may pertain more to mitigation than to adaptation. However, waste management and storage issues should be coupled with adaptation challenges as some of the latter are likely to aggravate or complexify the impact of such issues; conversely, waste value chains are sufficiently important to be taken into account in adaptation plans. Taking this two-way perspective can allow to surface gaps and needs for (combinations / developments of) innovative products and services. Cities are affected by many the challenges linked to other application domains, often at more acute levels due to the concentration of population and economic activities. Classic examples are heatwaves, who are generally expected to rise in frequency, duration and intensity, and urban heat islands mostly in meridional regions. Heatwaves are mentioned in almost every region of the mapping. Being characterised in comparison with average local temperatures, they remain globally hotter in more southern regions; however, they also come on top of climate challenges in regions that are generally cooler (from the northeast of France to the southern half of Finland) as local populations are much less used to dealing with abnormally high temperatures, both biologically and in terms of housing design, insulation and equipment. In many cases, e.g. in Spain and in part of Italy, heatwaves and degradation of air quality are coupled and amplify each other's negative impact on human health. Droughts, water quality and quantity concerns appear wherever they also affect energy and utilities: they have been a major challenge in the southern half of Europe for many years, where they are often linked with water scarcity

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	including drinking water, but they are now also concerning countries such as Belgium, the Netherlands, the south of Germany. Swelling and shrinking soils are also an increasingly common consequence of hydrogeological instability, for instance in southern France and in Italy: they primarily affect agriculture and land use but also create vulnerability for building foundations in urban areas, and sometimes landslide risks. (possibly less relevant here) One other frequently recurring challenge is the growing risk of flooding in urban areas, coming from heavy rainfall or from river overflow, marine submersion or sea level rise, often aggravated by soil degradation, itself amplified by droughts. Almost every province in Belgium and in the Netherlands is affected, as are some Greek, Italian, Polish and inland French regions.
Companies offering EO-based CS in similar domains (T1.3)	Disaitek
Possible topics for PCP (cross-analysis)	**Predicting and preventing waste fires**

Showcase title (cross-analysis)	**Flooding in coastal areas**
Domain (cross-analysis)	Marine and coastal environment (also: Sustainable urban communities, Civil security and protection, Energy and utilities)
Explanation (cross-analysis)	Floods pose risks to the cities in coastal areas leading to potential disaster. More insights into the phenomena are needed, overcoming data gaps and combining data in a timely manner. Reliable mapping of flooded areas is needed for planning, preventing, predicting and for post event intervention, as well as for cooperation towards a positive end result.
Concerned climate challenges (T1.1.2)	With the exception of Slovakia, all countries addressed by this mapping have coastal regions. Flooding risks are mentioned in almost all coastal regions, associated with sea level rise (French Mediterranean coastline, Liguria, Andalucia, Balears, but also northern Germany and Poland, Asturias, Friuli Venezia Giulia), marine submersion (North and Baltic seas, Cantabria, Liguria, Provence Côte d'Azur), extreme rainfall, thunderstorms and gales (Poland, Cantabria), combinations of those factors (e.g. northern Germany, northern Spain, Netherlands, Lithuania, French Atlantic coast), general hydrogeological instability (western and eastern Italy) combined with more frequent droughts and change in rainfall regime (e.g. Liguria). It may be relevant also to feed in elements related to flooding from other application domains: energy and utilities, sustainable urban communities, AFOLU. The multiplication of extreme events – flooding, either extreme rainfall or sea level rise, threatens to disrupt energy production in Germany, Lithuania, Poland. Increase in other more specific risks ranges from water pollution, landfill flooding and fires (Lithuania) to peak flood discharges (northern Germany) or consequences of ocean acidification on infrastructures (western France). One other frequently recurring challenge is the growing risk of flooding in urban areas, coming from heavy rainfall or from river overflow, marine submersion or

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	sea level rise, often aggravated by soil degradation, itself amplified by droughts. Almost every province in Belgium and in the Netherlands is affected, as are some Italian, Polish and inland French regions. More frequent or intense extreme events shall also impact land use, often in combinations (floodings, droughts, heavy rains, storms) from southwestern (Emilia Romagna, Lombardy, Aragon) to north-eastern Europe (Lithuania, Poland). Flooding risk will increase notably in agricultural areas (e.g. Åland, Lappi, Île-de-France, Thuringia, Sardinia, Veneto, Canary Islands…), amplified by destructive storms (e.g. east of France), more intense rainfall episodes (Friuli-Venezia Giulia, Tuscany) and globally increased precipitation (e.g. northern Slovakia), often causing faster surface run-off, less soil hydration, erosion (e.g. Poland).
Possible scopes (cross-analysis)	- water quality and quantity - flood mapping (incl. post-event analysis)
Relevant EU legislation (T1.1.1)	Directive for Maritime Spatial Planning Marine Strategy Framework Directive (indirectly)
Companies offering EO-based CS in similar domains (T1.3)	CLS, DIGINOVE, GECOSistema, GMV, Hydroclimat PREDICT SERVICES, SUEZ EAU France – Center Rivages Pro Tech, Thales Services Numériques, WASDI sarl
Possible topics for PCP (cross-analysis)	**integrating real time analytics and mapping on a relevant range of risks: flooding, sea level rise, marine submersion, extreme rainfall and storms/gales** **coupled data between above risks and infrastructural risks (multiplication of extreme events etc.)**

Showcase title (T1.5)	
Domain (cross-analysis)	Civil security and protection (also: Sustainable urban communities, Marine and coastal environment)
Explanation (cross-analysis)	When waste is dumped illegally (in water or elsewhere), it may be difficult for law enforcement agencies to trace the responsible of criminal behaviour. It is also not possible to inform and prevent the flow of the waste cross-borders. There is no data which can be used in criminal proceedings as proof.
Concerned climate challenges (T1.1.2)	Many of the challenges pertaining to civil security and protection stem from other application domains. (Also see comments above on Waste management and storage.) Increased frequency of droughts and of heatwaves is a concern from Lithuania and Poland to Spain, from Belgium to France, Germany, Italy and Greece, with consequences both on water quality and quantity and indirectly on other economic sectors, e.g. energy production (water scarcity in highly industrialised regions of western Germany and in Marche, impact of hotter waters in parts of Belgium, France, Italy, Lithuania). The multiplication of extreme events – flooding, either extreme rainfall or sea level rise, threatens to disrupt energy production in Germany, Lithuania, Poland; frost is mentioned as a disrupting factor in some Polish regions, but also in Tuscany (affecting water provision), as can be tree falls resulting from storms e.g. in Finland. Increase in other more specific risks ranges from water pollution, landfill flooding and fires (Lithuania) to peak flood discharges (northern Germany) or consequences of ocean acidification on infrastructures (western France).

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	Cities are affected by many the challenges linked to other application domains, often at more acute levels due to the concentration of population and economic activities. Classic examples are heatwaves, who are generally expected to rise in frequency, duration and intensity, and urban heat islands mostly in meridional regions. Heatwaves are mentioned in almost every region of the mapping. Being characterised in comparison with average local temperatures, they remain globally hotter in more southern regions; however, they also come on top of climate challenges in regions that are generally cooler (from the northeast of France to the southern half of Finland) as local populations are much less used to dealing with abnormally high temperatures, both biologically and in terms of housing design, insulation and equipment. In many cases, e.g. in Spain and in parts of Italy, heatwaves and degradation of air quality (as well as increase in allergens such as pollens, often linked to northbound migration of vegetal species, and in infectious diseases gaining ground) are coupled and amplify each other's negative impact on human health. One other frequently recurring challenge is the growing risk of flooding in urban areas, coming from heavy rainfall or from river overflow, marine submersion or sea level rise, often aggravated by soil degradation, itself amplified by droughts. Almost every province in Belgium and in the Netherlands is affected, as are some Greek, Italian, Polish and inland French regions. Swelling and shrinking soils are also an increasingly common consequence of hydrogeological instability, for instance in southern France and in Italy: they primarily affect agriculture and land use but also create vulnerability for building foundations in urban areas, and sometimes landslide risks. Flooding risks are mentioned in almost all coastal regions, associated with sea level rise (French Mediterranean coastline, Liguria, Andalusia, Balearic Islands, but also northern Germany and Poland, Asturias, Friuli Venezia Giulia), marine submersion (North and Baltic seas, Cantabria, Liguria, Provence Côte d'Azur), extreme rainfall, thunderstorms and gales (Poland, Cantabria), combinations of those factors (e.g. northern Germany, northern Spain, Netherlands, Lithuania, French Atlantic coast), general hydrogeological instability (western and eastern Italy) combined with more frequent droughts and change in rainfall regime (e.g. Liguria). Coastal water issues include risks of salinization and freshwater & drinking water shortages (western France, Emilia-Romagna, Spain, the Netherlands…), decreased water quality (Lithuania, Tuscany, bathing water quality in the Netherlands). Effects of climate change are also seen inland: higher risks of land subsidence and of peat oxidation (northern Netherlands), of landslides (Pomerania), biodiversity loss, affected endorheic ecosystems, eutrophication of water bodies, damaged ecosystem services (Asturias, Emilia-Romagna, Galicia, Bremen). Systemic issues are highlighted, such as the increasing tension between urbanisation and vulnerable natural environments.
Possible scopes (cross-analysis)	- illegal waste dumping - use of satellite-based evidence to identify perpetrators and as evidence before courts
Relevant EU legislation (T1.1.1)	Likely forbidden by national laws.
Companies offering EO-based CS in similar domains (T1.3)	MEOSS Disaitek
Possible topics for PCP	**Illegal waste dumping**

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(cross-analysis)	

Showcase title (cross-T1.5)	**Building and restoring climate-resilient infrastructure**
Domain (cross-analysis)	Civil security and protection (also: Sustainable urban communities, Energy and utilities)
Explanation (cross-analysis)	Infrastructure is, ideally, built to last. Nonetheless, the current best practices do not always take into consideration the latest and future evolution of the climate crisis, thus not accounting for the increased number and frequency of extreme events when building or restructuring resilient infrastructure.
Concerned climate challenges (T1.1.2)	Some challenges are very widely shared across countries and regions, notably those related to flooding risks and a range of others, separately or in combination: heavy rainfall, storms and hailstorms, sea level rise, groundwater rise, river overflow, marine submersion, landslides, mudflows, avalanches… affecting land use, urbanised areas and built environments, critical infrastructures, energy and water production, transportation and mobility; to severe droughts and acute water scarcity; to forest fires; to increasingly intense, frequent and longer heatwaves, which can also trigger cascading effects and disrupt key value chains; to swelling and shrinking soils.
Possible scopes (cross-analysis)	- planning of new resilient infrastructure - making existing infrastructure more climate-change-resilient - monitoring of multiple (integrated) risks
Relevant EU legislation (T1.1.1)	The European Green Deal aims to transform Europe into a greener, more sustainable, and climate-resilient continent by promoting the efficient use of resources, reducing greenhouse gas emissions, protecting the environment, and fostering sustainable innovation and economic development, while ensuring a just and inclusive transition for all stakeholders.
Companies offering EO-based CS in similar domains (T1.3)	SARWind EOMAP Foundation for Climate Research geopredict HD Rain Hydroclimat Ticinum Aerospace Srl CLS DIGINOVE GECOSistema GMV PREDICT SERVICES SUEZ EAU France – Centre Rivages Pro Tech Thales Services Numériques (WASDI sarl)
Possible topics for PCP (cross-analysis)	integrating data to anticipate and react to cascading effects as energy demand rises. also as above: integrating real time analytics and mapping on a relevant range of risks: flooding, sea level rise, marine submersion, extreme rainfall and storms/gales, coupled data between above risks and infrastructural risks

Showcase title (1.5)	**Detecting climate vulnerability in agriculture and planning resilience**
Domain (cross-analysis)	AFOLU
Explanation (cross-analysis)	The climate crisis is putting more and more and more pressure on agricultural species. Information and forecasting of the environmental conditions, combined with other data can be a valuable input for mitigation actions.

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Concerned climate challenges (T1.1.2)	Climate change will hit productivity. Agricultural yield may decrease in very different contexts (Centre-Val de Loire, Saarland, Berlin, Hessen, Mecklenburg-Vorpommern, Emilia Romagna, Liguria, Marche, Sardinia, Tuscany, the Netherlands, Castilla-Leon, Murcia…), linked with higher evaporation (southern Spain), shorter crop maturation due to higher average temperatures (Galicia), higher risk of loss of nutritional value (Sardinia). Plants and animals may reach their adaptation limits (e.g. Hessen, Saxony). Impacts on agriculture will often depend on species. A risk on fruit and vine already observed with increasing frequency is linked to frost risk during flowering, which can trigger earlier harvests (e.g. PACA). Other challenges come from thinner snow cover (alpine Italian regions), higher volatility of snow cover and vegetation periods (Lithuania), negative consequences on permafrost (Trentino Alto Adige). Generally, there are fears of more inadequacy of precipitation cycles to seasonal agricultural needs (e.g. in Poland). Forests shall suffer as well with degradation risks (e.g. PACA, Saarland), high vulnerability of species to droughts and parasites (Wallonia, Grand Est, Île-de-France, Pays de la Loire); in contrast, forests are expected to extend further in Lappi, which may provoke albedo reduction. Higher risks of infectious diseases, pests, fungi, also invasive species are foreseen everywhere, linked or not to the migration of species (e.g. Grand Est, Galicia, Bavaria, North Rhine-Westphalia, Saxony, Thuringia, northern Italy, regions across Spain – Aragon, Asturias, Canary Islands, Extremadura, Navarra, Valencian Community); longer wet periods and modified climate patterns will probably increase diseases, mosquitoes and pests (the Netherlands). Other negative developments concern eutrophication in the summer (e.g. Saarland), increased oxidation by ozone and high concentrations of ozone and air pollutants in dry seasons that can also affect plant growth (Île-de-France, Saarland), risks on pasture lands (PACA), even threats to reindeer husbandry (Lappi – the rest of Finland expects mixed or overall slightly positive effects of climate change). Biodiversity threats are also more and more emphasised (Antwerp, Brussels, most French regions and half of Spanish regions including Canary Islands, Lower Saxony, Emilia Romagna, Liguria, Aosta Valley…); more broadly, biodiversity displacement and change, migration of alien species, combined with other phenomena such as tropicalisation, might have more mixed impacts (Bavaria, North Rhine-Westphalia, Saxony, Thuringia, Friuli Veneto Giulia, Piedmont, Murcia, Poland…). Other expected changes whose effects have yet to be further assessed include changes in seasonal rhythms, modification of flowering cycles (e.g. Centre-Val de Loire), potentially longer and more productive agricultural seasons as well as timber production expected to increase but more vulnerable to the extreme weather events (Aosta Valley), extension of the growing period and vegetation cycles (eastern Slovakia, Poland).
Possible scopes (cross-analysis)	- decrease of agricultural yield - plant and animals hitting their adaptation limits, lower tolerance to pests and parasites - thinner snow cover - biodiversity risks
Relevant EU legislation (T1.1.1)	A Farm to Fork strategy New CAP (2023-2027)
Companies offering EO-based CS in similar domains (T1.3)	Will depend on narrower / more clearly defined scope
Possible topics for PCP (cross-analysis)	**Increased coordination on data for land use between sectoral public bodies, EO and climate/weather services and stakeholders/users across scales**

The above showcases are only exemplative. However, they attest to several possible, and complementary, paths to progress towards relevant PCP preparations by the end of the project.

5.2 Way forward

The specific needs mentioned above will be further explored with the procurers who pushed them forward. Consortium members shall investigate whether organisations in their respective networks (in particular regional and metropolitan or municipal authorities) could share a common interest for the same needs and could be willing to engage in a dialogue to understand similarities and differences in their respective place-based perception of these needs, with the aim to increase the critical mass of procurers interested and their aggregated capacity to reach out to the market.

The needs will be linked with broader patterns and clusters of regions identified through the mapping of regional challenges. This may help approach more proactively public procurers across regions that share common priority climate challenges related to the above-mentioned needs, while potentially widening the scope of CS applications around those needs, which could help engage further stakeholders once interested procurers are found and consolidate demand, increasing the benefit for procuring organisations and visibility for providers.

The work to consolidate demand and benefits for both the procurer and the provider sides will be further informed and refined by going back in greater detail to the relevant regional plans and surveys and EU, national and regional regulations. This shall be crossed checked with findings on national procurement legal frameworks, providing guidance to procurers interested in pursuing work towards possible PCPs while navigating more efficiently and effectively the possibilities of, or barriers to joint cross-border procurements linking the countries of the identified procurers.

Conversely, we shall seek to identify other granular needs in thematic areas where the analysis of climate challenges and risks across regions, complemented by findings from other sections of this document, may suggest strong potential added value for PCPs to unlock climate service development and use. The same steps as above shall be used to confirm or infirm the capacity to gather viable groups of public procurers to work on such possible PCPs.

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ANNEXES

ANNEX I - Mapping of EU Policies relevant for the Pre-Commercial Procurement of EO-based end user services

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Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The strategy will contribute to achieving the EU's biodiversity objectives as well as greenhouse gas emission reduction target of at least 55% by 2030 and climate neutrality by 2050.	Communication	Agriculture, forestry, and other land use	The **EU Biodiversity Strategy for 2030** sets outs a pledge to plant at least **3 billion additional trees by 2030 in full respect of ecological principles** with a long-term planning and monitoring.	2021	High	In this context, Earth Observation offers key status and temporal trend data on forest cover and composition, forest biomass and carbon stock, forest condition, forest disturbances, deforestation and forest degradation in Europe and the rest of the world. Additional key products EO offers in this domain support emergency management with respect to natural hazards affecting EU forests

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The Farm to Fork Strategy is at the heart of the Green Deal. It addresses comprehensively the challenges of sustainable food systems and recognises the inextricable links between healthy people, healthy societies and a healthy planet. The strategy is also central to the Commission's agenda to achieve the United Nations' Sustainable Development Goals (SDGs). All citizens and operators across value chains, in the EU and elsewhere, should benefit from a just transition, especially in the aftermath of the COVID-19 pandemic and the economic downturn. A shift to a sustainable food system can bring environmental, health and social benefits, offer economic gains and ensure that the recovery from the crisis puts us onto a sustainable path. Ensuring a sustainable livelihood for primary producers, who still lag behind in terms of income, is essential for the success of the recovery and the transition.	Communication	Agriculture, forestry, and other land use	Farm to Fork 2030 targets * Increase agriculture, fisheries and aquaculture GHG reduction target to over 50% * 25% of agriculture land to be used for organic farming * 50% reduction in sales of antimicrobials used for farmed animals * 50% reduction of the use and risk of pesticides * 20% reduction in the use of fertilisers	2020 (May)	High	High relevance for the project: Agriculture Earth Observation enhances agriculture In agriculture, Earth Observation imagery and data analytics have revolutionised food production and supply chain management with the development of precision farming.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
Launched in 1962, the EU's common agricultural policy (CAP) is a partnership between agriculture and society, and between Europe and its farmers. support farmers and improve agricultural productivity, ensuring a stable supply of affordable food; safeguard European Union farmers to make a reasonable living; help tackle climate change and the sustainable management of natural resources; maintain rural areas and landscapes across the EU; keep the rural economy alive by promoting jobs in farming, agri-food industries and associated sectors.	Other	Agriculture, forestry, and other land use	10 different 'general' objectives, and then related **country-specific objectives**	2021 (December last update)	High	Several areas of the Common Agricultural Policy (CAP) benefit from Copernicus data and services. These span from monitoring of agricultural market, the CAP control systems, environmental monitoring and farmer level support. Specific examples include improvement in environmental performance of farms, the Land Parcel Identification System, on-demand EO data, along with high resolution data to monitor agricultural practices, integration with modelling for yield forecasting and identifying exceptional circumstances which can support both environmental compliance measures and on-farm agronomic practices

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The EAFRD aims to improve competitiveness for farming, protect the environment and the countryside, improve the quality of life and diversification of the rural economy, and support locally based approaches to rural development. ach EU country will design a CAP Strategic Plan, combining funding for income support, rural development, and market measures. When designing their strategic plans, EU countries will contribute to the nine specific objectives through a toolbox of broad policy measures provided by the Commission, which can be shaped around national needs and capabilities.	Other	Agriculture, forestry, and other land use	The EAFRD priorities are in turn broken down into 18 specific focus areas. In their programmes, countries set out targets relating to their chosen priorities and focus areas, as well as a strategy for meeting their targets.	2021	High	EO solutions are well established and extremely useful when it comes to the classification and monitoring of crops. Through the computation of vegetation indices from satellite data, the health, growth rate and projected yields of crops can be understood which can help decision making, and in particular, help to optimise resource utilisation, such as fertilizer application, irrigation or weed spraying. - Programme duration: 2021-2027
In 2012 EIP AGRI was launched to contribute to the EU's strategy for smart, sustainable and inclusive growth. EIP-AGRI brings together innovation actors (farmers, advisers, researchers, businesses, NGOs etc.) in agriculture. Its aim is to strengthen research and innovation to foster competitive and sustainable farming.	Other	Agriculture, forestry, and other land use	The aim of EIP-AGRI in the new programming period shall be to stimulate innovation and improve the exchange of knowledge and contribute to achieving the specific objectives of the new European CAP Network.	2012	High	Companies are using satellites to try to shed light on the sometimes tightly held secrets in the commodity trading world, from corn to barley to oranges. EO can help monitor the regional and international and trade of many agricultural commodities

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The European Green Deal presents a roadmap for making the EU's economy sustainable by turning climate and environmental challenges into opportunities across all policy areas and making the transition just and inclusive for all. The European Green Deal aims to boost the efficient use of resources by moving to a clean, circular economy and stop climate change, revert biodiversity loss and cut pollution. It outlines investments needed and financing tools available and explains how to ensure a just and inclusive transition. The European Green Deal covers all sectors of the economy, notably transport, energy, agriculture, buildings, and industries such as steel, cement, ICT, textiles, and chemicals. The European Green Deal provides an action plan, to boost the efficient use of resources by moving to a clean, circular economy and to restore biodiversity and cut pollution. It embraces various policy areas (compare timeline to the right)	Other	All	* Reducing net greenhouse gas emissions by at least 55% by 2030 * No net emissions of greenhouse gases by 2050	2020 (year of approval of the set of policies)	High	Earth observation is a key tool for the implementation of the European Green Deal, because it provides unique information, invisible down to earth. Timeline: https://drive.google.com/file/d/1FWuBXyo6WwWfZfPEM6lUYa3UA92CF3qL/view?usp=sharing

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The European climate law sets a binding Union climate target of a reduction of net greenhouse gas emissions (emissions after deduction of removals) by at least 55% by 2030 compared to 1990. It aims to put climate at the heart of all EU policy making, ensuring that future regulations support the emissions-cutting aims. This law also requires the creation of an independent expert body to advise on climate policies, and to develop a mechanism to calculate the total emissions the EU can produce from 2030-2050.	Regulation	All	**The Climate Law includes:** * an objective for the Union to reach climate neutrality by 2050 * an ambitious 2030 climate target of at least 55% reduction of net emissions of greenhouse gases as compared to 1990, with clarity on the contribution of emission reductions and removals * recognition of the need to enhance the EU's carbon sink through a more ambitious LULUCF regulation, for which the Commission made a proposal in July 2021 * a process for setting a 2040 climate target, taking into account an indicative greenhouse gas budget for 2030-2050 to be published by the Commission * a commitment to negative emissions after 2050	2021	Medium	Clear climate target that could possibly be monitored through, among others, EO technologies

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The European Green Deal Investment Plan, also known as the Sustainable Europe Investment Plan, aims to contribute to financing a sustainable transition, while supporting the regions and communities most exposed to its impact. By combining legislative and non-legislative initiatives, the plan addresses three aspects: 1) mobilising funding worth at least €1 trillion from the EU budget and other public and private sources over the next decade; 2) putting sustainability at the heart of investment decisions across all sectors; and 3) providing support to public administrations and project promoters to create a robust pipeline of sustainable projects	Communication	All	The plan will mobilise 25% of the EU budget for climate financing and invest in environmental objectives through several EU programmes.	2021	High	Very relevant for the project, as there is push for investments in the sustainability field

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The Arctic's fragile environment is a key indicator of climate change, which requires specific mitigation and adaptation actions as agreed with the global agreement at the COP-21 held in Paris in December 2015. To this end, the integrated EU Arctic policy has identified three priority areas: climate change and safeguarding the Arctic environment, sustainable development in and around the Arctic, and international cooperation on arctic issues.	Communication	Civil security and protection	One of the goals: contribute to improving maritime SAR, **making greater use of EU satellite systems and cooperation between coastguards,** in particular the Arctic Coast Guard Forum. Also, promote research and **collection of satellite data on the long-term implications of thawing permafrost,** to assess the potential impacts on communities, health and sustainable development and develop mitigation measures.	2021	High	Earth Observation -and Copernicus in particular- addresses these policy areas with a dedicated Arctic Ocean monitoring and forecasting centres that maintain long-time series of changes in the Arctic. Additionally, EO data for cryosphere monitoring, climate records on sea-ice and glaciers, and maritime surveillance services for Arctic fishing and shipping purposes also help shape action to safeguard the Arctic and polar areas.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The Safe System includes demands for safer and improved infrastructure • Properly maintained roads are believed to reduce the probability of road traffic accidents	Other	Civil security and protection	The introduction of a first set of eight key performance indicators (KPIs) will enable a more targeted analysis of Member States' performances and identify deficiencies. The 8 KPI: DISTRACTION, DISTRACTION TARGET, VEHICLE SAFETY, VEHICLE SAFETY TARGET, INFRASTRUCTURE, INFRASTRUCTURE TARGET, POSTCRASH CARE, POST-CRASH CARE TARGET	2021	Medium	Remote sensing can be applied to map overground road networks, including a classification of road type and surface material. At the same time, characteristics associated with ageing of specific materials can be detected, revealing or even predicting damages in the surface. Radar is applied to detect anomalies such as ground movement and change detection, e.g. displacement of bridges or rails can be performed based on historical data, enabling action before failure.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The EU emissions trading system (ETS)156 sets a fixed amount (cap) of allowable GHG emissions for EU electricity generation and industry. It covers around 45 % of the EU's greenhouse gas emissions. Economic operators are required to acquire an EU emission allowance (EUA) for each tonne of CO2e that they emit. Allowances can be acquired at auction and traded between operators. This would lead to cost-effective emissions reductions, as operators would reduce emissions where this has lower costs than the market price of allowances. Emissions covered under the ETS must be reduced by 43 % by 2030, compared with the levels in 2005, the year when the EU ETS was set up. The Carbon Capture and Storage (CCS) Directive sets the legal framework for carbon capture and storage in the EU.	Other	Energy and ulilities	The overall volume of greenhouse gases that can be emitted by power plants, industry factories and aviation sector covered by the EU Emissions Trading System (EU ETS) is limited by a **'cap' on the number of emission allowances.** Within the cap, companies receive or buy emission allowances, which they can trade as needed. **The cap decreases every year**, ensuring that total emissions fall	2021 (phase 4)	High	Satellite data could play a role in monitoring, reporting and verifying compliance with emissions trading systems also known as cap and trade. To date, satellite data has not been widely applied to the task of supporting those systems. This raises interest for pre-commercial procurement.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
On 27 February 2018 the Council formally approved the reform of the EU emissions trading system (ETS) for the period after 2020. The revised ETS directive is a significant step towards the EU reaching its target of cutting greenhouse gas emissions by at least 40% by 2030, as agreed under the EU's 2030 climate and energy framework and fulfilling its commitments under the Paris Agreement.	Other	Energy and ulilities	The long- term objective for 2050, agreed by the European Council in 2009, is an 80-95 % reduction in GHG emissions compared to 1990. In the medium term, the EU aims to reduce GHG emissions by 20 % by 2020, and by 40 % by 2030.	2020	High	Satellite data could play a role in monitoring, reporting and verifying compliance with emissions trading systems also known as cap and trade. To date, satellite data has not been widely applied to the task of supporting those systems. This raises interest for pre-commercial procurement.
The Fit for 55 package is a set of proposals to revise and update EU legislation and to put in place new initiatives with the aim of ensuring that EU policies are in line with the climate goals agreed by the Council and the European Parliament. The package of proposals aims at providing a coherent and balanced framework for reaching the EU's climate objectives, which: • ensures a just and socially fair transition • maintains and strengthens innovation and competitiveness of EU industry while ensuring a level playing field vis-à-vis third country economic operators • underpins the EU's position as leading the way in the global fight against climate change	Other	Energy and ulilities	Reduce greenhouse gas emissions by 55% by 2030.	Proposed: July 2021 (the plans may become law in 2022)	Medium	Relevant field, but no specific call for EO pre-commercial procurement

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
In July 2016, the European Commission presented a proposal for a regulation to limit post-2020 national emissions of greenhouse gases (GHG) in sectors not covered by the EU emissions trading system (ETS). These include transport, buildings and agriculture. The proposed regulation would be the successor of the Effort Sharing Decision that sets annual national GHG emission limits for the period 2013-2020. The proposed regulation is part of the EU's efforts to reduce its GHG emissions by at least 40% below 1990 levels by 2030. This target was set by the European Council in October 2014, and also constitutes the EU's international commitment under the 2015 Paris Agreement on climate change.	Regulation	Energy and ulilities	The maximum limit that can be used annually in **2021-2030 is set at 2% of each country's emissions in 2005,** except for Ireland, Luxembourg and Iceland that are allowed up to a limit of 4%. The total maximum amount for all eleven eligible countries is limited to **107 million tonnes.**	2018	High	Advancements in satellite technology and imaging can support national emission reporting exercises under the Paris Agreement. It is possible to monitor the geologic storage of carbon dioxide using multicomponent SAR and optical interferometry. Interest for pre-commercial procurement of tools that can conduct this type of monitoring.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The 2030 framework proposes new targets and measures to make the EU's economy and energy system more competitive, secure and sustainable. It includes targets for reducing greenhouse gas emissions and increasing use of renewable energies, and proposes a new governance system and performance indicators.	Other	Energy and ulilities	The 2030 Climate and Energy Framework set three key targets for the year 2030: - at least 40% cuts in greenhouse gas emissions from 1990 levels - at least 27% share for renewable energy - at least 27% improvement in energy efficiency	2020 (These targets have since been revised again under the European Green Deal published in December 2019, the European Commission's 'Roadmap' for moving to a climate neutral economy by 2050)	High	Advancements in satellite technology and imaging can support national emission reporting exercises under the Paris Agreement

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
In November 2017, the European Commission proposed a revision of Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles (the Clean Vehicles Directive), after an evaluation showed that the directive had yielded limited results. The proposed directive aims to promote clean mobility solutions in public procurement tenders and thereby raise the demand for, and the further deployment of, clean vehicles. The proposal provides a definition for clean light-duty vehicles based on a combined CO2 and air-pollutant emissions threshold; for heavy-duty vehicles, it gives a definition based on alternative fuels. The proposal is in line with the European Commission's energy union package, which plans action on the further decarbonisation of road transport in line with the 2030 climate and energy targets	Directive	Energy and ulilities	The national targets are defined as a minimum percentage of clean vehicles in the aggregate public procurement across a Member State. This means, Member States have full flexibility in how they distribute the effort across different contracting authorities and contracting entities.	2021	Medium	Literature shows that satellite data can be used to track vehicles emissions. For example, cities and states may soon have a new high-tech tool in the battle against automotive air pollution, thanks to NASA satellite technology originally developed to track global greenhouse gases and the Earth's protective ozone layer. This raises interest in pre-commercial procurement for this type of technology. Nevertheless, this type of monitoring requires a very high-res solution (both temporal and spatial). I do not see it feasible in the short-mid term.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
On 30 November 2016, the European Commission presented a proposal for a revised Energy Efficiency Directive, as part of the Clean Energy package. This aims to adapt and align EU energy legislation with the 2030 energy and climate goals and contribute towards delivering the energy union strategy. The Commission initially proposed a 30 % binding EU energy efficiency target for 2030, to be achieved by means of indicative national targets and the extension beyond 2020 of the energy savings obligation scheme, which currently requires utility companies to help their consumers use 1.5 % less energy each year. The Commission proposal also aims to make the rules on energy metering and billing clearer for consumers. Trialogue negotiations started in February 2018 and resulted in a provisional agreement among the EU Institutions on 19 June 2018.	Directive	Energy and ulilities	* The revised directive introduces a binding EU 30 % energy efficiency target, to be achieved by means of indicative national energy efficiency contributions * The 1.5% annual energy savings obligation is extended from 2020 to 2030 and possibly beyond.	2018	Medium	EO has a growing importance in the field of energy saving. An example are the upcoming Sentinel missions, which are part of the Copernicus programme, that will aid in identifying potential sites for solar or wind power generation.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The Directive aims to provide guiding principles on financial support schemes for RES, renewable energy self-consumption, energy communities and district heating. It seeks to enhance mechanisms for cross-border cooperation, simplify administrative processes, strengthen the sustainability and greenhouse gas emissions-savings criteria for biofuels, and mainstream the use of RES in the transport sector and in the heating and cooling sector.	Directive	Energy and ulilities	The revised directive sets higher GHG emissions savings criteria for biofuels and bioliquids. New installations, from 2021, will need to reduce GHG emissions by 65 % (compared to equivalent fossil fuels), in order to be defined as a RES. Meanwhile, biomass for electricity, heating and cooling will need to reduce GHG emissions by 70 % from 2021, rising to 80 % reductions from 2026.	2018	High	High potential for the project Because it can provide high temporal and spatial resolution, remote sensing technology is already making available quality-controlled geodata and information. This now makes it possible to support the routine and standardized monitoring of biomass resources over large areas. This raises interest in pre-commercial procurement for this type of technology.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
This Communication proposes an EU strategy to make offshore renewable energy a core component of Europe's energy system by 2050. This requires taking a diversified approach tailored to different situations. Therefore the strategy presents a general enabling framework, addressing barriers and challenges common to all offshore technologies and sea basins but also sets out specific policy solutions adapted to the different state of development of technologies and regional contexts.	Communication	Energy and ulilities	The strategy sets **targets for an installed capacity of at least 60 GW** of offshore wind and 1 GW of ocean energy by 2030, and **300 GW and 40 GW**, respectively, by **2050**.	The strategy sets targets for an installed capacity of at least 60 GW of offshore wind and 1 GW of ocean energy by 2030, and 300 GW and 40 GW, respectively, by 2050.	High	High potential for the project: The problem is there is hardly any offshore wind data available to industry. Furthermore, existing data record mainly extreme wind events. And to gather in-situ data from a single offshore meteorological mast can cost a million Euros a year, and provides data only for a small area. But using satellites enables a shift from a local to a global view. The sophisticated Synthetic Aperture Radar (SAR) instruments on board ESA's ERS-2 and Envisat can provide high-resolution 100-metre data on the wind field, and a decade-long data archive is available. There is therefore incentive for pre-commercial procurement, to get the right technology to built offshore energy stations.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The Clean energy for all Europeans package consists of 8 new laws. Following political agreement by the EU Council and the European Parliament (finalised in May 2019) and the entry into force of the different EU rules, EU countries have 1-2 years to convert the new directives into national law. The new rules will bring considerable benefits for consumers, the environment, and for the economy. By coordinating these changes at EU level, the legislation also underlines EU leadership in tackling global warming and makes an important contribution to the EU's long-term strategy of achieving carbon neutrality (net-zero emissions) by 2050.	Directive	Energy and ulilities	n/a	2019	Medium	As mentioned above, there are several possible applications for pre-commercial procurement of EO technology in the filed of energy

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
Sector integration means linking the various energy carriers - electricity, heat, cold, gas, solid and liquid fuels - with each other and with the end-use sectors, such as buildings, transport or industry. Linking sectors will allow the optimisation of the energy system as a whole, rather than decarbonising and making separate efficiency gains in each sector independently. The new EU strategy will involve various existing and emerging technologies, processes and business models, such as ICT and digitalisation, smart grids and meters and flexibility markets.	Other	Energy and ulilities	The strategy aims to ensure that the EU fully exploits its head-start and expertise in renewable and smart energy technologies	2020	High	Relevant for PROTECT, since a lot of what EO does for energy can feed into integrating the right sources together for this purpose
This Regulation lays down rules for the timely development and interoperability of trans-European energy networks in order to achieve the energy policy objectives of the Treaty on the Functioning of the European Union (TFEU) to ensure the functioning of the internal energy market and security of supply in the Union, to promote energy efficiency and energy saving and the development of new and renewable forms of energy, and to promote the interconnection of energy networks.	Regulation	Energy and ulilities	Set of guidelines for the timely development and interoperability of energy infrastructure priority corridors and areas that contribute to ensuring climate change mitigation, in particular achieving the EU's 2030 energy and climate targets and overall climate neutrality by 2050.	2013	High	Earth Observation is key in reaching energy efficiency and energy saving and the development of new and renewable forms of energy. For this reason, there is a high potential for PROTECT and pre-commercial procurement in this field.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The EU Industrial Strategy is meant to support the twin transition to a green and digital economy, make EU industry more competitive globally, and enhance Europe's open strategic autonomy. As a primary vehicle of innovation in the various ecosystems, small and medium enterprises (SMEs) need to be borne in mind in all actions under this Strategy. This is reflected in a horizontal manner by increased attention to regulatory burdens for SMEs. New actions will strongly benefit SMEs and start-ups, whether it be from a strengthened Single Market, reduced supply dependencies or the accelerated green and digital transitions. The Strategy also includes some measures dedicated to SMEs such as on increased resilience, combating late payments, and supporting solvency.	Communication	Energy and ulilities	The 2020 Industrial Strategy included a list of actions to support the green and digital transitions of EU industry, many of which have already been adopted or launched.	2020	Medium	No clear link with EO, but there are several fields in which it would be relevant. Such as: energy intensive and renewable energy industries

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
To pursue this dual ambition of energy gains and economic growth, in 2020 the Commission published the strategy "A Renovation Wave for Europe – Greening our buildings, creating jobs, improving lives" to boost renovation in the EU. It aims to double annual energy renovation rates in the next 10 years. As well as reducing emissions, these renovations will enhance quality of life for people living in and using the buildings, and should create many additional green jobs in the construction sector. The Renovation Wave identifies 3 focus areas: Tackling energy poverty and worst-performing buildings Public buildings and social infrastructure Decarbonising heating and cooling	Communication	Energy and ulilities	It aims to double annual energy renovation rates in the next 10 years. As well as reducing emissions, these renovations will enhance quality of life for people living in and using the buildings, and should create many additional green jobs in the construction sector.	2020	Medium	No clear link with EO, but there are several fields in which it would be relevant. Such as: public buildings and infrastructure, decarbonising heating and cooling, and monitoring buildings' energy efficiency.
REPowerEU is the European Commission's plan to make Europe independent from Russian fossil fuels well before 2030, in light of Russia's invasion of Ukraine. The REPowerEU plan sets out a series of measures to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition, while increasing the resilience of the EU-wide energy system.	Communication	Energy and ulilities	* 2/3 cut in Russian gas consumption by the end of 2022 * Increase the binding 'Energy Efficiency Directive (EED)' target to 13% from 9%. * Increase the EU's headline 2030 target for renewables from 40% to 45%	Published: 18-May-2022	Medium	This policy is relevant for PROTECT in at least two ways: first, through the push for more renewables will enable the use of EO for renewables. Secondly, since EO can be used for mapping energy efficiency of buildings.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
As part of the REPowerEU plan, this strategy aims to bring online over 320 GW of solar photovoltaic by 2025 (more than doubling compared to 2020) and almost 600 GW by 2030 . These frontloaded additional capacities displace the consumption of 9 bcm of natural gas annually by 2027.	Communication	Energy and ulilities	* 320 GW of solar photovoltaic by 2025 and almost 600 GW by 2030	2022	High	Accessible earth observation data can enhance clean energy projects by enabling monitoring energy capacity and maintenance status at scale. Incorporating satellite-based earth observation will help to fast track this by providing advanced insights that can be used for forecast models, information products and other tools to improve decision making – be it at an organisational or policy-making level. Earth Observation can be used for planning on where to deploy single PVs (solar atlas) and solar farms.
The EU Water Framework Directive 2000 (WFD) is arguably the most important, far-reaching, water legislation ever to emerge from the EU. It was transposed into law in EU Member States at the end of 2003. In addition to chemical water quality targets, ecological objectives have been set for each water body. A key aim of the WFD is for all water bodies to achieve 'good ecological and chemical status'. The original target for achieving good status was 2015, but further deadlines are set for 2021 and 2027.	Directive	Marine and Coastal environment	In addition to chemical water quality targets, ecological objectives have been set for each water body. A key aim of the WFD is for all water bodies to achieve 'good ecological and chemical status'. The original target for achieving good status was 2015, **but further deadlines are set for 2021 and 2027**	2014	High	In this context, Earth Observation data from satellite are useful to integrate and coordinate different sources of information for decision-making, as well as to model for forecasting and alerts (these are services built on EOdata, so perfect for PROTECT). For instance, this includes the near real-time detection of pollution from satellite together with ship position from traffic monitoring systems at least for ship-based pollution (the union maritime information and exchange system - SafeSeaNet) and manned or unmanned aerial means from coastal states for verification and identification of polluters

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The Directive for Maritime Spatial Planning in Europe was adopted to reduce conflicts, encourage investments (blue economy), increase cross-border cooperation and protect the environment.	Directive	Marine and Coastal environment	Objectives: reducing conflicts and creating synergies between different activities encouraging investment through predictability, transparency and legal certainty increasing cross-border cooperation between EU countries to develop renewable energy, allocate shipping lanes, lay pipelines and submarine cables etc protecting the environment by assigning protected areas, calculating impacts on ecosystems and identifying opportunities for multiple uses of space	2014	High	Part of such environmental information is provided by Copernicus through long-time series of ocean products necessary to produce atlas (European Atlas of the Seas). However, there is a need for additional Earth Observation services to identify and monitor man-made activities like shipping lanes, fisheries and aquaculture grounds along with land-sea consistent data and information products for coastal management.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The aim of the European Union's ambitious Marine Strategy Framework Directive is to protect more effectively the marine environment across Europe.	Directive	Marine and Coastal environment	The new E**U Biodiversity Strategy for 2030 (adopted in May 2020)** aims to strengthen th**e protection of marine ecosystems and to restore them to achieve "good environmental status"**, including through the expansion of protected areas and the establishment of strictly protected areas for habitats and fish stocks recovery	2017	High	Earth Observation supports a wide range of coastal and marine environment applications such as those on rising sea levels and sea surface temperature, but also with increasing emphasis on the "green" ocean aspects with products addressing coastal ecology, biogeochemistry and pollution/eutrophication. There is therefore a significant opportunity to develop new applications and services that would facilitate the implementation of this directive
The Common Fisheries Policy (CFP) Regulation has defined a set of harmonised provisions to ensure sustainability of fisheries and aquaculture in EU waters and for the EU fleet worldwide	Regulation	Marine and Coastal environment	Goal: to ensure sustainable fisheries and guarantee incomes and stable jobs for fishers.	2013	High	High relevance for PROTECT, as there is large potential for EO services in the field of sustainable fisheries. This includes. In fact, satellite data is already widely used to monitor the marine environment, support maritime safety and help manage fishing activities as well as detecting illegal fishing activities.

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The European Climate Pact is an opportunity for people, communities, and organisations to participate in climate action across Europe: • learn about climate change • develop and implement solutions • connect with others and maximise the impact of these solutions As part of the European Green Deal, the Pact aims to become a lively space to share information, debate, and act on the climate crisis, and offer support for a European climate movement to grow and consolidate.	Other	All	the Pact is part of the European Green Deal and is **helping the EU to meet its goal to become climate-neutral by 2050**.	2019	High	As for the Green Deal, this policy is relevant for the project, as there is push for investments in the sustainability field. In this case, even more so due to the element of citizen engagement.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
It strategy aims to support the financing of the transition to a sustainable economy by proposing action in four areas: transition finance, inclusiveness, resilience and contribution of the financial system and global ambition.	Communication	Sustainable urban communities	The strategy includes six sets of actions: (1)Extend the existing sustainable finance toolbox to facilitate access to transition finance (2)Improve the inclusiveness of small and medium-sized enterprises (SMEs), and consumers, by giving them the right tools and incentives to access transition finance. (3)Enhance the resilience of the economic and financial system to sustainability risks (4)Increase the contribution of the financial sector to sustainability (5)Ensure the integrity of the EU financial system and monitor its orderly transition to sustainability (6)Develop international sustainable finance initiatives and standards, and support EU partner countries	2021	High	Very relevant for the project, as there is push for investments in the sustainability field

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The EU ETS is a cornerstone of the EU's policy to combat climate change and its key tool for reducing greenhouse gas emissions cost-effectively. It is the world's first major carbon market and remains the biggest one.	Directive	Sustainable urban communities	The sectors covered by the EU Emissions Trading System (EU ETS) must reduce their emissions by 43% compared to 2005 levels. To increase the pace of emissions cuts, the overall number of emission allowances will decline at an annual rate of 2.2% from 2021 onwards, compared to 1.74% currently.	2021	High	EO pre-commercial procurement is extremely relevant for the monitoring of emissions.
It aims to protect the environment in the European Union (EU) from the adverse effects (such as eutrophication) of urban wastewater. It sets out EU-wide rules for collection, treatment and wastewater discharge. The law also covers wastewater generated by industries such as the agro-food industries (like food-processing and brewing).	Directive	Sustainable urban communities	By 2040 the new rules will (1) save almost EUR 3 billion per year across the Europe, (2) reduce greenhouse gas emissions by over 60% compared to 1990, (3) **decrease water pollution by more than 365 thousand tonnes**, (4) **cut microplastics emissions by 9**%	2021	Medium	Satellite imaging has potential for the monitoring of waste water treatment. Therefore there is a link with pre-commercial procurement and PROTECT

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The EU Covenant of Mayors for Climate & Energy brings together thousands of local governments voluntarily committed to implementing EU climate and energy objectives. The Covenant of Mayors was launched in 2008 in Europe with the ambition to gather local governments voluntarily committed to achieving and exceeding the EU climate and energy targets. Not only did the initiative introduce a first-of-its-kind bottom-up approach to energy and climate action, but its success quickly went beyond expectations.	Other	Sustainable urban communities	**Goals for 2030:** Reducing CO2 (and possibly other greenhouse gas) emissions on the territory of our municipalities by at least 40% by 2030, namely through improved energy efficiency and the greater use of renewable energy sources; **Goal for 2050:** Decarbonised territories, thus contributing to keeping average global warming well below 2°C above pre-industrial levels. Universal access to secure, sustainable and affordable energy services for all, thus enhancing quality of life and improving energy security. Grant universal access to secure, sustainable and affordable energy services for all, thus enhancing quality of life and improving energy security.	2008	High	Adapting to climate change requires data and information from all Earth system components: the atmosphere, the land, the cryosphere and oceans. As an example, in order to adhere to Covenant of Mayors Sustainable Energy and Climate Action Plan (SECAP) commitments, it is imperative to have both reference time series (data demonstrating of changes and trends) and climate change indicators that cover composite or specific economic sectors impacted by regional and international policies

The Directive on open data and the re-use of public sector information provides common rules for a European market for government-held data. The Directive introduces the concept of high-value datasets. Defined as documents, the re-use of high-value datasets is associated with important benefits for the society and economy. They are subject to a separate set of rules ensuring their availability free of charge, in machine readable formats. They are provided via Application Programming Interfaces (APIs) and, where relevant, as a bulk download. The thematic scope of high value datasets is provided in an Annex to the Directive. The thematic categories of high-value datasets, as referred to in Article 13(1) of the Directive, are: 1. geospatial 2. earth observation and environment 3. meteorological 4. statistics 5. companies and company ownership 6. mobility	Directive	All	n/a	2019	Medium	Once fully transposed on the national level, the new rules will: - stimulate the publishing of dynamic data and the uptake of Application Programme Interfaces (APIs); - limit the exceptions which currently allow public bodies to charge more than the marginal costs of dissemination for the re-use of their data; - enlarge the scope of the Directive to: *Data held by public undertakings, under a specific set of rules. In principle, the Directive will only apply to data which the undertakings make available for re-use. Charges for the re-use of such data can be above marginal costs for dissemination; *Research data resulting from public funding – Member States will be asked to develop policies for open access to publicly funded research data. New rules will also facilitate the re-usability of research data that is already contained in open repositories. -strengthen the transparency requirements for public–private agreements involving public sector information, avoiding exclusive arrangements.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The current proposal complements the Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information (Open Data Directive) 6 . This proposal addresses data held by public sector bodies that is subject to rights of others and therefore falls outside the scope of this Directive. The proposal has logical and coherent links with the other initiatives announced in the European strategy for data. It aims at facilitating data sharing including by reinforcing trust in data sharing intermediaries that are expected to be used in the different data spaces. It does not aim to grant, amend or remove the substantial rights on access and use of data. This type of measures is envisaged for a potential Data Act (2021) 7 .	Other	All	n/a	n/a	Medium	The adoption of this proposal would facilitate the use of data which might lead to the development of additional and more diverse climate services.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
A key pillar of the European strategy for data, the Data Governance Act seeks to increase trust in data sharing, strengthen mechanisms to increase data availability and overcome technical obstacles to the reuse of data. The Data Governance Act will also support the set-up and development of common European data spaces in strategic domains, involving both private and public players, in sectors such as health, environment, energy, agriculture, mobility, finance, manufacturing, public administration and skills.	Other	All	n/a	2022 (23 June)	Medium	The initiative aims to make more data available and facilitate data sharing across sectors and EU countries in order to leverage the potential of data for the benefit of European citizens and businesses.

Summary	Type of policy instrument	Application domain	KPIs	Enforcement date	Relevance to the project	Comments / Opportunities for PROTECT
The Taxonomy Regulation was published in the Official Journal of the European Union on 22 June 2020 and entered into force on 12 July 2020. It establishes the basis for the EU taxonomy by setting out 4 overarching conditions that an economic activity has to meet in order to qualify as environmentally sustainable. The Taxonomy Regulation establishes six environmental objectives Climate change mitigation Climate change adaptation The sustainable use and protection of water and marine resources The transition to a circular economy Pollution prevention and control The protection and restoration of biodiversity and ecosystems Different means can be required for an activity to make a substantial contribution to each objective.	Regulation	All	n/a	2020	Medium	The systemic use of the taxonomy could foster the uptake of climate services.

The EU's transport policy aims to increase mobility, remove major barriers in key areas and fuel growth and employment. Articles 90-100 of the Treaty on the Functioning of the European Union provide the legal bases for the EU's transport policy.	Directives	Sustainable urban communities	The European Commission's Sustainable and Smart Mobility Strategy together with an Action Plan of 82 initiatives, guide the work in the field of EU transport policy for the period 2021-2024. This strategy lays the foundation for how the EU transport system can achieve its green and digital transformation and become more resilient to future crises. The result will be a **90% cut in emissions by 2050,** delivered by a smart, competitive, safe, accessible and affordable transport system. The EU has also defined clear goals: the European Commission's current **"White Paper on Transport" calls for 30 percent of road freight transport to be transferred to other modes of transport such as rail or shipping by 2030, rising to more than 50 percent by 2050**. With regard to urban and private mobility, the share of **"conventionally fuelled" vehicles in city centres is to be halved by 2030** and reduced to the absolute minimum by 2050.	Common policy started in 1992, but new objectives set regularly	High	Evolving needs have shown that the sector has a need of Earth Observation data for a broad range of applications like topography (digital elevation models), geophysical and soil characteristics for civil engineering related to networks deployment, real-time monitoring and long-time records of known sites affected by ground motion or natural risks and more.

ANNEX II - Snapshot of Climate Challenges in European Regions

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
BELGIUM Adaptation priorities/fields (climate adapt): National level: [b] Biodiversity, [c] Crisis management, [e] Energy, [h] Health, [ic] International cooperation, [r] Research,[t] Transversal issues Regional level:[a] Climate adaptive agriculture and food chain, [ce] Climate adaptive and circular economy, [gb] Green blue networks and biodiversity, [h] Health, [ie] Climate adaptive infrastructure and environment, [sp] Spatial planning, [w] Water management						
Antwerpen	Massive emissions from Port of Antwerp and petrochemical cluster (world no. 2) [e] *Geothermal energy potential [e]*	Massive emissions from Port of Antwerp and petrochemical cluster [e] High emissions from very dense road network and from heating of buildings [h][ie][sp] Untapped potential of residual heat [e]	Massive emissions from Port of Antwerp and petrochemical cluster (second largest in the world) [e] Potential threats on inland shipping [c][ie]	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Higher forest fire risk [c][h][gb] Biodiversity threats [b][gb][h]	Higher flooding risk [c][gb][ie][sp][w] Higher forest fire risk [c][h][gb]	https://www.gouverneurantwerpen.be/sterk-antwerpen/klimaat-en-energie.html
Brabant Wallon	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	More frequent heatwaves [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	Higher forest fire risk [c][h][gb] High vulnerability of forest species to droughts and parasites [c][gb]	Higher flooding risk [c][gb][ie][sp][w] Higher forest fire risk [c][h][gb]	CPDT Wallonie (incl. https://cpdt.wallonie.be/sites/default/files/pdf/dt2_defi_2.pdf)
Bruxelles-Capitale	Greater pressure on energy consumption [e][ie]	More frequent heatwaves, heat island effect [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Biodiversity threats [b][gb][h]	Higher flooding risk [c][gb][ie][sp][w]	https://document.environnement.brussels/opac_css/elecfile/Clim_06
Hainaut	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	More frequent heatwaves [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	Higher forest fire risk [c][h][gb] High vulnerability of forest species to droughts and parasites [c][gb]	Higher flooding risk (incl. groundwater rise in former mining areas) [c][gb][ie][sp][w] Higher forest fire risk [c][h][gb]	CPDT Wallonie (incl. https://cpdt.wallonie.be/sites/default/files/pdf/dt2_defi_2.pdf)
Liège	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	More frequent heatwaves [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	Higher forest fire risk [c][h][gb] High vulnerability of forest species to droughts and parasites [c][gb]	Higher flooding risk [c][gb][ie][sp][w] Higher forest fire risk [c][h][gb]	CPDT Wallonie (incl. https://cpdt.wallonie.be/sites/default/files/pdf/dt2_defi_2.pdf)

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Limburg	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	More frequent heatwaves [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	Higher flooding risk [c][gb][ie][sp][w] Higher forest fire risk [c][h][gb]	https://klimaat.vmm.be/tools/impact
Luxembourg	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	More frequent heatwaves [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	Higher forest fire risk [c][h][gb] High vulnerability of forest species to droughts and parasites [c][gb]	Higher flooding risk [c][gb][ie][sp][w] Higher forest fire risk [c][h][gb]	NBRACER project proposal (currently in GAP phase)
Namur	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	More frequent heatwaves [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	Higher forest fire risk [c][h][gb] High vulnerability of forest species to droughts and parasites [c][gb]	Higher flooding risk [c][gb][ie][sp][w] Higher forest fire risk [c][h][gb]	CPDT Wallonie (incl. https://cpdt.wallonie.be/sites/default/files/pdf/dt2_defi_2.pdf)
Oost-Vlaanderen	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	-	n/a	Higher water erosion of the fertile arable land in hilly areas [a][gb][ie][w]	Higher flooding risk (rainfall, fluvial) [c][gb][ie][sp][w]	NBRACER project proposal (currently in GAP phase)
Vlaams-Brabant	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	More frequent heatwaves [h][ie][sp] Higher flooding risk [c][gb][ie][sp][w] More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	n/a	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	Higher flooding risk (rainfall, fluvial) [c][gb][ie][sp][w]	https://klimaat.vmm.be/tools/impact
West-Vlaanderen	More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w] Impact of hotter waters on energy production [c][e][ie][w]	-		More frequent droughts, water quality and quantity concerns [c][h][a][gb][ie][w]	Higher flooding risk (rainfall, fluvial, marine), heightened by polder structure under sea level [c][a][gb][ie][sp][w]	NBRACER project proposal (currently in GAP phase)

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
FINLAND **National adaptation priorities/fields (climate adapt): [b] Biodiversity, [c] Buildings and construction, [e] Environmental protection, [l] Land use, [w] Use and management of water resources**						
Åland	-	-	Some flooding risk (limited) [e]	-	Some flooding risk (limited) [e]	https://www.regeringen.ax/miljo-natur/klimat
Etelä-Karjala	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Etelä-Pohjanmaa	Risk of disrupted energy production (tree fall…)	-	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Etelä-Savo	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Kainuu	Risk of disrupted energy production (tree fall…)		n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Kanta-Häme	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Keski-Pohjanmaa	Risk of disrupted energy production (tree fall…)	-	Increased risk of erosion and quality degradation of coastal waters [e][w]	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Keski-Suomi	Risk of disrupted energy production (tree fall…)	-	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Kymenlaakso (Kymmenedalen)	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	Increased risk of erosion and quality degradation of coastal waters [e][w]	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Lappi	Risk of disrupted energy production (tree fall…)	-	Increased risk of erosion and quality degradation of coastal waters [e][w]	Extension of forests and albedo reduction [e][l] Threats to reindeer husbandry [l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Päijät-Häme	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Pirkanmaa	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Pohjanmaa	Risk of disrupted energy production (tree fall…)	-	Increased risk of erosion and quality degradation of coastal waters [e][w]	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Pohjois-Karjala	Risk of disrupted energy production (tree fall…)	-	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Pohjois-Pohjanmaa	Risk of disrupted energy production (tree fall…)	-	Increased risk of erosion and quality degradation of coastal waters [e][w]	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Pohjois-Savo	Risk of disrupted energy production (tree fall…)	-	n/a	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Satakunta	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	Increased risk of erosion and quality degradation of coastal waters [e][w]	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Uusimaa (Nyla nd)	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	Increased risk of erosion and quality degradation of coastal waters [e][w]	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
Varsinais-Suomi (Egentlig a Finland)	Risk of disrupted energy production (tree fall…)	More frequent heatwaves [c][e]	Increased risk of erosion and quality degradation of coastal waters [e][w]	Higher flooding risk [e][l][w] Erosion and landslide risk [e][l][w] Higher forest fire risk [e][l]	Higher flooding risk [e][l][w] Landslide risk [e][l][w] Higher forest fire risk [e][l] Risk of disrupted energy production Higher risk of infectious bacteria [e][l][w]	https://www.stat.fi/tup/khkinv/luku6
FRANCE **National adaptation priorities/fields (climate adapt): [a] Agriculture, [fa] Fishing and aquaculture, [fi] Finance and insurance, [fw] Forestry and its wood sector, [nbe] Nature, biodiversity and environmental heritage, [pr] Prevention and resilience to extreme events, [t] Tourism**						
Auvergne-Rhône-Alpes	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][fa][pr]	More frequent heatwaves [pr] Swelling and shrinking soils [a] Higher flooding risk [fi][pr] More frequent droughts, water quality and quantity concerns [a][pr]	n/a	Higher forest fire risk [fi][fw][pr] Swelling and shrinking soils [a] Biodiversity threats [nbe]	Higher forest fire risk [fi][pr] Higher flooding and landslide risk [fi][pr] Higher ozone pollution risk Higher risk of infectious bacteria in hotter fresh water [fa]	

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		Degradation of roads and railways [fi][t]				
Bourgogne-Franche-Comté	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][fa][pr]	More frequent droughts, water quality and quantity concerns [a][pr] Higher flooding risk [fi][pr] More frequent heatwaves and heat islands (low tolerance of local populations) [pr] Swelling soils	n/a	More frequent droughts, water quality and quantity concerns [a][fa][fw][nbe][pr] Swelling and shrinking soils [a] Higher risk of destructive storms [a][fi][fw][pr] Higher forest fire risk [fw][pr] High vulnerability of forest species to droughts and parasites [fw] *Earlier vine harvests and sweeter wines [a]*	Higher flooding and landslide risk [fi][pr] Higher risk of infectious bacteria and tiger mosquito Higher forest fire risk [fi][pr] Higher risk of destructive storms [a][fi][pr]	https://www.alterrebourgognefranchecomte.org/_recherche-images/download/8965/pdf/488/0
Bretagne	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][fa][pr]	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][pr]	Higher risk of marine submersion (incl. touristic areas) [fi][pr][t] Risk on fishing and shellfish farming [fa]	More frequent droughts, water quality and quantity concerns [a][fa][fw][nbe][pr] Biodiversity threats [nbe]	Higher sea and river flooding risk [fi][pr]	https://bretagne-environnement.fr/contenus?f%5B0%5D=field_tag_th_matique_gemet%3A1200
Centre-Val de Loire	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][fa][pr]	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][pr]	n/a	Higher forest fire risk [fi][fw][pr] More frequent droughts, water quality and quantity concerns [a][fw][nbe][pr] Modification of flowering cycles [a][nbe] Limited productivity (soft wheat) [a] Biodiversity threats [nbe]	Higher forest fire risk [fi][pr] Higher pollen allergy risk	https://www.centre-val-de-loire.developpement-durable.gouv.fr/changement-climatique-r1396.html
Corse	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][fa][pr] Risk on hydroelectricity	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][pr]	Higher risk of marine submersion (incl. ports, touristic beaches) [fi][pr][t] Higher risk of sea level rise [fi] Risk on fishing and shellfish farming [fa]	Higher forest fire risk [fi][fw][pr] More frequent droughts, water quality and quantity concerns [a][fa][fw][nbe][pr] Biodiversity threats [nbe]	Higher forest fire risk [fi][pr] Higher flooding risk [fi][pr] Higher risk of infectious bacteria and tiger mosquito [fa]	https://www.cerema.fr/system/files/documents/2021/06/analyse_des_effets_du_changement_climatique_en_corse_vfinale.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Grand Est	Impact of hotter waters on energy production	More frequent heatwaves (low tolerance of local populations) [pr] More frequent droughts, water quality and quantity concerns [a][pr]	n/a	Higher forest fire risk [fi][fw][pr] More frequent droughts, water quality and quantity concerns [a][fw][nbe][pr] Potentially higher risk of infectious diseases (vine, corn) [a] High vulnerability of forest species to droughts and parasites [fw]	Higher forest fire risk [fi][pr] Higher risk of ground collapse due to underground cavities [fi][pr] Higher risk of infectious human diseases	https://www.grand-est.developpement-durable.gouv.fr/changement-climatique-r6352.html
Guadeloupe	More frequent droughts, water quality and quantity concerns [a][fa][pr] Risk of salination of sweet water ecosystems [nbe]	More frequent droughts, water quality and quantity concerns [a][fa][pr] More frequent and intense cyclones [pr] Higher risk of marine submersion [fi][pr][t]	Some risk of sea level rise [fi][t] Higher risk of marine submersion [fi][pr][t] Higher risk of coastal erosion [nbe][t] Risk of salination of sweet water ecosystems [nbe] Risk on aquaculture (cyclones, coral reef degradation) [fi]	Risk of massive agricultural productivity drop (sugar cane, banana) [a] Higher impact of water scarcity on fodder [a] Biodiversity threats (marine and terrestrial) [nbe] Higher impact of cyclones on forests and mangroves [fw]	Higher risk of marine submersion [fi][pr][t] More frequent and intense cyclones [pr] Higher flooding risk [fi][pr]	https://guadeloupe.ademe.fr/sites/default/files/profil-vulnerabilite-guadeloupe-changement-climatique-2018.pdf https://www.ecologie.gouv.fr/sites/default/files/ONERC_Rapport_2012_OutreMer_WEB.pdf
Guyane française	More frequent droughts, impact on hydroelectricity [pr] Risk of salination of sweet water ecosystems [nbe]	Higher risk of marine submersion [fi][pr][t] Higher risk of coastal erosion [nbe][t] Higher flooding risk [fi][pr] Risk of increased thermal stress	Higher risk of marine submersion [fi][pr][t] Higher risk of coastal erosion [nbe][t] Risk of salination of sweet water ecosystems [nbe] Negative impact of higher sea temperatures on fishing, ecosystems Higher risk of marine submersion [fi]	Higher impact of water scarcity on fodder and on agricultural productivity, subsequent increase in deforestation [a] Loss of agricultural land due to coastal erosion [a] Higher forest fire risk [fi][fw][pr] Higher risk of drought [fw] High vulnerability of forest species to climate change, threats on biodiversity [fw][nbe]	Higher risk of marine submersion [fi][pr][t] Higher flooding risk [fi][pr] Higher forest fire risk [fi][fw][pr] Higher risk of development for tropical diseases Higher risk of landslides [fi][pr]	https://guyane.ademe.fr/sites/default/files/rapport-changement-climatique-pistes-reflexion-adaptation-regionale.pdf https://www.ecologie.gouv.fr/sites/default/files/ONERC_Rapport_2012_OutreMer_WEB.pdf
Hauts-de-France	More frequent heatwaves [pr]	More frequent heatwaves (low tolerance of local populations) [pr]	Higher risk of marine submersion [fi][pr][t] Risk on fishing? [fa]	Water scarcity [a][fw][nbe] More frequent droughts, water quality and quantity concerns [a][fa][fw][nbe][pr]	Higher risk of marine submersion [fi][pr]	observatoireclimat-hautsdefrance.org (incl. https://www.observatoireclimat-hautsdefrance.org/Les-grandes-questions/Changement-climatique-en-Hauts-de-France-ou-en-sommes-nous)

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Île-de-France	More frequent heatwaves (risk of electric grid disruption) [pr] Increased flooding risk [pr] Indirect impact of hotter waters on energy availability Impact of heatwaves and extreme rainfall on railways [pr] More frequent droughts, water quality and quantity concerns [a][fa][pr] Amplified systemic risk (very dense urban area)	More frequent heatwaves [pr] Heat islands, hot summer nights [t] (Somewhat) more intense extreme rainfall events, increased flooding risk [fi][pr] (Somewhat) more frequent droughts [a][pr] Low air quality Urban biodiversity threats [nbe] *Adaptation of public buildings and housing to increased thermal stress [pr]*	n/a	Higher forest fire risk [fi][fw][pr] (Somewhat) more frequent droughts [a][fw][nbe][pr] Water quality and quantity concerns, stress on humid areas [a][fa][nbe] Swelling and shrinking soils [a] Increased soil vulnerability [a][fw] Increased flooding risk [a][fi][fw][pr] Increased oxidation by ozone [a][fw][nbe] Biodiversity threats [nbe] High vulnerability of forest species and agriculture to droughts and parasites [fw][nbe]	More frequent heatwaves [pr] Increased flooding risk [fi][pr] Increased risk on energy availability Continuing ozone pollution risk Higher risk of infectious human diseases, pollen allergies Swelling and shrinking soils (risk for built areas)	https://www.arec-idf.fr/fileadmin/NewEtudes/000pack3/Etude_2851/20221115_diag_PRACC.pdf
Martinique	More frequent droughts, water quality and quantity concerns [a][fa][pr] More frequent droughts, impact on hydroelectricity [pr] Higher risk of landslides, threat on water availability [fi][pr] Potential positive effect on solar energy	More frequent droughts, water quality and quantity concerns [a][fa][pr] More frequent and intense cyclones [pr] Higher risk of marine submersion [fi][pr][t] Higher flooding risk [fi][pr]	Some risk of sea level rise [fi][t] Higher risk of marine submersion [fi][pr][t] Higher risk of coastal erosion and beach & ecosystem destruction [nbe][t] Risk on aquaculture (cyclones, coral reef degradation) [fi] Higher flooding risk [fi][pr]	Risk of massive agricultural productivity drop (sugar cane, banana) [a] Higher impact of water scarcity on fodder [a] Biodiversity threats (marine and terrestrial) [nbe] Higher impact of cyclones on forests and mangroves [fw]	More frequent and intense cyclones [pr] Higher flooding risk [fi][pr] Higher risk of marine submersion [fi][pr][t] Higher risk of landslides, threat on water availability [fi][pr]	http://www.biodiversite-martinique.fr/sites/default/files/etude_et_evaluation_des_impacts_de_la_vulnerabilite_et_de_ladaptation_de_la_martinique_au_changement_climatique_climpact_2012.pdf https://www.martinique.developpement-durable.gouv.fr/IMG/pdf/diagnostic_vf.3.pdf https://www.ecologie.gouv.fr/sites/default/files/ONERC_Rapport_2012_OutreMer_WEB.pdf
Mayotte	Risk of salination of sweet water ecosystems [nbe]	Higher risk of sea level rise [fi] Higher risk of marine submersion [fi][pr][t] Risk of salination of sweet water ecosystems [nbe]	Higher risk of sea level rise [fi] Higher risk of marine submersion [fi][pr][t] Risk of salination of sweet water ecosystems [nbe]		Higher risk of marine submersion [fi][pr][t] Higher risk of development for tropical diseases	https://www.ecologie.gouv.fr/sites/default/files/ONERC_Rapport_2012_OutreMer_WEB.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Normandie	Risk of strongly decreased water quantity (both on the ground and underground) [a] Concern on water quality (soil erosion, chemical concentration, saltwater intrusions) [a][fa]	More frequent heatwaves [pr] Increased risk of skin diseases More frequent droughts, water quality and quantity concerns [pr] Increased air quality concerns	Widespread coastal erosion, cliff collapse [nbe][pr][t] Increased flooding risk (sea level, rivers) [fi][pr] Increased saltwater intrusions [a] Risk of environmental contamination in estuaries [a][fa][nbe] Threats on oyster farming + several other shellfish *(positive impact for scallops)[fa]* Decrease of cod population (and probably temperate and cold water fish)[fa]	Increased soil erosion, run-off and mudflows [a][pr] Increased thermal stress (impact on grain, cattle) [a] (Partially) higher risk of droughts [a][fw][nbe][pr] Decrease of agricultural yield [a]	Higher sea and river flooding risk [fi][pr] Higher mudflow risk [pr] Higher ozone pollution risk Higher risk of infectious bacteria in hotter fresh water [fa]	https://www.normandie.fr/giec-normand (several synthetic and more extended reports)
Nouvelle-Aquitaine	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][pr]	More frequent heatwaves [pr] Swelling and shrinking soils [a] More frequent droughts, water quality and quantity concerns [a][pr]	Higher coastal risk of marine flooding (storms, erosion, modified rainfall and waves) [fi][pr][t] Higher risk of saltwater intrusions Disappearance of coastal sediment stocks [a]	Higher forest fire risk [fi][fw][pr] More frequent droughts, water quality and quantity concerns [a][fw][nbe][pr] Swelling and shrinking soils [a] Biodiversity threats (esp. coastal, mountain) [nbe]	Higher forest fire risk [fi][pr] Higher flooding and landslide risk [fi][pr]	Changement climatique en Aquitaine : quels impacts pour les risques naturels et comment s'y adapter ? (INP Bordeaux)
Occitanie	More frequent heatwaves [pr] More frequent droughts, water quality and quantity concerns [a][fa][pr]	More frequent heatwaves [pr] Swelling and shrinking soils [a] More frequent droughts, water quality and quantity concerns [a][pr]	Higher risk of marine submersion (incl. touristic beaches) [fi][pr][t] Higher risk of sea level rise [fi] Risk of lagoons disappearing [nbe] Risk on fishing and shellfish farming [fa]	Higher forest fire risk [fi][fw][pr] More frequent droughts, water quality and quantity concerns [a][fw][nbe][pr] Swelling and shrinking soils [] Biodiversity threats (esp. coastal, mountain) [nbe]	Higher forest fire risk [fi][pr] Higher sea and river flooding risk [fi][pr] Higher landslide risk [fi][pr] Higher ozone pollution risk Higher risk of infectious bacteria in hotter fresh water [fa]	https://www.occitanie.developpement-durable.gouv.fr/changement-climatique-r1610.html

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Pays de la Loire	More frequent and longer heatwaves [pr] More frequent and intense, longer droughts, water quality and quantity concerns [a][fa][pr] Risk on infrastructures due to ocean acidification [fa] More frequent extreme rainfall, risk of rainwater overflow, energy supply disruption [pr] Risk of road infrastructure deformations (brutal temperature change, swelling and shrinking soils, storms, heavy rainfall) [pr]	Higher flooding risk (sea level, river overflow) [fi][pr] More frequent and longer heatwaves, higher risk for ageing population [pr] Heat islands Risk of drinking water shortages [pr][t] Higher vulnerability to storms [fi][pr]	Higher risk of marine submersion [fi][t] Higher risk of sea level rise [fi] Higher risk of coastal erosion [t] Increasing tension between urbanisation and vulnerable natural environments [nbe][t] Risk of environmental contamination in estuaries [a][fa][nbe] Threats on some species (e.g. salmon) [fa][nbe]	More frequent and intense, longer droughts [a][fw][nbe][pr] Higher forest fire risk [fi][fw][pr] High vulnerability of forest species and agriculture to droughts and parasites [fw] High biodiversity threats (both coastal and inland) [nbe] Reduced river flows [a][fa][nbe]	Higher risk of marine submersion [fi][pr] Higher risk of coastal erosion More frequent extreme rainfall, risk of rainwater overflow, energy supply disruption [pr] Risk of road infrastructure deformations (brutal temperature change, swelling and shrinking soils, storms, heavy rainfall) [fi][pr][t] Higher forest fire risk [fi][pr] Risk of drinking water shortages [pr][t]	http://www.comite21.org/docs/2022/giec-des-pays-de-la-loire---1er-rapport-(29-09-2022).pdf
Provence-Alpes-Côte d'Azur	More frequent and intense droughts [a][fa][pr] Higher risk of water scarcity (lower water recharge) [a][fa] More frequent extreme rainfall (longer term) [pr]	More frequent heatwaves Heat islands, hot summer nights Higher risk of water scarcity (lower water recharge) [a] More frequent and intense extreme rainfall [pr] Higher risk of river flooding, landslides [fi]	Higher risk of marine submersion [fi][pr] Higher risk of sea level rise [fi] Higher risk of beach erosion or destruction [nbe][t] Risk of saltwater intrusion (uncertain) [a] Threats on marine species due to warmer and acidified sea (fish, shellfish) [fa][nbe] Jellyfish proliferation *[fa]*	Higher risk of water scarcity (lower water recharge) [a][fw][nbe] Higher forest fire risk (frequency, intensity) [fi][fw][pr] Degradation and migration of forest species [fw] risk on fruit and vine linked to frost risk during flowering, earlier harvests [a] risk on pasture lands [a] Swelling and shrinking soils [a] Impacts on agriculture depending on species [a] Threats on biodiversity [nbe]	Extended periods for mosquitos *(variable effects on diseases)* Risk of longer and more intense pollen allergies	http://www.grec-sud.fr/wp-content/uploads/2017/09/GREC-PACA_Enjeux_CC_BD_062015.pdf http://www.grec-sud.fr/wp-content/uploads/2018/09/GREC_PACA_Cahier_Mer_Littoral_ref.pdf http://www.grec-sud.fr/wp-content/uploads/2023/01/Cahier_territorial_NCA_GREC_SUD_juin_2021_VF_MD.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Réunion	More frequent droughts, impact on hydroelectricity [pr] Higher flooding risk, threat on electricity production and (shoemwhat) on waste treatment [pr]	Higher risk of sea level rise [fi] Higher flooding risk [fi][pr] Higher risk of marine submersion [fi][pr][t] Heat islands	More frequent and intense cyclones and rainfalls [pr] Higher risk of sea level rise [fi] Higher flooding risk [fi][pr] Higher risk of marine submersion [fi][pr][t] Risks on marine biodiversity [nbe]	Risk of massive agricultural productivity drop (sugar cane) [a] Higher impact of water scarcity on fodder [a] Risks on river system due to droughts, water scarcity [fi][nbe] Higher landslide risk [a][pr] Higher forest fire risk [fi][fw][pr] Higher risk of invasive species [nbe]	More frequent and intense cyclones and rainfalls [pr] Higher flooding risk [fi][pr] Higher risk of marine submersion [fi][pr][t] Higher landslide risk [a][pr] Higher forest fire risk [fi][fw][pr] Higher risk of development for tropical diseases	https://www.departement974.fr/sites/default/files/pcet-diagnostic-vulnerabilite.pdf https://www.profil-environnemental.re/media/fiches/Fiche_risques_naturels.pdf https://www.ecologie.gouv.fr/sites/default/files/ONERC_Rapport_2012_OutreMer_WEB.pdf
Saint-Martin	Risk of salination of sweet water ecosystems [nbe] Higher vulnerability of drinking water availability [pr] More frequent heatwaves and higher energy needs	More frequent droughts, water quality and quantity concerns [a][fa][pr] More frequent and intense cyclones [pr Higher risks on urban infrastructures [fi][pr] Risk of salination of sweet water ecosystems [nbe] Higher risk of marine submersion [fi][pr][t]	Some risk of sea level rise [fi] Higher risk of marine submersion [fi][pr][t] Somewhat higher risk of coastal erosion [t]	Higher impact of water scarcity on fodder [a]	More frequent and intense cyclones [pr] Higher risk of marine submersion [fi][pr][t] Higher vulnerability of drinking water availability [pr] Higher risks on urban infrastructures [fi][pr] Higher risk of development for tropical diseases	http://www.com-saint-martin.fr/ressources/Fascicule-6-Quelle-capacit%C3%A9-d-accueil-et-modalit%C3%A9s-de-d%C3%A9veloppement-demain.pdf https://www.ecologie.gouv.fr/sites/default/files/ONERC_Rapport_2012_OutreMer_WEB.pdf
GERMANY **National adaptation priorities/fields (climate-adapt): [e] Economy, [h] Health, [i] Infrastructure, [l] Land, [sc] Spatial Planning and Civil Protection, [w] Water**						
Baden-Württemberg	More frequent heatwaves [h] More frequent droughts, water quality and quantity concerns, floods [e][h][i][sc][w]	Higher flooding risk [e][i][sc] Higher risk of heatwaves [h] Higher risk of disease-carriers from warmer climate [h] Higher risk of tropical diseases such as chikungunya and dengue fever [h]	n/a	Higher risk of more frequent and longer periods of drought during the summer months [e][l][w] Higher risk of species of fauna and flora migration	Higher risk of sever hailstorms that can cause massive damage to buildings, vehicles and fields [e][i][sc] Higher risk of flooding for smaller rivers and streams [sc][w]	https://www.baden-wuerttemberg.de/fileadmin/redaktion/m-um/intern/Dateien/documents/publication/Climate_Change.pdf https://www.hochwasser.baden-wuerttemberg.de/ https://lokale-klimaanpassung.de/lokales-klimaportal/ https://www.heidelberg.de/hd/HD/Leben/klimawandel-anpassung.html

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Bayern	Higher risk of damaging infrastructure for electricy supply [e][i][sc]	More frequent droughts, water quality and quantity concerns [e][h][w] Higher flooding risk [e][i][sc]	n/a	Higher risk of changes in crop yields and increased spread of invasive species [e][l] Higher risk of wild fires [e] Biodiversity displacement and change [h] Higher risk of pest and disease increase [h] Higher risk of torrents and avalanches [h]	Higher flooding risk [e][i][sc][w]	https://www.bestellen.bayern.de/application/eshop_app000003?SID=44167250&ACTIONxSESSxSHOWPIC(BILDxKEY:%27stmuv_klima_012%27,BILDxCLASS:%27Artikel%27,BILDxTYPE:%27PDF%27) https://www.bestellen.bayern.de/application/eshop_app000007?SID=589832196&ACTIONxSESSxSHOWPIC(BILDxKEY:%27stmuv_vs_056%27,BILDxCLASS:%27Artikel%27,BILDxTYPE:%27PDF%27)
Berlin	Risk of higher energy demand due changing weather patterns and rising temperatures [e] Higher risk of damage of power lines and other infrastructure [e][i][sc]	Higher risk of flooding [e][i][sc] Higher risk of heatwaves and air pollution [h] Higher risk to water resources [e][h[i][w]	n/a	Higher risk of changes in crop yields [e] Risk of spread of invasive species [h] Higher risk of wildfires [h]	Higher risk of disruptions of transport networks and energy systems [e][i][sc] Higher risk of damage of critical infrastructure [e][i][sc] Higher risk of heat-related illnesses and other health impacts [h][sc]	https://cdn.locomotive.works/sites/5ab410c8a2f42204838f797e/content_entry5ab410faa2f42204838f7990/5da8946484832e00a69c5586/files/bek2030_broschuere_en.pdf?1632314683
Brandenburg	The changes in the water supply will have serious effects on the regional water balance in general, on water availability and on a wide variety of economically important sectors [e][i][w]	Higher risk of flooding [e][i][sc]	n/a	Higher risk of drought (frequency and length) [l][w] Higher risk of forest fires [h]	Higher risk of heat-related illnesses and other health impacts [h][sc]	https://www.ioew.de/fileadmin/user_upload/Zwischenbericht-Gutachten-KlimaplanBB.pdf https://www.umweltbundesamt.de/themen/klima-energie/klimafolgen-anpassung/folgen-des-klimawandels/klimafolgen-deutschland/regionale-klimafolgen-in-brandenburg#wichtige-studien-und-projekte

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Bremen	Higher risk of outage of supply facilities and networks (energy, water, heat and telecommunications) [e][i][sc][w] Higher risk of demand on resources for the maintenance of bodies of water and for municipal cleaning [i][w] Reduced output by power plants arising from restricted access to cooling water due to drought [e][i][w]	More frequent heatwaves [h] Increased human-bioclimatic impact due to heat stress [h] Higher risk of wear and tear on green spaces and recreation grounds due to increased solar irradiation and intensive usage [l][sc] Higher risk of congestion of the sewage network as a result of heavy precipitation exceeding the established thresholds [e][h][i][sc]	Eutrophication of bodies of water due to the erosion of dry soils (esp. in areas on the urban fringe) [w] Restrictions on inland waterway transport due to high and low water levels	Shifting species diversity/spread of invasive thermophilic animal and plant species [l] Damage (e.g. protein coagulation) to heat-stressed vegetation [l] Impairment/loss of soil functions due to increased soil temperature [e][l] Higher risk of damage to and loss of soil functions due to erosion and the entry of pollutants [e][l] Higher risk of damage to vegetation/crops due to increased waterlogging [e][l][w] Risk of fire and falling branches due to drought Pest infestations and fungal diseases affecting trees due to increased humidity Negative impact on industrial/agricultural production due to water shortages [e][l][w]	Increase in the number of days of extreme precipitation [sc] Increase physical strain and risk of accidents due to heat stress and a reduced ability to concentrate [h][sc] Establishment of new and spread of existing pathogenic agents and disease carriers [h][sc] Higher risk of material stress and damage to transport routes due to heat and temperature fluctuations [e][i][sc] Higher risk of flooding and damage of private and public buildings and property [e][i][sc] Higher risk of damage to buildings and infrastructure due to changes in soil and groundwater levels in conjunction with rising sea levels [e][i][sc]	https://www.klimaanpassung.bremen.de/sixcms/media.php/13/SUMMARY_Climate%2BAdaptation%2BStrategy%2BBremen%2BBremerhaven%2BWEB.pdf
Hamburg	Rising sea levels can threaten coastal power plants and distribution networks [e][i]	Higher risk of flooding [e][i][sc]	Higher risk of sea level rise that can lead to increased coastal erosion, flooding, and storm surges that can damage coastal infrastructure such as buildings, roads, and ports [e][i][sc]		Higher risk of sea level rise that can lead to increased coastal erosion, flooding, and storm surges that can damage coastal infrastructure such as buildings, roads, and ports [e][i][sc]	https://climate-adapt.eea.europa.eu/en/metadata/case-studies/four-pillars-to-hamburg2019s-green-roof-strategy-financial-incentive-dialogue-regulation-and-science/hamburg_doc1_climate_plan.pdf/view
Hessen	Negative consequences resulting from changing precipitation patterns and the associated changes in the discharge process of both fossil and regenerative generation plants as well as the	More frequent heatwaves [h] Higher risk of groundwater contamination [h][w] Higher risk of spread of invasive species Increase in the intensity of pollen allergies [h]	n/a	Higher risk of yield losses of crops [e][l] Higher risk of erosion and nutrient leaching as well as increased drying of the harvest [e][l] Higher risk that plants and animals can no longer adapt to the	Higher risk of disrupting private and public transport due to road flooding [e][i][sc][w] Higher risk of heavy rainfall events Higher risk of heat waves [h][sc] Higher risk of transport and	https://umwelt.hessen.de/sites/umwelt.hessen.de/files/2021-06/integrierter_klimaschutzplan.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	supply networks and their infrastructure [e][i]	Increase in the transmission of infection diseases (Chicunguña and Zika) [h]		changed weather conditions [h][l]	transportation infrastructure being affected [e][i][sc]	
Mecklenburg-Vorpommern	-	More frequent heatwaves [h]	-	Higher risk of erosion by wind [l] Higher risk of more frequent negative effects on plant growth, product quality and yields [l]	-	https://www.regierung-mv.de/Landesregierung/lm/Klima/Klimaschutz/ https://www.umweltbundesamt.de/themen/klima-energie/klimafolgen-anpassung/folgen-des-klimawandels/klimafolgen-deutschland/regionale-klimafolgen-in-mecklenburg-vorpommern#landerspezifische-klimaanderungen https://www.umweltbundesamt.de/sites/default/files/medien/5750/publikationen/2021-06-10_cc_21-2021_kwra2021_land_1.pdf
Niedersachsen	Higher risk of periods of time in which the water supply will not be sufficient without human management [e][w] Increases in peak flood discharges of at least 20% at many gauges in Lower Saxony, especially in the summer months [w]	More frequent heatwaves [h] More frequent heavy precipitations that might lead to flooding [sc][w] Increasing heat stress in metropolitan areas and the associated burden on health [h]	Increased risk of coastal and inland flooding [e][i][sc] Stress on the aquatic ecology due to high water temperatures and high oxygen levels	Increasing drought stress in natural ecosystems and in agriculture and forestry [l][w] Increasing risk of forest fires [l][w] Increasing soil erosion due to heavy rain or extreme drought [l][w] Higher risk of invasive species and the preservation of biodiversity [l]	Declining snow reliability in winter sports areas [e]	https://www.umwelt.niedersachsen.de/startseite/themen/klima/klimaschutz/klimaschutz_in_niedersachsen/klimaschutz-in-niedersachsen-200413.html https://www.arl-net.de/system/files/media-shop/pdf/ab/ab_011/ab_011_gesamt.pdf
Nordrhein-Westfalen	Higher risk of water scarcity for the cooling of power plants during long periods of heat	-	-	Biodiversity displacement and change [l] Higher risk of climate-induced migration of species from southern areas [l] More frequent irrigation is expected in the agricultural sector [l][w] Increased risk for drought damages, plant diseases and pests in agriculture and forestry [l][w]	-	https://www.klimaschutz.nrw.de/fileadmin/Dateien/Download-Dokumente/Broschueren/klimaschutzbericht_nrw_151201.pdf https://www.klimlandrp.de/en/background/#:~:text=In%20Rhineland%2DPalatinate%20there%20are,of%20the%20vegetation%20growth%20period.

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Rheinland-Pfalz	-	Higher risk of flooding [e][i][sc] More frequent heatwaves [h]	n/a	-	-	https://mkuem.rlp.de/fileadmin/mulewf/Themen/Klima-_und_Ressourcenschutz/Klimaschutz/Klimaschutzkonzept/Klimaschutzkonzept_Strategie_net_01_02_2021.pdf https://hochwassermanagement.rlp-umwelt.de/servlet/is/176954/Wasser_und_Klimawandel_in_RLP.pdf?command=downloadContent&filename=Wasser_und_Klimawandel_in_RLP.pdf
Saarland	Higher risk of changes in precipitation patterns and water availability can impact the efficiency of hydropower plants [e][w] Higher risks to the energy sector due to extreme weather events such as heatwaves, droughts, and floods which can disrupt power generation and transmission [e][i][sc]	Higher flooding risk [e][i][sc]	n/a	Higher risk of soil erosion [l] Higher risk of soil degradation [l] Higher risk of forest fires Higher risk of eutrophication in the summer Higher risk of forest degradation Decline in yields of some agricultural products (cereals, potatoes, silo maize, etc) [e][l] High concentrations of ozone and air pollutants in dry seasons also affect plant growth [l]	Higher risk of flooding of low-lying settlement areas [e][i][sc] Higher risk of falling trees on roads an railway lines [i][sc]	https://www.izes.de/sites/default/files/publikationen/KlimaKomPass_IZES.pdf
Sachsen	Higher risk of infrastructure damage due to heavy precipitation and floodings [i][w]	Higher flooding risk [sc][w] Higher risk of heatwaves [h]	n/a	Higher risk of droughts [l][w] Biodiversity displacement and change [l] Higher risk of pest and disease increase [h][l] Higher risk of soil erosion [l][w] Higher risk that plants and animals can no longer adapt to the changed weather conditions [h][l]	Higher risk of infrastructure damage due to heavy precipitation and floodings [i][w]	https://publikationen.sachsen.de/bdb/artikel/37830

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Sachsen-Anhalt	-	Higher risk of heavy rains events combined with flooding, hailstorms and lightning strikes	n/a	-	-	https://mwu.sachsen-anhalt.de/fileadmin/Bibliothek/Politik_und_Verwaltung/MWU/Klimaschutz/00_Startseite_Klimaschutz/190205_Klima-_und_Energiekonzept_Sachsen-Anhalt.pdf https://www.umweltbundesamt.de/themen/klima-energie/klimafolgen-anpassung/folgen-des-klimawandels/klimafolgen-deutschland/regionale-klimafolgen-in-sachsen-anhalt
Schleswig-Holstein	-	More frequent heatwaves [h]	Higher risk of sea level rise that can lead to increased coastal erosion, flooding, and storm surges that can damage coastal infrastructure such as buildings, roads, and ports [e][i][sc]	-	-	https://www.umweltbundesamt.de/themen/klima-energie/klimafolgen-anpassung/folgen-des-klimawandels/klimafolgen-deutschland/regionale-klimafolgen-in-schleswig-holstein#bereits-aufgetretene-und-erwartete-klimaanderungen
Thüringen	Risk of a slight decrease in wind speeds for the production of solar energy Higher risk of damage of critical energy infrastructure [e][i][sc]	More frequent heatwaves [h] Higher risk of skin cancer [h] Increase in vectors of disease transmission [h] Higher risk of food being spoiled by high temperatures [h] Higher risk from allergies and germs [h]	n/a	Biodiversity threats [h] Higher flooding risk [e][l] Higher risk of an increase of dry spells [l] Risk of larger range of plant pests and weeds [e][l] Risk of water scarcity for vegetation areas [l][w] Higher risk of water erosion [l][w] Increased risk of forest fires [h] Higher risk of disruptions in timber harvesting [e]	Higher risk from allergies and germs [h][sc] Higher risk of impairing road safety Higher risk of flooding causing damages to buildings [e][i][sc]	
GREECE **National adaptation priorities/fields (ESPKA): [aa] Agriculture and animal husbandry, [ac] Action, [aq] Aquaculture, [be] Biodiversity and ecosystems, [ch] Cultural heritage, [co] Coastal zones, [fi] Fishing, [fo] Forestry, [he] Health, [is] Insurance sector, [it] Infrastructure and transport, [mi] Mining industry, [se] Structured environment, [to] Tourism, [wr] Water resources**						
Ανατολική Μακεδονία και Θράκη (Eastern Macedonia and Thrace)	-	-	Higher risk of migration of species due to changes in water temperature [aq][co][fi]	Higher risk of forest fires [fo][is]	-	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Αττική (Attica)	-	More frequent heatwaves [he][it] Higher flooding risk [co][he][is][it] Higher occurrence of extreme precipitation events [aa][co][fo][is][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi] Higher risk of coastal erosion [be][ch][co][is][it][to]	Higher risk of forest fires [fo][is]	-	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Βόρειο Αιγαίο (North Aegean)	Higher risk of water scarcity [aq][be][co][wr]	-	Higher risk of migration of species due to changes in water temperature [aq][co][fi] Higher risk of coastal erosion [be][ch][co][is][it][to]	Higher risk of forest fires [fo][is]	-	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Δυτική Ελλάδα (Western Greece)	-	-	Higher risk of migration of species due to changes in water temperature [aq][co][fi]	-	-	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Δυτική Μακεδονία (Western Macedonia)	-	More frequent heatwaves [he][it] Higher flooding risk [co][he][is][it]	-	-	Higher risk of landslides, floods [aa][co][he][is][it][mi]	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Ήπειρος (Epirus)	-	Higher flooding risk [co][he][is][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi]	-	-	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Θεσσαλία (Thessaly)	Higher risk of water scarcity [aq][be][co][wr]	Higher flooding risk [co][he][is][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi] Higher risk of coastal erosion [be][ch][co][is][it][to]	Higher risk of forest fires [fo][is]	Higher risk of landslides, floods [aa][co][he][is][it][mi]	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Ιόνια νησιά (Ionian Islands)	-	Higher flooding risk [co][he][is][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi] Higher risk of coastal erosion [be][ch][co][is][it][to]	-	-	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Κεντρική Μακεδονία (Central Macedonia)	-	Higher flooding risk [co][he][is][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi]	Higher risk of forest fires [fo][is]	Higher risk of landslides, floods [aa][co][he][is][it][mi]	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf
Κρήτη (Crete)	-	More frequent heatwaves [he][it]	Higher risk of migration of species due to changes	Higher risk of forest fires [fo][is]	-	https://www.bankofgreece.gr/Publications/ClimateChange_FullReport_bm.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
			in water temperature [aq][co][fi]			
Νότιο Αιγαίο (South Aegean)	Higher risk of water scarcity [aq][be][co][wr]	Higher flooding risk [co][he][is][it] More frequent heatwaves [he][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi] Higher risk of coastal erosion [be][ch][co][is][it][to]	Higher risk of forest fires [fo][is]	-	
Πελοπόννησος (Peloponnese)	-	Higher flooding risk [co][he][is][it] More frequent heatwaves [he][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi]	Higher risk of forest fires [fo][is]	-	
Στερεά Ελλάδα (Central Greece)	Higher risk of water scarcity [aq][be][co][wr]	Higher flooding risk [co][he][is][it] More frequent heatwaves [he][it]	Higher risk of migration of species due to changes in water temperature [aq][co][fi]	-	-	
ITALY **National adaptation priorities/fields (climate adapt):[a] Agriculture, food, aquaculture, fishing, [ci] Critical infrastructures, [e] Energy, [h] Health, [i] Infrastructure, [l] Land (incl. ecosystems, forests, droughts), [t] Tourism, [u] Urban settlements, [w] Water**						
Abruzzo	Hydrogeological instability [ci][e][i][w]	Higher risk of heatwaves [h][u] Higher risk of heavy rainfall and thunderstorms [e][i][u][w] Higher risk of urban flooding [ci][i][u][w] Higher risk of droughts [a][l][u][w]	Hydrogeological instability [ci][e][i][w]	Soil consumption [a][l]	Hydrogeological instability [ci][e][i][w] Increased flooding risk [ci][e][i][u][w] Risk of more irregular and unforeseeable snowfalls, greater risk of avalanches [h][w]	No regional plan available, ABRUZZO rapporto sullo stato dell'ambiente 2018 https://www.artaabruzzo.it/download/pubblicazioni/relaz_stato_ambiente_abruzzo_2018.pdf
Basilicata	Hydrogeological instability posing risk to energy production [ci][e][i][w]	Higher risk of droughts[l][u][w]	-	Higher risk of droughts, desertification [a][l][w]	-	Legge 15 ottobre 2018, n.32 REGIONE BASILICATA Decarbonizzazione e politiche regionali sui cambiamenti climatici (Basilicata Carbon Free)
Calabria	Hydrogeological instability [ci][e][i][w]	More frequent heatwaves [h][u] Swelling and shrinking soils [i][u] More frequent droughts, water quality and quantity concerns [a][ci][h][i][l][u][w]	Higher risk of erosion [i][l][u]	Higher risk of droughts, desertification [a][l][w]	Higher risk of extreme weather events [ci][e][i][u]	https://www.irpi.cnr.it/wp-content/uploads/2016/05/focus-siccit%C3%A0-desertificazione-cambiamenti-climatici-calabria-2.pdf, https://www.lacnews24.it/ambiente/il-cambiamento-climatico-fa-paura-ma-in-calabria-di-piu-secondo-legambiente-e-tra-le-regioni-piu-colpite_162752/

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Campania	Slow adoption of renewables [e][u] Suboptimal insulation of buildings [e][u]	Poor air quality [h][u] Ageing population [h][u]	-	Soil consumption [a][l]	Hydrogeological instability [ci][e][i][w] Higher risk of extreme events (floodings, droughts, heavy rains) [ci][e][i][l][u][w]	Legambiente – Il Clima è già cambiato: la Campania, una sfida per l'Europa - https://legambiente.campania.it/wp-content/uploads/2019/05/dossier-clima-campania.pdf
Emilia-Romagna	Growth of energy demand [e][u] Less energy produced by hydro sources [e][w]	Water quality concerns (driven by large quantity of water being used for irrigation) [a][h][i][u][w] Desertification [a][l][u] Negative effects on health [h][u] Negative impact on economic activities [i][t][u] Damage on the built environment [i][t][u] Increased insurance costs [u] Loss of value of affected buildings [i][u] Higher health risk (incl. pathologies related to the effects of climate change) [h][u]	Coastal erosion [i][l][t][u] Saltwater intrusion [a] Biodiversity loss (incl. local fisheries) [a][h][l]	Higher risk of extreme events (floodings, droughts, heavy rains) [l][w] Higher risk of forest fires [l] Soil consumption [a][l] Desertification [a][l] Loss of agricultural production (in term of quantity and quality) [a][l] Decreased water quantity and quality [a][l][w] Loss of biodiversity [h][l]	Higher risk of extreme events (floodings, droughts, heavy rains) [ci][e][i][l][u][w] Higher risk of forest fires [ci][h][l] Hydrogeological instability [ci][e][i][w]	Documento di sintesi della Strategia di mitigazione e adattamento per i cambiamenti climatici https://ambiente.regione.emilia-romagna.it/it/cambiamenti-climatici/temi/la-regione-per-il-clima/strategia-regionale-per-i-cambiamenti-climatici/la-regione-per-il-clima-la-strategia-di-mitigazione-e-adattamento-per-i-cambiamenti-climatici
Friuli-Venezia Giulia	Expected decrease of energy consumption in the winter, later increase of energy consumption in the summer [e][u]	Higher risk of droughts and heatwaves [h][l][u][w] Negative effects on health [h][u]	Hydrogeological instability [ci][e][i][w] Increased sea level [e][i][l][u] Risk for the local marine biodiversity [a][h] Risk for aquaculture (esp. in lagoons) [a]	Fewer but more intense rainfalls [l][w] Higher risk of droughts and heatwaves [a][h][l] risk for biodiversity - some species (e.g. in the field of forestry) react negatively to warmer and dryer conditions (and others react positively) [h][l]	-	Sintesi dello Studio conoscitivo dei cambiamenti climatici e di alcuni loro impatti in Friuli Venezia Giulia - https://www.meteo.fvg.it/clima/clima_fvg/03_cambiamenti_climatici/02_SLIDES_cambiamenti_climatici_e_impatti_per_il_FVG/00_report_completo_in_slides/CambiaClimaFVG_sintesiStudio.pdf
Lazio	Increased energy demand in summer [e][u]	Increased frequency of heatwaves [h][u]	Hydrogeological instability [ci][e][i][w] Coastal erosion [i][l][u]	High risk of forest fires [l] Reduction of soil moisture [a][l]	Higher risk of landslides, floods [ci][e][i][u][w]	Lazio, Regione partecipata e sostenibile – Il contributo dell'adattamento ai cambiamenti climatici - https://progetti.regione.lazio.it/contrattidifiume/wp-content/uploads/sites/53/LAZIO-SOSTENIBILE-Contributo-adattamento-cambiamenti-climatici.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Liguria	More blackouts [ci][e][i][u] Hydrogeological instability [ci][e][i][w] More frequent heatwaves [h][u] More frequent droughts, water quality and quantity concerns [a][ci][i][l][u][w] Suboptimal energy efficiency of the built environment [e][u]	Higher risk of heatwaves (esp. at higher altitude and in western Liguria) [h][u] Higher risk of flooding [ci][i][u][w] More frequent droughts, water quality and quantity concerns - incl. quantity of drinking water [ci][h][i][l][t][u][w] Harmful effects on urban infrastructure - transport and others [ci][i][t][u]	Hydrogeological instability - incl. storm surges [ci][e][i][w] Increasing water levels [ci][i][u] More frequent droughts, water quality and quantity concerns [ci][h][i][l][t][u][w] Fewer winter precipitation in the East, more in the West, fewer summer precipitations overall [w] Strong precipitations to become more common in the East, less common in the West [w] Risk for aquaculture and fishing activities, incl. the invasion of alien species from warmer zones [a] High risk of erosion [i][l]	More frequent droughts, esp. near the coast [a][l][w] Biodiversity threats (incl. invasions of fungi, insects. migrations of species) [a][h][l] Reduction of agricultural production [a] Increasing risk of forest fires [h][l]	Higher flooding, drought, and landslide risk [ci][e][i][l][u][w] Risk of more damaged buildings [i][u]	Strategia regionale di adattamento ai cambiamenti climatici - https://www.regione.liguria.it/homepage-ambiente/cosa-cerchi/sviluppo-sostenibile/strategia-adattamento-cambiamenti-climatici.html
Lombardia	-	Populations exposed to worse air quality [h][u]	Changes in the hydro-geological cycle [w] Increased risk of algal blooms [a]	Negative effects on soil quality, water quantity [a][l] Increased risk of extreme events [a][e][l] Increased risk of diffusion of parasites and fungi [a][l] Reduced quantity and quality of waters [a][w]	-	DOCUMENTO DI AZIONE REGIONALE PER L'ADATTAMENTO AL CAMBIAMENTO CLIMATICO IN LOMBARDIA - https://www.regione.lombardia.it/wps/wcm/connect/946249ce-87c4-4c39-88f9-5eab3a264f14/Documento+Azione+Adattamento+RL_9dic.pdf?MOD=AJPERES&CACHEID=946249ce-87c4-4c39-
Marche	Water scarcity influencing the production of hydro energy [h][t][u][w] Not self-sufficient at the level of regional energy production Increased energy demand in summer [e][u] More blackouts [ci][e][i][u]	Water scarcity [h][t][u][w] Higher risk of flooding [ci][i][u][w] Increased health risk (chronic diseases) [h][u]	Increased risk of algal blooms [a] Very high risk of coastal erosion (especially in coastal tourist areas) [i][l][t][u] Higher risk of coastal floods [ci][e][i][u][w] Biodiversity threats (due to higher temperatures and decreased levels of oxygen in the waters and introduction of non-local species) [b][hl][hr	Water scarcity (Also due to intensive agriculture practices) [h][t][u][w] Soil erosion [a][b] Higher risk of loss of agri production [a][h][i][l][w]	Higher risk of floods [ci][e][i][u][w] Higher risk of avalanches [h][t] Biodiversity threats in coastal areas (due to anthropization) [b][hl][hr]	Piano di adattamento al cambiamento climatico Regione Marche 2023 - 2029 https://www.regione.marche.it/portals/0/Ambiente/VAS/VASR/VAS_0038/Piano_Rev0.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Molise	-	-	-	-	-	
Piemonte	Unforeseeable peaks of energy demand [e][u] Water scarcity [h][t][u][w]	Increased health risk (chronic diseases) [h][u]	n/a	Thinner show cover [l][t] *Migration of flora and fauna, moving the line between Mediterranean and Alpine species* [a][l] Increase of damage caused by parasites [a][l] Water scarcity [h][t][u][w] Variation in the sugar content of vines [a][l]	Higher risk of extreme events (stemming from the change of precipitation cycles) influencing the public safety[h][t]	Strategia Regionale sul Cambiamento Climatico - https://www.regione.piemonte.it/web/temi/ambiente-territorio/cambiamento-climatico/strategia-regionale-sul-cambiamento-climatico So far only the first part of the plan is available, focused mainly on biodiversity Annex 1 of SET DI STRATEGIE DI ADATTAMENTO AI CAMBIAMENTI CLIMATICI PER LA ZONA OMOGENEA PINEROLESE DELLA CITTÀ METROPOLITANA DI TORINO PER GLI STRUMENTI DI PIANIFICAZIONE DI LIVELLO LOCALE E DI AREA VASTAhttp://www.cittametropolitana.torino.it/cms/risorse/territorio/dwd/urbanistica/ProgEurop/WP4.2_Strategie%20_di_adattamento_%20all_1.pdf
Puglia	-	Water scarcity [h][t][u][w] More frequent droughts, water quality and quantity concerns [ci][h][l][t][u][w]	-	Water scarcity [a][h][u][w] More frequent droughts, water quality and quantity concerns [a][h][i][l][w]	Water scarcity [h][t][u][w]	PNACC https://www.mase.gov.it/sites/default/files/archivio/allegati/clima/PNACC_versione_dicembre2022.pdf A consultation phase is undergoing, a regional plan still does not exist (Feb 2023). Aditional source: https://focusicilia.it/clima-impazzito-citta-a-rischio-175-eventi-estremi-in-sicilia-in-12-anni/
Sardegna	Droughts influencing the production of energy [e][l][w]	Higher risk of heatwaves [h][u] Higher risk of flooding in urban areas [i][u][w] More frequent droughts, water quality and	Higher risk of coastal flooding [ci][i][l][t][u] Higher risk of coastal erosion [i][l][t][u]	More frequent droughts, water quality and quantity concerns - causing competition for water use between urban and agricultural	Higher risk of floods [ci][e][i][u][w] Hydrological risk for infrastructure (e.g. rails) [ci][e][i][u][w]	Allegato 1 alla SRACC: studio per l'elaborazione della Strategia - https://delibere.regione.sardegna.it/protected/45525/0/def/ref/DBR45368/

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		quantity concerns - causing competition for water use between urban (esp. touristic areas) and agricultural [a][ci][h][l][t][u][w] Landslide risk in urban environments [i][u] Hydrological risk for productions and industries [ci][e[i][u][w]		[a][l][u][w] Higher risk of loss of agri production [a][h][i][l][w] Higher risk of loss of nutritional value of agri production [a][h] Higher risk of forest fires and fires in rural areas [l] Higher risk of floods in agricultural areas [a][l]	Landslide risk for infrastructure (e.g. rails) [ci][e][i][u]	
Sicilia	-	-	Increasing water levels [ci][i][u]	Higher risk of desertification [a][b][fo][hr][w] Higher risk of fires [f][h][ri]	Higher risk of extreme events [h][t] Higher risk of fires [f][h][ri]	A regional adaptation plan does not exist. For a couple of sectors (agriculture and energy), there are approved guidelines for the creation of similar strategies. https://pti.regione.sicilia.it/portal/pls/portal/docs/152524670.PDF http://pti.regione.sicilia.it/portal/pls/portal/docs/151514774.PDF So far, no official documents identifying climate risk in Sicily are available.
Toscana	Results of extreme events (snow storms, landslides, fallen trees) can cause disruption in the delivery of energy [ci][e][u] Increased energy demand in summer [e][u] Increased difficulty to cool down power plants (due to limited water resources and increasing temperature) [ci][e][w] The provision of drinking water can be interrupted in case of extreme events (incl. very low temperature) [ci][i][u][w]	Higher risk of heatwaves [h][u] Higher risk of flooding [ci][i][l][u][w] Increased health risk (cardiovascular and respiratory, diseases spreadable by vector insects) [h][u]	Decreased water quality, loss of habitats [a][h][t][u][w]	More prolonged periods of both droughts and heavy rains [a][l][w] Increased demand for water for irrigation [a][w] Reduced (in quantity and in quality) agri production [a[h][l] Increased diffusion of parasitic and invasive species [a][l]	Higher risk of flooding [ci][e][i][l][u][w]	ANALISI VRV E PIANO DI ADATTAMENTO Comune di Firenze - https://www.comune.fi.it/system/files/2022-04/FIRENZE_VRV_azioniadattamento%20%281%29.pdf The plan of the city of Florence also provides an overview of regional challenges.

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Trentino-Alto Adige / Südtirol	Suboptimal energy efficiency of the built environment [e][u] Hydrogeological instability [ci][e][i][w]	Higher risk of heatwaves [h][u]	n/a	Negative consequences on the permafrost [l] Fewer precipitation overall (fewer in altitude and in summer) [w]	Hydrogeological instability [ci][e][i][w] Higher risk of flooding [ci][e][i][u][w] Higher risk of avalanches [h][t]	I CAMBIAMENTI CLIMATICI IN TRENTINO. OSSERVAZIONI, SCENARI FUTURI E IMPATTI: http://www.climatrentino.it/binary/pat_climaticamente/notizie_clima/Report_clima_documento_di_posizionamento_finale2023.1672934412.pdf, https://pericoli-naturali.provincia.bz.it/it/cambiamento-climatico
Umbria	-	Higher risk of heatwaves [h][u] Increased health risk [h][u]	n/a	?	?	No official sources on existence - or preparation-- or regional adaptation plan or other official sources on climate risk.
Valle d'Aosta	Effects on hydroelectrical energy (the plants using seasonal pools would be less impacted, more at risk will be plants using running water or very small water pools) [ci][e][u][w] Less energy consumption for heating (and more for cooling in summer) [e][u]	Increased risk of heatwaves (esp. within vulnerable citizens- allergies, age, cardiovascular diseases) [h][u] Decrease of quantity and quality of drinking water [ci][h][i][t][u][w]	n/a	Increasingly melting snow cover [t][w] *Potentially longer and more productive agricultural season [a][l]* Higher risk of droughts, increased need for irrigation [a][l][w] Risk for biodiversity (rare plants being substituted by a more common and more adaptable ones) [h][l] *Potential changes for forests (increased timber production, but more vulnerable to the extreme weather events) [l]*	Higher risk of extreme events (in particular for the cryosphere - glaciers, permafrost, snow - incl. avalanches) [h][t] Increased risk for mountain infrastructure [i][t]	Strategia di adattamento ai cambiamenti climatici - Valle d'Aosta - https://www.arpa.vda.it/it/effetti-sul-territorio-dei-cambiamenti-climatici/3716-strategia-di-adattamento-ai-cambiamenti-climatici-valle-d-aosta
Veneto	-	Higher risk of flooding [ci][e][i][l][u][w] Increased health risk (esp. for the newborns and the elderly, and for cardiovascular or respiratory pathologies) [h][u]	-	Higher risk of flooding [a][ci][e][i][l][w] Higher risk of droughts [a][l][w] Higher risk of forest fires [h][l]	Higher risk of flooding [a][ci][e][i][u][w] Higher risk of landslides [ci][e][i][l][u] Higher risk of forest fires [h][l]	Presentazione L'ALLINEAMENTO NELLA PIANIFICAZIONE LOCALE DELLE POLITICHE PER IL CLIMA Luca Marchesi Direttore Area Tutela e Sicurezza del Territorio - https://www.venetoadapt.it/wp-content/uploads/2021/12/10.-Marchesi.pdf A regional adaptation strategy does not exist but is currently under elaboration.
LITHUANIA **National adaptation priorities/fields (climate adapt): [a] Agriculture/aquaculture, [e] Emergency management, [f] Forestry, ecosystems, biodiversity and landscape, [h] Public health, [io] Intersectoral objective, [is] Infrastructure, [t] Transport, [u] Urbanized areas, [w] Water resources**						

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
(Lietuva)	Higher risk of extreme events [is][e] Impact of hotter waters on energy production [is][e] Higher risk of droughts, reduction of river runoff and extreme water level fluctuations [w][is] Higher risk of flooding (sea level rise) [is][e] Higher risk of water pollution and landfill fires [w][is][e] Vulnerability of landfills to flooding [is][e]	More frequent heatwaves [h][e][u] Higher risk of droughts [w][u] Higher risk of flooding (rainfall and storms, sea level rise) - coastal regions [f][t][is][e][u]	Higher risk of flooding (rainfall and storms, sea level rise) [f][t][is][e][u] Risk of salinity changes [w][f][a][h] Risk of water quality deterioration [w][a][h][e][u]	Higher volatility of vegetation period and snow cover [f][a] Higher risk of droughts [f][a] Higher flooding risk [f][a][e] Higher forest fire risk [f][e] Higher risk of other extreme events (frost, storms) [f][a][e] Risk of disease and pest increase [f][a][h] Risk of soil degradation and changes in soil, water and air quality [f][a][h]	Higher risk of flooding (rainfall and storms, sea level rise) - coastal regions [f][t][is][e][u] Higher risk of extreme events [f][t][is][a][e][u]	www.meteo.lt https://am.lrv.lt/uploads/am/documents/files/KLIMATO%20KAITA/Studijos%2C%20metodin%C4%97%20med%C5%BEiaga/Klimato%20kaita_galutine%20ataskaita_2015_08_31.pdf
NETHERLANDS **National adaptation priorities/fields (climate adapt): [a] Agriculture, horticulture, [ce] Cascading effects, [ci] Critical infrastructures, [h] Health (incl. allergies, infections), [n] Nature (incl. ecosystems), [w] Water**						
Noord-Nederland	Longer heatwaves, higher energy consumption Risk of more frequent and intense extreme events (wind, storms, rainfall) affecting electricity provision and infrastructure accessibility [ce][ci][w]	More frequent droughts [n][w] Higher flooding risk [ci] Risk of exposure to water-borne pathogens from flooded streets [ce][h] Higher risk of pollen allergy linked to CO2 increase, or longer allergy periods [h] Higher risk of heatwaves [h]	Higher risk of land subsidence [a][n] Higher risk of peat oxidation [n] Higher risk of salinization, drinking water shortage [a][h][n][w] Higher flooding risk [ci]	Higher risk of land subsidence [a][n] Higher risk of peat oxidation [n] Higher risk of salinization [a][n][w] Risk of droughts affecting soils and groundwater levels [a][n][w] Risk of longer wet periods and extreme events affecting harvests [a] Risk of lower crop yields [a] Longer wet periods and modified climate patterns increasing diseases, mosquitoes and pests [a][h][n]	Higher risk of drinking water shortage [ci][h][w] Higher flooding risk [a][ci]	NBRACER project proposal (currently in GAP phase) https://klimaatadaptatienederland-nl.translate.goog/kennisdossiers/
Oost-Nederland	Longer heatwaves, higher energy consumption Risk of more frequent and intense extreme events (wind, storms, rainfall) affecting electricity provision and	More frequent droughts [n][w] Higher flooding risk [ci] Risk of exposure to water-borne pathogens from flooded streets [ce][h] Higher risk of pollen	Risk of coastal erosion shrinking natural areas [n] Higher risk of salinization, drinking water shortage [a][ci][h][n][w] Possible deterioration of bathing water quality [h]	Risk of droughts affecting soils and groundwater levels [a][n][w] Risk of longer wet periods and extreme events affecting harvests [a] Risk of lower crop yields [a]	Higher risk of drinking water shortage [ci][h][w] Higher flooding and hailstorm risk [a][ci] Higher risk of pathogens in water & disseminated by flooding [a][ce][h][n][w] Higher risk of allergens,	https://klimaatadaptatienederland-nl.translate.goog/kennisdossiers/

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
	infrastructure accessibility [ce][ci][w]	allergy linked to CO2 increase, or longer allergy periods [h] Higher risk of heatwaves[h]	Higher flooding risk [ci] *Migration of fish species from hotter waters [n]*	Longer wet periods and modified climate patterns increasing diseases, mosquitoes and pests [a][h][n]	infectious bacteria and mosquitoes [a][h][n]	
West-Nederland	Longer heatwaves, higher energy consumption Risk of more frequent and intense extreme events (wind, storms, rainfall) affecting electricity provision and infrastructure accessibility [ce][ci][w] Higher risk of salinization of drinking water [ci][w]	More frequent droughts [n][w] Higher flooding risk [ci] Risk of exposure to water-borne pathogens from flooded streets [ce][h] Higher risk of pollen allergy linked to CO2 increase, or longer allergy periods [h] Higher risk of heatwaves [h]	Decrease of freshwater availability [ci][n] Risk of coastal erosion shrinking natural areas [n] Higher risk of salinization, drinking water shortage [a][ci][h][n][w] Possible deterioration of bathing water quality [h] Higher flooding risk [ci] *Migration of fish species from hotter waters [n]*	Risk of droughts affecting soils and groundwater levels [a][n][w] Risk of longer wet periods and extreme events affecting harvests [a] Risk of lower crop yields [a] Longer wet periods and modified climate patterns increasing diseases, mosquitoes and pests [a][h][n]	Higher risk of drinking water shortage [ci][w] Higher flooding and hailstorm risk [a][ci] Higher risk of pathogens in water & disseminated by flooding [a][ce][h][n][w] Higher risk of allergens, infectious bacteria and mosquitoes [a][h][n]	https://klimaatadaptatienederland-nl.translate.goog/kennisdossiers/
Zuid-Nederland	Longer heatwaves, higher energy consumption Risk of more frequent and intense extreme events (wind, storms, rainfall) affecting electricity provision and infrastructure accessibility [ce][ci][w]	More frequent droughts [n][w] Higher flooding risk [ci] Risk of exposure to water-borne pathogens from flooded streets [ce][h] Higher risk of pollen allergy linked to CO2 increase, or longer allergy periods [h] Higher risk of heatwaves [h]	n/a	Risk of droughts affecting soils and groundwater levels [a][n][w] Risk of longer wet periods and extreme events affecting harvests [a] Risk of lower crop yields [a] Longer wet periods and modified climate patterns increasing diseases, mosquitoes and pests [a][h][n]	Higher risk of drinking water shortage [ci][w] Higher flooding and hailstorm risk [a][ci] Higher risk of pathogens in water & disseminated by flooding [a][ce][h][n][w] Higher risk of allergens, infectious bacteria and mosquitoes [a][h][n]	https://klimaatadaptatienederland-nl.translate.goog/kennisdossiers/
POLAND: National adaptation priorities/fields (climate adapt): [af] Agriculture and fishing, [bf] Biodiversity and forest management, [cz] Coastal zones, [e] Energy security, [h] Health, [sc] Spatial management and construction,[t] Transport, [w] Water management						
Dolnośląskie	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]		
Kujawsko-pomorskie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf
Łódzkie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]		
Lubelskie	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Lubuskie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf
Małopolskie	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				health and production [af]		
Mazowieckie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of landslides [cz][e][sc][t]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of landslides [cz][e][sc][t]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf
Opolskie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of gales [e]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				[af][cz][w] Impact of higher temperature on animal health and production [af]		
Podkarpackie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf
Podlaskie	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]		
Pomorskie	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e] Higher risk of landslides [cz][e][sc][t] Higher risk associated with sea level rise [af][cz][e][sc][t][w]	Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of landslides [cz][e][sc][t] Higher risk associated with sea level rise [af][cz][e][sc][t][w]	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of gales [e] Higher risk of landslides [cz][e][sc][t] Higher risk associated with sea level rise [af][cz][e][sc][t][w]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Śląskie	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf
Świętokrzyskie	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				health and production [af]		
Warmińsko-Mazurskie	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of droughts [af][bf][e][h][w] Higher risk of gales [e]	Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of gales [e] Higher risk of landslides [cz][e][sc][t] Higher risk associated with sea level rise [af][cz][e][sc][t][w]	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	Higher risk of heatwaves [e][h][sc] Higher risk of frost [e][t] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of floods (rivers) [cz][e][sc][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of gales [e] Higher risk of landslides [cz][e][sc][t] Higher risk associated with sea level rise [af][cz][e][sc][t][w]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf
Wielkopolskie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	n/a	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				[af][cz][w] Impact of higher temperature on animal health and production [af]		
Zachodniopomorskie	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of gales [e]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of gales [e]	Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of gales [e]	*Regulations to reduce emissions [af][bf][e][h][sc][t]* *Extended vegetation cycles [af][bf]* *Migration of alien species [af][bf]* Higher risk of extreme events [af][bf][cz][e][sc][t][w] Aggravation of water scarcity, risk on pastures and fodder [af][w] Inadequacy of precipitation cycles to seasonal agricultural needs [af][w] Heavy rainfall, faster surface run-off, less soil hydration, erosion [af][cz][w] Impact of higher temperature on animal health and production [af]	Higher risk of heatwaves [e][h][sc] Higher risk of heavy rainfall and thunderstorms [e][sc][t][w] Higher risk of urban flooding [cz][e][sc][t][w] Higher risk of flooding (sea) [cz][e][sc][t][w] Higher risk of gales [e]	https://www.imgw.pl/sites/default/files/2020-08/imgw_wspolczesne-problemy-klimatu-polski.pdf https://publikacje.pan.pl/Content/119782/PDF/14_Prandecki_Wrzaszcz.pdf
SLOVAKIA **National adaptation priorities/fields (climate adapt): [a] Agriculture, [b] Biodiversity and natural environment, [ei] Energy, industry, [f] Forestry [g] Geology, [h] Health, [re] Residential environment, [ri] Risk management, emergency management, [sc] Spatial management and construction, [to] Tourism, [tr] Transportation, [w] Water management**						
Bratislavský kraj	Higher demand for energy in summer season [ei] Increased risk of storm-related electricity distuptions (e.g. caused by floods) [ei][w]	Overheating of buildings [ei][h][re] Higher demands on water consumption [w] Deterioration of traffic safety and flow [ei][h][re][ri][sc][tr] Disruption in supplies of energy, damage of equipment [ei][tr][w] Deterioration of general health (asthma, allergies, respiratory diseases) [h]	n/a	Fewer precipitations [a][b][w] Soil erosion [a][b] Decrease of soil moisture in Slovak lowlands - desiccation and salinization of soil [a][b][w]	Increased risk of extreme events - higher incidence of relatively longer droughts and relatively shorter heavy rain episodes [a][b][ei][re][ri][tr][w] More winter floods due to the unstable snow conditions [b][ri][to][tr] Increased risk of landslides [ei][g][re][ri][tr] Higher risk of forest fires [f][h][ri]	https://www.iea.org/articles/slovak-republic-climate-resilience-policy-indicator https://climate-adapt.eea.europa.eu/repository/11273729.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		Increased risk of infectious diseases caused by polluted water and food [a][ei][h][w]				
Stredné Slovensko	Higher demand for energy in summer season [ei] Increased risk of storm-related electricity disruptions (e.g. caused by floods) [ei][w]	Overheating of buildings [ei][h][re] Higher demands on water consumption [w] Deterioration of traffic safety and flow [ei][h][re][ri][sc][tr] Disruption in supplies of energy, damage of equipment [ei][tr][w] Deterioration of general health (asthma, allergies, respiratory diseases) [h] Increased risk of infectious diseases caused by polluted water and food [a][ei][h][w]	n/a	Northern Slovak Republic will likely experience the highest increase in annual precipitation [a][b][w] Soil erosion [a][b]	Increased risk of extreme events - higher incidence of relatively longer droughts and relatively shorter heavy rain episodes [a][b][ei][re][ri][tr][w] More winter floods due to the unstable snow conditions [b][ri][to][tr] Increased risk of landslides [ei][g][re][ri][tr] Higher risk of forest fires [f][h][ri]	https://www.iea.org/articles/slovak-republic-climate-resilience-policy-indicator https://climate-adapt.eea.europa.eu/repository/11273729.pdf
Východné Slovensko	Higher demand for energy in summer season [ei] Increased risk of storm-related electricity disruptions (e.g. caused by floods) [ei][w]	Overheating of buildings [ei][h][re] Higher demands on water consumption [w] Deterioration of traffic safety and flow [ei][h][re][ri][sc][tr] Disruption in supplies of energy, damage of equipment [ei][tr][w] Deterioration of general health (asthma, allergies, respiratory diseases) [h] Increased risk of infectious diseases caused by polluted water and food [a][ei][h][w]	n/a	*Extension of the growing period (43 more days) [a]* Northern Slovak Republic will likely experience the highest increase in annual precipitation [a][b][w] Decrease of soil moisture in Slovak lowlands - desiccation and salinization of soil [a][b][w] Soil erosion [a][b]	Increased risk of extreme events - higher incidence of relatively longer droughts and relatively shorter heavy rain episodes [a][b][ei][re][ri][tr][w] More winter floods due to the unstable snow conditions [b][ri][to][tr] Increased risk of landslides [ei][g][re][ri][tr] Higher risk of forest fires [f][h][ri]	https://www.iea.org/articles/slovak-republic-climate-resilience-policy-indicator https://climate-adapt.eea.europa.eu/repository/11273729.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Západné Slovensko	Higher demand for energy in summer season [ei] Increased risk of storm-related electricity disruption's (e.g. caused by floods) [ei][w]	Overheating of buildings [ei][h][re] Higher demands on water consumption [w] Deterioration of traffic safety and flow [ei][h][re][ri][sc][tr] Disruption in supplies of energy, damage of equipment [ei][tr][w] Deterioration of general health (asthma, allergies, respiratory diseases) [h] Increased risk of infectious diseases caused by polluted water and food [a][ei][h][w]	n/a	Fewer precipitations [a][b][w] Soil erosion [a][b] Decrease in water resources [a][b][w]	Increased risk of extreme events - higher incidence of relatively longer droughts and relatively shorter heavy rain episodes [a][b][ei][re][ri][tr][w] More winter floods due to the unstable snow conditions [b][ri][to][tr] Increased risk of landslides [ei][g][re][ri][tr] Higher risk of forest fires [f][h][ri]	https://www.iea.org/articles/slovak-republic-climate-resilience-policy-indicator https://climate-adapt.eea.europa.eu/repository/11273729.pdf
SPAIN **National adaptation priorities/fields (climate adapt): [a] Agriculture, livestock, fisheries, aquaculture, food, [b] Biodiversity and protected areas, [cm] Coasts and the marine environment, [cu] City, urban planning and building, [e] Energy, [fi] Finance and insurance, [fo] Forestry, desertification, hunting and inland fishing, [hl] Health, [hr] Heritage (cultural and natural), [i] Industry and services, [mt] Mobility and transport, [to] Tourism, [w] Water resources**						
Andalucía	More frequent heatwaves [cu][e][hl] More frequent droughts [a][b][cu][e][fi][fo][hl][hr][to][w]	Risk of water scarcity [a][cu][hl][to][w] More frequent heatwaves [cu][e][hl]	Risk of sea water intrusions [a][b][cm][w] Risk of sea level rise [a][b][cm][cu][fi][hr][i][mt][to]	Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr][to][w] Higher evaporation and decrease of productivity [a][fo][w] Erosion and soil degradation [a][cm] Risk of sea water intrusions [a][b][cm][w] Risk of sea level rise [a][b][cm][cu][fi][hr][i][mt][to]	Higher risk of heatwaves [cu][e][hl] Higher risk from allergies and germs [a][hl]	http://www.conama9.conama.org/conama9/download/files/CTs/2644_JM%E9ndez.pdf
Aragón	More frequent heatwaves [cu][e][hl] More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w]	More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w]	n/a	Biodiversity threats [b][hl][hr] More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w] Risk from extreme events [a][b][cm][fi][fo][hr] Risk of pest and disease increase [a][fo][hl]	Higher risk of heatwaves [cu][e][hl] Higher risk from infectious diseases [a][hl]	https://www.aragoncambioclimatico.es/wp-content/uploads/Estrategia-Aragonesa-Cambio-Climatico-2-19.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Canarias	More frequent heatwaves [cu][e][hl] More frequent droughts [a][b][cu][e][fi][fo][hl][hr][to][w] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk of tropical storms and heavy rainfall	More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w] Higher heat island effect [cu][hl][hr][to] Higher flooding risk (sea level rise) [a][cm][cu][e][fi][hl][i][mt][w]	Risk of saltwater intrusions [a][b][cm][w] Risk of sea acidification and oxygen loss [a][b][cm] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w]	Biodiversity threats [b][hl][hr] More frequent heatwaves [cu][e][hl] More frequent droughts [a][b][cu][e][fi][fo][hl][hr][to][w] Higher forest fire risk [b][fo][hl][hr][to] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Risk of pest and disease increase [a][fo][hl] *Tropicalisation [a][fo]*	Higher risk of heatwaves [cu][e][hl] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk from allergies and germs [a][hl] Higher forest fire risk [b][fo][hl][hr][to]	https://www.gobiernodecanarias.org/medioambiente/descargas/Cambio_climatico/Informacion-Publica/20220207_BORRADOR_ECAC.pdf
Cantabria	More frequent heatwaves [cu][e][hl] More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w]	Higher risk of marine submersion (most of the population lives near the coast) [cm][cu][e][fi][hr][i][mt][to] Higher flooding risk from ocean storms [a][cm][cu][e][fi][i][mt][w]	Higher risk of marine submersion (most of the population lives near the coast) Higher flooding risk from ocean storms [a][cm][cu][e][fi][hl][i][mt][w]		Higher risk of heatwaves [cu][e][hl] Higher forest fire risk [b][fo][hl][hr][to]	(FIHAC - Horizon Europe proposal under evaluation)
Castilla y León	-	-	n/a	Loss of agricultural production [a][fi] Higher forest fire risk [b][fo][hl][hr][to] Higher risk of soil erosion [a][cm][hr]	Higher forest fire risk [b][fo][hl][hr][to]	
Castilla-La Mancha	More frequent heatwaves [cu][e][hl] More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w]	More frequent heatwaves [cu][e][hl] More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w]	n/a	Higher forest fire risk [b][fo][hl][hr][to] Increased thermal stress (semi-arid areas) [a][b][fo][hr][w] Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr][to][w]	Higher risk of heatwaves [cu][e][hl] Higher forest fire risk [b][fo][hl][hr][to] Higher risk from infectious diseases [a][hl] Higher risk from allergies and germs [a][hl] Higher forest fire risk [b][fo][hl][hr][to]	https://www.castillalamancha.es/gobierno/desarrollosostenible/estructura/dgecocir/actuaciones/impactos-del-cambio-clim%C3%A1tico-en-castilla-la-mancha
Cataluña	-	More frequent heatwaves, pollution increase [cu][e][hl] More frequent droughts, water quality and	Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk of coastal erosion	Biodiversity threats [b][hl][hr] More frequent heatwaves [cu][e][hl] More frequent droughts [a][b][cu][e][fi][fo][hl][hr]	Higher risk of heatwaves [cu][e][hl] Higher risk from infectious diseases [a][hl] Higher forest fire risk [b][fo][hl][hr][to]	https://cads.gencat.cat/web/.content/Documents/Publicacions/tercer-informe-sobre-canvi-climatic-catalunya/Sintesis/CC_Sintesi-CASTELLA_web.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
		quantity concerns [a][cu][e][fi][fo][hl][to][w]	[b][cm][cu][fi][hr][to] Higher risk of toxic algae	[to][w] Higher forest fire risk [b][fo][hl][hr][to]		
Comunidad de Madrid	More frequent heatwaves [cu][e][hl] More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w]	More frequent heatwaves [cu][e][hl] Higher heat island effect [cu][hl][hr][to] Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr][to][w] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w]	n/a	Biodiversity threats [b][hl][hr] Higher forest fire risk [b][fo][hl][hr][to]	Higher risk of heatwaves [cu][e][hl] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher forest fire risk [b][fo][hl][hr][to]	https://www.madrid.es/UnidadesDescentralizadas/Sostenibilidad/EspeInf/EnergiayCC/04CambioClimatico/4bVulnera/Ficheros/InfVulneraCC2015VerWeb.pdf
Comunidad Foral de Navarra	-	More frequent heatwaves [cu][e][hl] Higher heat island effect [cu][hl][hr][to] Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr][to][w] Increased air pollution [a][cu][hl][hr][mt][to]	n/a	Higher transpiration and water stress [a][b][fo][hl][hr][w] Risk from heatwaves on livestock [a] Risk of pest and disease increase [a][fo][hl]	Higher risk of heatwaves [cu][e][hl] Higher risk from infectious diseases [a][hl] Higher risk from allergies [a][hl]	http://www.navarra.es/NR/rdonlyres/AE5EB2EC-64A8-4B0E-8584-D683B3E5CE2D/409037/hojarutamar19.PDF
Comunitat Valenciana	-	More frequent heatwaves [cu][e][hl] Higher heat island effect [cu][hl][hr][to] Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr][to][w] Increased air pollution [a][cu][hl][hr][mt][to]	Higher risk of coastal erosion [b][cm][cu][fi][hr][to]	Higher risk of soil erosion [a][cm][hr] Biodiversity threats [b][hl][hr] Higher forest fire risk [b][fo][hl][hr][to] Risk of pest and disease increase [a][fo][hl]	Higher risk of heatwaves [cu][e][hl] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher forest fire risk [b][fo][hl][hr][to] Higher risk from infectious diseases [a][hl] Higher risk from allergies [hl]	https://agroambient.gva.es/va/web/cambio-climatico/2020-2030
Extremadura	-	More frequent heatwaves [cu][e][hl] Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr][to][w]	n/a	Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr][to][w] Higher evaporation and decrease of productivity [a][fi][fo] More frequent heatwaves [cu][e][hl] Higher forest fire risk [b][fo][hl][hr][to] Risk of pest and disease increase [a][fo][hl]	Higher risk of heatwaves [cu][e][hl] Higher risk from infectious diseases [a][hl] Higher forest fire risk [b][fo][hl][hr][to] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk of landslides [cu][e][fi][i][mt]	http://extremambiente.juntaex.es/files/biblioteca_digital/Mapa%20de%20Impactos%20del%20Cambio%20Climatico%20en%20Extremadura%20web.pdf

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
Galicia	More frequent heatwaves (loss of heat dissipation) [cu][e][hl] More frequent droughts, impacts on hydroelectricity [cu][e][w]	Higher risk of water stress for local communities [a][cu][hl][yo][w] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk of severe droughts [a][cu][e][w] Higher risk of changing water quality [a][cu][hl][w] Higher risk from infectious diseases [a][hl]	Higher risk of sea water acidification [a][b][cm] Higher risk of disruptions in the composition of fisheries (new species and migration of others) [a][cm] Higher risk of affecting endorrheic ecosystems such as lakes, ponds, rivers and streams of high mountains [a][b]	Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr][to][w] Higher risk of desertification and erosion [a][b][fo][hr][w] Higher demand for irrigation [a][w] Appearance of new pests and diseases in plants and animals [a][fo][hl] Shorter crop maturation due to higher average temperatures and lower production [a] Biodiversity threats [b][hl][hr]	Rising temperatures and prolonged periods of heat waves will increase the problems of railway buckling [mt] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk of damage to roads [cu][mt] Higher risk of strong winds affecting branches and trees on roads [mt]	https://cambioclimatico.xunta.gal/c/document_library/get_file?folderId=86590&name=DLFE-54555.pdf
Illes Balears	Risk of overloading existing sanitation and drinking water supply facilities [cu][fi][hl][i][to][w] Higher risk of overloads and flow overflow in waste water treatment plants [cu][fi][hl][i][to][w] Damage to desalination plants [a][cm][cu][w] Less water availability in aquifers and surface water bodies due to a decrease in spillage and consequent increase in the need for use and production of desalination plants [a][b][cu][e][hl][i][to][w]	More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w] Reduction in the availability of drinking water [cu][hl][to][w]	Risk of sea level rise [a][b][cm][cu][fi][hr][i][mt][to] Risk of saltwater intrusions [a][b][cm][w]	Increased risk of hydrological and agricultural drought for irrigated crops [a][w] Decrease in the levels of some aquifers and problems in meeting demands [a][cu][to][w]	Material damage to water catchment infrastructures and desalination plants [a][cm][cu][w]	https://www.caib.es/sites/canviclimatic2/es/estudios_de_vulnerabilidad/
La Rioja	-	More frequent heatwaves [cu][e][hl] Degradation of roads and railways [fi][t] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w]	n/a	Higher risk of soil erosion [a][cm][hr] Higher risk of droughts, desertification [a][l][w] Higher risk of crop displacement due to changes in temperature Appearance of new pests and diseases in plants and animals [a][fo][hl]	-	https://theconversation.com/el-territorio-del-rioja-ante-el-desafio-del-cambio-climatico-117195

Region (S3)	Energy and Utilities	Sustainable urban communities	Marine and coastal environment	Agriculture, Forestry and other Land use	Civil security and protection	References
				More irrigation systems would be required for agricultural activities		
País Vasco		More frequent heatwaves [cu][e][hl] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w]	Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk of coastal erosion [b][cm][cu][fi][hr][to]	Biodiversity threats [b][hl][hr]	Higher risk of heatwaves [cu][e][hl]	https://bideoak2.euskadi.eus/debates/debate_1310/Estrategia_cambio_climatico_clima_2050_es.pdf
Principado de Asturias	Reduction in the availability of water for commercial and public use [a][cu][hl][to][w]	Higher risk of droughts [a][b][cu][e][fi][fo][hl][hr][to][w]	Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk of damaging ecosystemic services [b][fo][i] Risk of sea level rise [a][b][cm][cu][fi][hr][i][mt][to] Higher risk of coastal erosion [b][cm][cu][fi][hr][to] Reduction in the number of sandy beaches [b][cm][hr][to] Higher risk of depletion of water resources due to higher content of nitrates on the water streams [a][cm][cu][hl][to][w]	Risk of soil erosion [a][b][cm][hr] Higher forest fire risk [b][fo][hl][hr][to] Higher vulnerability of mountain ecosystems Biodiversity threats [b][hl][hr] Risk of pest and disease increase [a][fo][hl]	Higher risk of heatwaves [cu][e][hl] Higher forest fire risk [b][fo][hl][hr][to]	https://medioambiente.asturias.es/documents/646140/0/DiagnosticoPrevioCambioClimaAsturias_para+portal.pdf/95b9334d-76c1-c8ca-2b8c-91022e998fba
Región de Murcia	-	Higher heat island effect [cu][hl][hr][to] More frequent heatwaves [cu][e][hl] Increase in the transmission of infection diseases (Chicunguña and Zika) [a][hl] Increase in allergic reactions to pollen [hl] More frequent droughts, water quality and quantity concerns [a][cu][e][fi][fo][hl][to][w]	Risk of sea water intrusions [a][b][cm][w] Decreased access to fishing areas due to their displacement to the north [a][cm] Decrease in the capacity of carbon storage by the sea due to changes in marine ecosystems [cm]	Higher evaporation and decrease of productivity [a][fi][fo] Higher transpiration and water stress [a][b][fo][hl][hr][w] *Tropicalisation [a][fo]* *Biodiversity displacement and change [b][hl][hr]* Loss of agricultural production [a][fi]	Higher risk of heatwaves [cu][e][hl] Higher flooding risk [a][cm][cu][e][fi][hl][i][mt][w] Higher risk from infectious diseases [a][hl] Higher risk from allergies [hl]	https://transparencia.carm.es/wres/transparencia/doc/Organos-colegiados/Consejo_Asesor_Regional_Medio_Ambiente/2020_02_24/Estrategia_cambio_climatico.pdf

Annex III Survey template for mapping the EO-based CS

PROTECT - Survey - Mapping of European EO climate services providers

Are you a European company providing innovative EO services for climate adaptation or mitigation?

Fill in our EU Survey!

Background and objectives of this questionnaire

The European Union funded PROTECT project aims to support urgent action for climate adaptation, mitigation and resilience. The project aims to enable public authorities to use state-of-the-art public procurement approaches in order to identify solutions – climate services based on EO - that best fit the specific and systemic needs of public demand. The initial focus is on five encompassing application domains: Energy and Utilities, Sustainable Urban Communities, Marine and Coastal Environment and Agriculture, Forestry and Other Land Use (including bioeconomy) and Civil Security and Protection.

This project aims to prepare a future European funded Pre-Commercial Procurement initiative (2024). It has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592.

*Learn more about Innovation procurement and its two modalities - Pre-Commercial procurement (PCP) and Public procurement of Innovative solutions (PPI) – **in the attached document below**.*

Download

What_is_Innovation_Procurement.pdf

Context

The project partners are looking for innovative services using EO data addressing the needs of public authorities regarding climate adaptation and mitigation.

The objectives of this survey are :

1. To map European climate services that use EO (EO) data.
2. To give public authorities a snapshot of the state of the art of the market and on-going developments

Your interest in filling in this questionnaire
Each pre-identified provider will have the chance to be referenced by the PROTECT project and might have the opportunity to present their services in front of participating public buyers in the frame of an Open Market Consultation (online pitching sessions) and some of our project activities.

We are looking forward to working with you!

Instructions to fill in this questionnaire

* It is recommended to fill in this form together with the business representative of the your entity.

* If more than one of the company's services are fitting to the scope, the questionnaire should be filled in separately for each service by selecting Service 1 first, filling in all the details for the respective

service and after selecting Add another service option, filling in all the information for Service 2 etc.
* The information provided will only be used in the context of the PROTECT project. Processing of personal information is fully compliant with data protection regulations in place (learn more about GDPR here).

Do you give your consent for PROTECT project to procees your information?

- I agree – Please fill in the questions below
- I don't agree – **Thank you for your time ! Unfortunately, you won't be able to continue this survey ! Have a wonderful day !**

Personal and Organisation Information

*** 1. Name and surname**

*** 2. Name of the organization**

*** 3. Do you give your consent for PROTECT project to procees your information?**

- I agree
- I don't agree

*** 4. Email**

*** 5. Phone number**

*** 6. Website**

7. Logo

*** 8. Headquarter's country**

- AT - Austria
- BE - Belgium
- BG - Bulgaria
- HR - Croatia
- CY - Cyprus
- CZ - Czechia
- DK - Denmark

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- EE - Estonia
- FI - Finland
- FR - France
- DE - Germany
- EL - Greece
- HU - Hungary
- IE - Ireland
- IT - Italy
- LV - Latvia
- LT - Lithuania
- LU - Luxembourg
- MT - Malta
- NL - Netherlands
- PL - Poland
- PT - Portugal
- RO - Romania
- SK - Slovak Republic
- SI - Slovenia
- ES - Spain
- SE – Sweden

*** 9. City**

*** 10. Type of enterprise**

- Micro Enterprises (<10 employees)
- Small Enterprises (10-49 employees)
- Medium-sized Enterprises (50-249 employees)
- Large Enterprises (>250 employees)
- Public Organization
- Others

*** 11. Company's description (Max. 10 lines)**

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Description of your service

According to European Union Agency for the Space Programme (EUSPA): “EO refers to the use of remote sensing technologies to monitor land, marine (seas, rivers, lakes) and atmosphere. Satellite-based EO relies on the use of satellite-mounted payloads to gather imaging data about the Earth’s characteristics. The images are then processed and analysed in order to extract different types of information that can serve a very wide range of applications and industries.”

The European Union definition as outlined in the 2015 European Union research and innovation roadmap for climate services reads as follows:
“we attribute to the term a broad meaning, which covers the transformation of climate-related data — together with other relevant information — into customised products such as projections, forecasts, information, trends, economic analysis, assessments (including technology assessment), counselling on best practices, development and evaluation of solutions and any other service in relation to climate that may be of use for the society at large. As such, these services include data, information and knowledge that support adaptation, mitigation an disaster risk management (DRM).”

Service 1

*** A. Please select option:**

☐ Service 1 (S1)

*** S1.1. In which of the following five applications domains is the service delivered?**

○ **Agriculture, forestry and other land uses (including the bioeconomy)**
Ex : Agriculture, forestry and other land uses cover a wide range of environments and have great potential for climate services. Unsustainable agricultural and forestry practices (e.g. overexploitation of soils, conversion of forests to agricultural land) generate large amounts of greenhouse gases and disturb the already fragile balance of local ecosystems.

a) Environmental monitoring

○ Carbon capture & content assessment

○ Environmental impact monitoring

○ Biomass monitoring

○ Deforestation/degradation monitoring

○ Others

*** If Others, write which one :**

b) Natural resources monitoring

○ Biomass monitoring

○ Crop yield forecasting

○ Soil condition monitoring

○ Vegetation monitoring

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- Forest Inventory monitoring
- Forest vegetation health monitoring
- Others

*** If Others, write which one :**

c) Operations management

- Asset monitoring
- CAP monitoring
- Farm management systems
- Pastureland management
- Precision irrigation
- Variable rate application
- Forest asset management
- Forest exploitation certification
- Others

*** If Others, write which one :**

d) Weather services for agriculture

- Snow and ice
- Climate services for agriculture
- Weather forecasting for agriculture
- Others

*** If Others, write which one :**

- **Energy and utilities**
  Ex : Utilities include all activities related to water supply, sewage services, electricity, dams and natural gas.

  a) Renewable energy:

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- Site selection, planning and monitoring for renewable energy
- Renewable energy assessment potential and forecast
- Others

*** If Others, write which one :**

b) Other

- Energy network conditions monitoring
- Power plant design optimisation
- Environmental impact assessment of energy and mineral resources plants
- Pipeline monitoring
- Others

*** If Others, write which one :**

c) Waste

- Climate data and modelling for waste monitoring and management
- Others

*** If Others, write which one :**

- **Marine and coastal environment**
  Ex : Marine environments are aquatic environments with high levels of dissolved salt. They include the open ocean, the deep ocean and coastal marine ecosystems, each with different physical and biological characteristics and therefore representing different ecosystems.

a) Environmental monitoring

- Marine pollution monitoring
- Others

*** If Others, write which one :**

b) Maritime engineering

- Marine surveying and mapping
- Dredging

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- Others

*** If Others, write which one :**

c) Navigation

- Climate data and modelling for navigation
- Others

*** If Others, write which one :**

d) Ocean services

- Metocean
- Others

*** If Others, write which one :**

e) Ports

- Climate data and modelling for ports
- Others

*** If Others, write which one :**

f) Vessel tracking

- Dark vessel monitoring
- Others

*** If Others, write which one :**

g) Aquaculture

- Climate data and modelling for aquaculture
- Others

*** If Others, write which one :**

h) Fisheries

- Illegal, unreported and unregulated fishing (IUU) control
- Catch optimisation
- Fish stock detection
- Others

*** If Others, write which one :**

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- **Security and civil protection**
  Ex : Civil security and protection includes the policies, bodies and mechanisms that a country or region has in place to protect itself against new and urgent threats to the safety of people and/or the functioning of critical infrastructure.

a) Early warning

- Forecast
- Monitoring and warning services
- Others

*** If Others, write which one :**

b) Migration and settlement

- Monitoring and forecasting the climate impact of migration
- Forecasting of climate drivers for migration
- Others

*** If Others, write which one :**

c) Post-event analysis

- Post-event analysis
- Others

*** If Others, write which one :**

d) Preparedness

- Preparedness
- Others

*** If Others, write which one :**

e) Rapid mapping

- Rapid mapping
- Others

*** If Others, write which one :**

f) Search and Rescue

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- Beacons for Aviation
- Beacons for Land
- Situational awareness supporting search and rescue
- Others

*** If Others, write which one :**

g) Infrastructure Planning

- Permitting
- Vulnerability Analysis
- Others

*** If Others, write which one :**

h) Insurance for natural disasters

- Risk modelling
- Others

*** If Others, write which one :**

i) Critical infrastructure

- Construction Operations
- Monitoring of impact of human activities on infrastructure
- Infrastructure monitoring
- Predictive maintenance
- Emergency assistance
- Design of infrastructure
- Others

*** If Others, write which one :**

- **Sustainable urban communities**
Ex : Green and sustainable urban communities harness their human, natural and financial capital to meet current and future needs in a sustainable manner, with a long-term perspective (ex: heat islands, effects of climate change on the (vulnerable) urban population etc.).

a) Environmental monitoring

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- [ ] Air quality monitoring in urban environments
- [ ] Thermal auditing
- [ ] Urban greening
- [ ] Urban heat islands
- [ ] Others

*** If Others, write which one :**

b) Smart cities operations

- [ ] Smart waste management
- [ ] Others

*** If Others, write which one :**

c) Urban planning and monitoring

- [ ] Cultural heritage monitoring
- [ ] Surveying and mapping of urban areas
- [ ] Urban modelling, 3D modelling, Digital Twins
- [ ] Urban planning
- [ ] Others

*** If Others, write which one :**

d) Urban mobility

- ○ Climate data and modelling for urban mobility monitoring and forecasting
- ○ Others

*** If Others, write which one :**

*** S1.2. Service acronym or project name**
(Horizon 2020 projects and similar are being taken into consideration as well) :

*** S1.3. Which technologies are used for the service? (multiple choices)**

- [ ] Satellites

*** S1.3.1. Describe the typology of EO data you use (Ex: Sentinel 5P, Pléiades, Copernicus atmosphere services etc.) :**

- [ ] Drones

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- Aircrafts
- Ground sensors
- IoT
- Artificial Intelligence/Machine Learning
- Others

*** If Others, write which one :**

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ECSS-E-HB-11A_1March2017_.pdf

*** S1.4. Which is the Technological Readiness Level of the solution? The TRL levels for software are described according to the Annex A from ECSS-E-HB-11A which can be find above.**

- TRL 1
  Ex : Preliminary algorithmic stage. Publication of research results.

  *** S1.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

- TRL 2
  Ex : Individual algorithms or functions are prototyped.

  *** S1.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

- TRL 3
  Ex : Prototype of the main functionalities of the integrated system.

  *** S1.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

- TRL 4
  Ex : Alpha version. Preliminary release of non-mature software version; distributed to a community at an early stage of the software development life-cycle; that implements the main functionality of the software and by which preliminary verification and validation activities are archieved.

  *** S1.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

- TRL 5
  Ex : Beta version. Preliminary release of non-mature software version; distributed to a community at an early stage of the software life-cycle, that implements the complete functionality of the software and by which preliminary verification and validation activities are archived.

  *** S1.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

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○ TRL 6
Ex : Ready for use in an operational or production context, including user support, as a building block or a tool.

*** S1.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 7
Ex : Demonstrator. Building block and tailored generic software product qualified for a particular purpose.

*** S1.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

S1.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

○ TRL 8
Ex : System qualified and ready to be applied in an operational environment.

*** S1.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

S1.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

○ TRL 9
Ex : Has been applied in the execution of an operational environment.

*** S1.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

S1.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

*** S1.5. Explain how your service assists public authorities in climate adaptation or mitigation actions :**

*** S1.6. What kind of data do you lack of to improve your service?**

*** S1.7. What future missions or emerging technologies would help improve your service and make it fit better with market needs?**

*** S1.8. Do you have or do you plan to implement partnerships with other climate services providers to complement you service offer?**

S1.9. Comments

☐ Add another service – see below

Service 2

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*** B. If Add another service selected, please select option:**

- [ ] Service 2 (S2)

*** S2.1. In which of the following five applications domains is the service delivered?**

- **Agriculture, forestry and other land uses (including the bioeconomy)**
  Ex : Agriculture, forestry and other land uses cover a wide range of environments and have great potential for climate services. Unsustainable agricultural and forestry practices (e.g. overexploitation of soils, conversion of forests to agricultural land) generate large amounts of greenhouse gases and disturb the already fragile balance of local ecosystems.

a) Environmental monitoring

- Carbon capture & content assessment
- Environmental impact monitoring
- Biomass monitoring
- Deforestation/degradation monitoring
- Others

*** If Others, write which one :**

b) Natural resources monitoring

- Biomass monitoring
- Crop yield forecasting
- Soil condition monitoring
- Vegetation monitoring
- Forest Inventory monitoring
- Forest vegetation health monitoring
- Others

*** If Others, write which one :**

c) Operations management

- Asset monitoring
- CAP monitoring
- Farm management systems
- Pastureland management

- Precision irrigation
- Variable rate application
- Forest asset management
- Forest exploitation certification
- Others

*** If Others, write which one :**

d) Weather services for agriculture

- Snow and ice
- Climate services for agriculture
- Weather forecasting for agriculture
- Others

*** If Others, write which one :**

- **Energy and utilities**
Ex : Utilities include all activities related to water supply, sewage services, electricity, dams and natural gas.

a) Renewable energy:

- Site selection, planning and monitoring for renewable energy
- Renewable energy assessment potential and forecast
- Others

*** If Others, write which one :**

b) Other

- Energy network conditions monitoring
- Power plant design optimisation
- Environmental impact assessment of energy and mineral resources plants
- Pipeline monitoring

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- Others

*** If Others, write which one :**

c) Waste

- Climate data and modelling for waste monitoring and management
- Others

*** If Others, write which one :**

- **Marine and coastal environment**
  Ex : Marine environments are aquatic environments with high levels of dissolved salt. They include the open ocean, the deep ocean and coastal marine ecosystems, each with different physical and biological characteristics and therefore representing different ecosystems.

a) Environmental monitoring

- Marine pollution monitoring
- Others

*** If Others, write which one :**

b) Maritime engineering

- Marine surveying and mapping
- Dredging
- Others

*** If Others, write which one :**

c) Navigation

- Climate data and modelling for navigation
- Others

*** If Others, write which one :**

d) Ocean services

- Metocean
- Others

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

*** If Others, write which one :**

e) Ports

- Climate data and modelling for ports
- Others

*** If Others, write which one :**

f) Vessel tracking

- Dark vessel monitoring
- Others

*** If Others, write which one :**

g) Aquaculture

- Climate data and modelling for aquaculture
- Others

*** If Others, write which one :**

h) Fisheries

- Illegal, unreported and unregulated fishing (IUU) control
- Catch optimisation
- Fish stock detection
- Others

*** If Others, write which one :**

- **Security and civil protection**
  Ex : Civil security and protection includes the policies, bodies and mechanisms that a country or region has in place to protect itself against new and urgent threats to the safety of people and/or the functioning of critical infrastructure.

a) Early warning

- Forecast
- Monitoring and warning services
- Others

*** If Others, write which one :**

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b) Migration and settlement

- Monitoring and forecasting the climate impact of migration
- Forecasting of climate drivers for migration
- Others

*** If Others, write which one :**

c) Post-event analysis

- Post-event analysis
- Others

*** If Others, write which one :**

d) Preparedness

- Preparedness
- Others

*** If Others, write which one :**

e) Rapid mapping

- Rapid mapping
- Others

*** If Others, write which one :**

f) Search and Rescue

- Beacons for Aviation
- Beacons for Land
- Situational awareness supporting search and rescue
- Others

*** If Others, write which one :**

g) Infrastructure Planning

- Permitting
- Vulnerability Analysis
- Others

*** If Others, write which one :**

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h) Insurance for natural disasters

- Risk modelling
- Others

*** If Others, write which one :**

i) Critical infrastructure

- Construction Operations
- Monitoring of impact of human activities on infrastructure
- Infrastructure monitoring
- Predictive maintenance
- Emergency assistance
- Design of infrastructure
- Others

*** If Others, write which one :**

- **Sustainable urban communities**
Ex : Green and sustainable urban communities harness their human, natural and financial capital to meet current and future needs in a sustainable manner, with a long-term perspective (ex: heat islands, effects of climate change on the (vulnerable) urban population etc.).

a) Environmental monitoring

- [ ] Air quality monitoring in urban environments
- [ ] Thermal auditing
- [ ] Urban greening
- [ ] Urban heat islands
- [ ] Others

*** If Others, write which one :**

b) Smart cities operations

- [ ] Smart waste management
- [ ] Others

*** If Others, write which one :**

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c) Urban planning and monitoring

- [ ] Cultural heritage monitoring
- [ ] Surveying and mapping of urban areas
- [ ] Urban modelling, 3D modelling, Digital Twins
- [ ] Urban planning
- [ ] Others

*** If Others, write which one :**

d) Urban mobility

- ○ Climate data and modelling for urban mobility monitoring and forecasting
- ○ Others

*** If Others, write which one :**

*** S2.2. Service acronym or project name**
(Horizon 2020 projects and similar are being taken into consideration as well) :

*** S2.3. Which technologies are used for the service? (multiple choices)**

- [ ] Satellites

*** S2.3.1. Describe the typology of EO data you use (Ex: Sentinel 5P, Pléiades, Copernicus atmosphere services etc.) :**

- [ ] Drones
- [ ] Aircrafts
- [ ] Ground sensors
- [ ] IoT
- [ ] Artificial Intelligence/Machine Learning
- [ ] Others

*** If Others, write which one :**

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*** S2.4. Which is the Technological Readiness Level of the solution? The TRL levels for software are described according to the Annex A from ECSS-E-HB-11A which can be find above.**

- TRL 1
  Ex : Preliminary algorithmic stage. Publication of research results.

  *** S2.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

- TRL 2
  Ex : Individual algorithms or functions are prototyped.

  *** S2.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

- TRL 3
  Ex : Prototype of the main functionalities of the integrated system.

  *** S2.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

- TRL 4
  Ex : Alpha version. Preliminary release of non-mature software version; distributed to a community at an early stage of the software development life-cycle; that implements the main functionality of the software and by which preliminary verification and validation activities are archieved.

  *** S2.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

- TRL 5
  Ex : Beta version. Preliminary release of non-mature software version; distributed to a community at an early stage of the software life-cycle, that implements the complete functionality of the software and by which preliminary verification and validation activities are archived.

  *** S2.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

- TRL 6
  Ex : Ready for use in an operational or production context, including user support, as a building block or a tool.

  *** S2.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

- TRL 7
  Ex : Demonstrator. Building block and tailored generic software product qualified for a particular purpose.

  *** S2.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

  S2.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

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- TRL 8
  Ex : System qualified and ready to be applied in an operational environment.

  *** S2.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

  S2.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

- TRL 9
  Ex : Has been applied in the execution of an operational environment.

  *** S2.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

  S2.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

*** S2.5. Explain how your service assists public authorities in climate adaptation or mitigation actions :**

*** S2.6. What kind of data do you lack of to improve your service?**

*** S2.7. What future missions or emerging technologies would help improve your service and make it fit better with market needs?**

*** S2.8. Do you have or do you plan to implement partnerships with other climate services providers to complement you service offer?**

S2.9. Comments

- [ ] Add another service - see below

Service 3

*** C. If Add another service selected, please select option:**

- [ ] Service 3 (S3)

*** S3.1. In which of the following five applications domains is the service delivered?**

- **Agriculture, forestry and other land uses (including the bioeconomy)**
  Ex : Agriculture, forestry and other land uses cover a wide range of environments and have great potential for climate services. Unsustainable agricultural and forestry practices (e.g. overexploitation of soils, conversion of forests to agricultural land) generate large amounts of greenhouse gases and disturb the already fragile balance of local ecosystems.

  a) Environmental monitoring

- Carbon capture & content assessment

- Environmental impact monitoring
- Biomass monitoring
- Deforestation/degradation monitoring
- Others

*** If Others, write which one :**

b) Natural resources monitoring

- Biomass monitoring
- Crop yield forecasting
- Soil condition monitoring
- Vegetation monitoring
- Forest Inventory monitoring
- Forest vegetation health monitoring
- Others

*** If Others, write which one :**

c) Operations management

- Asset monitoring
- CAP monitoring
- Farm management systems
- Pastureland management
- Precision irrigation
- Variable rate application
- Forest asset management
- Forest exploitation certification
- Others

*** If Others, write which one :**

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d) Weather services for agriculture

- Snow and ice
- Climate services for agriculture
- Weather forecasting for agriculture
- Others

*** If Others, write which one :**

- **Energy and utilities**
  Ex : Utilities include all activities related to water supply, sewage services, electricity, dams and natural gas.

a) Renewable energy:

- Site selection, planning and monitoring for renewable energy
- Renewable energy assessment potential and forecast
- Others

*** If Others, write which one :**

b) Other

- Energy network conditions monitoring
- Power plant design optimisation
- Environmental impact assessment of energy and mineral resources plants
- Pipeline monitoring
- Others

*** If Others, write which one :**

c) Waste

- Climate data and modelling for waste monitoring and management
- Others

*** If Others, write which one :**

- **Marine and coastal environment**
  Ex : Marine environments are aquatic environments with high levels of dissolved salt. They include the open ocean, the deep ocean and coastal marine ecosystems, each with

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different physical and biological characteristics and therefore representing different ecosystems.

a) Environmental monitoring

- Marine pollution monitoring
- Others

*** If Others, write which one :**

b) Maritime engineering

- Marine surveying and mapping
- Dredging
- Others

*** If Others, write which one :**

c) Navigation

- Climate data and modelling for navigation
- Others

*** If Others, write which one :**

d) Ocean services

- Metocean
- Others

*** If Others, write which one :**

e) Ports

- Climate data and modelling for ports
- Others

*** If Others, write which one :**

f) Vessel tracking

- Dark vessel monitoring
- Others

*** If Others, write which one :**

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g) Aquaculture

- Climate data and modelling for aquaculture
- Others

*** If Others, write which one :**

h) Fisheries

- Illegal, unreported and unregulated fishing (IUU) control
- Catch optimisation
- Fish stock detection
- Others

*** If Others, write which one :**

- **Security and civil protection**
  Ex : Civil security and protection includes the policies, bodies and mechanisms that a country or region has in place to protect itself against new and urgent threats to the safety of people and/or the functioning of critical infrastructure.

a) Early warning

- Forecast
- Monitoring and warning services
- Others

*** If Others, write which one :**

b) Migration and settlement

- Monitoring and forecasting the climate impact of migration
- Forecasting of climate drivers for migration
- Others

*** If Others, write which one :**

c) Post-event analysis

- Post-event analysis
- Others

*** If Others, write which one :**

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d) Preparedness

- Preparedness
- Others

*** If Others, write which one :**

e) Rapid mapping

- Rapid mapping
- Others

*** If Others, write which one :**

f) Search and Rescue

- Beacons for Aviation
- Beacons for Land
- Situational awareness supporting search and rescue
- Others

*** If Others, write which one :**

g) Infrastructure Planning

- Permitting
- Vulnerability Analysis
- Others

*** If Others, write which one :**

h) Insurance for natural disasters

- Risk modelling
- Others

*** If Others, write which one :**

i) Critical infrastructure

- Construction Operations
- Monitoring of impact of human activities on infrastructure
- Infrastructure monitoring
- Predictive maintenance
- Emergency assistance

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- ○ Design of infrastructure
- ○ Others

*** If Others, write which one :**

○ **Sustainable urban communities**
Ex : Green and sustainable urban communities harness their human, natural and financial capital to meet current and future needs in a sustainable manner, with a long-term perspective (ex: heat islands, effects of climate change on the (vulnerable) urban population etc.).

a) Environmental monitoring

- ☐ Air quality monitoring in urban environments
- ☐ Thermal auditing
- ☐ Urban greening
- ☐ Urban heat islands
- ☐ Others

*** If Others, write which one :**

b) Smart cities operations

- ☐ Smart waste management
- ☐ Others

*** If Others, write which one :**

c) Urban planning and monitoring

- ☐ Cultural heritage monitoring
- ☐ Surveying and mapping of urban areas
- ☐ Urban modelling, 3D modelling, Digital Twins
- ☐ Urban planning
- ☐ Others

*** If Others, write which one :**

d) Urban mobility

- ○ Climate data and modelling for urban mobility monitoring and forecasting
- ○ Others

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*** If Others, write which one :**

*** S3.2. Service acronym or project name**
(Horizon 2020 projects and similar are being taken into consideration as well) :

*** S3.3. Which technologies are used for the service? (multiple choices)**

- [ ] Satellites

*** S3.3.1. Describe the typology of EO data you use (Ex: Sentinel 5P, Pléiades, Copernicus atmosphere services etc.) :**

- [ ] Drones
- [ ] Aircrafts
- [ ] Ground sensors
- [ ] IoT
- [ ] Artificial Intelligence/Machine Learning
- [ ] Others

*** If Others, write which one :**

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*** S3.4. Which is the Technological Readiness Level of the solution? The TRL levels for software are described according to the Annex A from ECSS-E-HB-11A which can be find above.**

○ TRL 1
Ex : Preliminary algorithmic stage. Publication of research results.

*** S3.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 2
Ex : Individual algorithms or functions are prototyped.

*** S3.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 3
Ex : Prototype of the main functionalities of the integrated system.

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*** S3.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 4
Ex : Alpha version. Preliminary release of non-mature software version; distributed to a community at an early stage of the software development life-cycle; that implements the main functionality of the software and by which preliminary verification and validation activities are archieved.

*** S3.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 5
Ex : Beta version. Preliminary release of non-mature software version; distributed to a community at an early stage of the software life-cycle, that implements the complete functionality of the software and by which preliminary verification and validation activities are archived.

*** S3.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 6
Ex : Ready for use in an operational or production context, including user support, as a building block or a tool.

*** S3.4.1. Describe your project in 15 lines (Challenges addressed, Technological barriers to raise, Innovative aspect of your project etc.) :**

○ TRL 7
Ex : Demonstrator. Building block and tailored generic software product qualified for a particular purpose.

*** S3.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

S3.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

○ TRL 8
Ex : System qualified and ready to be applied in an operational environment.

*** S3.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

S3.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

○ TRL 9
Ex : Has been applied in the execution of an operational environment.

*** S3.4.1. Description of your service in 15 lines (Ex: Challenges addressed, value proposition, uniqueness of the solution, collaborations with other providers if it is a project, clients targeted etc.) :**

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S3.4.2. Provide an example of use case with a client or an end-user (Max. 15 lines) :

*** S3.5. Explain how your service assists public authorities in climate adaptation or mitigation actions :**

*** S3.6. What kind of data do you lack of to improve your service?**

*** S3.7. What future missions or emerging technologies would help improve your service and make it fit better with market needs?**

*** S3.8. Do you have or do you plan to implement partnerships with other climate services providers to complement you service offer?**

S3.9. Comments

☐ I have more than 3 services – Please fill in the questionnaire again. Thank you !

Presentation of the results of the survey

The consortium would like to display the results of the mapping on the PROTECT online platform to provide an actionable and readable catalogue of climate services that will be consulted by our community of public procurers.

*** 1. Do you authorise the PROTECT consortium to use your answers to feed into the catalogue of climate services that will be displayed on PROTECT's online platform? (Multiple choices)**

☐ Yes, I agree for all services.

☐ Yes, I agree for Service 1.

☐ Yes, I agree for Service 2.

☐ Yes, I agree for Service 3.

☐ No, I disagree and I wish that PROTECT keeps the results confidential.

*** 2. Do you accept to be contacted by PROTECT team to have additional information after you filled the questionnaire?**

○ Yes, I agree.

○ No, I disagree.

Annex IV Database for the dissemination among multipliers of the survey in the second stage of the mapping

#	Organisation	Country
1	Aeronautics and Space Agency of the Austrian Research Promotion Agency (FFG) – 2004 (ASA in 1972)	Austria
2	Belgium Federal Science Policy Office (BELSPO)	Belgium
3	Bizgarden S.R.O.	Czech Republic
4	Brno Space Cluster	Czech Republic
5	Centre D'Estudes Spatiales de la Biosphere	France
6	Climateeurope2	Europe
7	Connect by CNES	France
8	Consiglio Nazionale delle Ricerche (CNR)	Italy
9	Copernicus Challenge	France
10	Croatian Space Agency (CSA) - 2002	Croatia
11	Cyprus Space Exploration Organisation	Cyprus
12	Czech Space Office (CSO) - 2003	Czech Republic
13	DLR	Germany
14	E-SHAPE	Europe
15	EARSC	Belgium
16	ENEA Casaccia	Italy
17	Envision H2020	Europe
18	ESA BIC Austria	Austria
19	ESA BIC Baden-Wurttemberg	Germany
20	ESA BIC Bavaria	Germany
21	ESA BIC Belgium	Belgium
22	ESA BIC Czech Republic	Czech Republic
23	ESA BIC Denmark	Denmark
24	ESA BIC Estonia	Estonia
25	ESA BIC Estonia	Estonia
26	ESA BIC Finland	Finland
27	ESA BIC Greece	Greece
28	ESA BIC Hessen	Germany
29	ESA BIC Hungary	Hungary
30	ESA BIC Ireland	Ireland
31	ESA BIC Lazio	Italy
32	ESA BIC Madrid Region	Spain
33	ESA BIC Noordwijk	Netherlands
34	ESA BIC Nord France	France

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#	Organisation	Country
35	ESA BIC North Rhine-Westphalia	Germany
36	ESA BIC Northern Germany	Germany
37	ESA BIC Portugal	Portugal
38	ESA BIC Sud France	France
39	ESA BIC Sweden	Sweden
40	ESA BIC Turin	Italy
41	Estonian Space Offices	Estonia
42	European Innovation Council	Europe
43	European Space Resources Innovation Centre - ESRIC	Luxembourg
44	Fondazione E. Amaldi	Italy
45	Fundacion para el Conocimiento madri+d	Spain
46	Hellenic Space Center	Greece
47	Hungarian Space Office (HSO) - 1992	Hungary
48	InCubed by ESA	Europe
49	Institute for Space Application and Remote Sensing - National Observatory of Athens (ISARS-NOA) - 1955	Greece
50	Italian Space Agency - Agenzia Spaziale Italiana	Italy
51	Latvian Technology in Space	Latvia
52	Lithuanian Space Agency	Lithuania
53	Luxembourg Space Agency	Luxembourg
54	Malta Space	Malta
55	National Center for Space Studies (CNES) - 1961	France
56	National Institute for Aerospace Technology (INTA)- 1942; Center for the Development of Industrial Technology (CDTI)	Spain
57	National Space Institute - Technical University of Denmark (DTU Space) - 2007 (DSRI in 1968)	Denmark
58	NEREUS - Network of European Regions Using Space Technologies	Belgium
59	Netherlandse Space Office	Netherlands
60	Pole Theia	France
61	Romanian Space Agency (ROSA) - 1991	Romania
62	Royal Belgian Institute for Space Aeronomy	Belgium
63	Science and Technology Foundation - Space Office	Portugal
64	Slovak Space Office	Slovakia
65	Slovenia Space Office	Slovenia
66	Space for Climate Observatory	France
67	Space Research Center - Polish Academy of Science (SBK-PAN) - 1977	Poland
68	Space Research in Bulgaria - Bulgarian Academy of Sciences (SRI-BAS) - 1987	Bulgaria
69	Suomen Ymparistokeskus	Finland
70	Swedish National Space Board (SNSB)- 1972	Sweden
71	Tartu Science Park	Estonia
72	TNO - Netherlandse Organisation for Applied Scientific Research	Netherlands

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#	Organisation	Country
73	Turku Science Park	Finland
74	Verhaert	Belgium
75	VTT Technical Research Centre of Finland	Finland

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Annex V Database for the dissemination among providers of the survey in the second stage of the mapping

#	Organisation	Country
1	+ Association	Portugal
2	3E	Belgium
3	52°North Initiative for Geospatial	Germany
4	52impact	Netherlands
5	AARHUS UNIVERSITY	Denmark
6	AAT	Poland
7	ACRI-ST S.A.S.	France
8	ADELPHI CONSULT GMBH	Germany
9	ADVANCED COMPUTER SYSTEMS A.C.S. S.	Italy
10	ADWÄISEO	Luxembourg
11	AEROVISION	Netherlands
12	Agri Dataservices BioScope BV	Germany
13	AGRIBORA GMBH	Germany
14	AGRICOLUS S.R.L.	Belgium
15	AGROINSIDER	Italy
16	Aguila	France
17	AIOFAR	Portugal
18	AIRMO	Austria
19	AMIGO	Austria
20	AMPHITRITE	Germany
21	ANALYTICS PIKA OY	Italy
22	ARGANS	France
23	ASMAN	France
24	Atraksis	France
25	AVIA-GIS NV	Finland
26	Baltic Satellite Service	France
27	BENENATI & EDWARDS GBR	France
28	BIOCONSULT SH	Belgium
29	Biomede	France
30	BLACKSHORE	Belgium

#	Organisation	Country
31	Blue Horizon Sàrl	Italy
32	Brockmann Consult	Germany
33	BUSINESS NEATNESS MAGNANIMITY BNM SRL	Italy
34	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	France
35	CGI DEUTSCHLAND B.V. & CO. KG	Ireland
36	CGI IT Czech Republic	Czech Republic
37	COLLECTIVECRUNCH	Italy
38	COMICON	Germany
39	CONSIGLIO NAZIONALE DELLE RICERCHE	Italy
40	Constellr GmbH	Germany
41	CRAT – CONSORZIO PER LA RICERCA NELL'AUTOMATICA E NELLE TELECOMUNICAZIONI	Czech Republic
42	CROWDSPACE	Italy
43	CYBELE	Ireland
44	DEEP BLUE GLOBE	Germany
45	DHI	Poland
46	DIGINOVE	Netherlands
47	DRIFT + NOISE POLAR SERVICES GMBH	Portugal
48	DriveClean	Germany
49	DUBLIN OFFSHORE	Belgium
50	E-GEOS	Germany
51	E.RAY EUROPA GMBH	Ireland
52	eLeaf	Poland
53	ENEA ITALIAN NATIONAL AGENCY	Bulgaria
54	EnergyFamily	Austria
55	EnergyHood	Poland
56	eODyn	Italy
57	EOMAP	Germany
58	eOnsight	Finland
59	EXOBOTIC TECHNOLOGIES	Germany
60	Exovision	Belgium
61	EXTREME WEATHER EXPERTISES	Germany
62	EXTREME WEATHER EXPERTISES (EXWEXS)	France
63	FARM TECHNOLOGIES SRL	France

#	Organisation	Country
64	FARMEYE	Hungary
65	FIELD DATA ZOOM SRL	Belgium
66	FIELDSENSE	Germany
67	FireDynamo	Bulgaria
68	Forest Owners Consulting Center	Italy
69	FutureWater	Netherlands
70	GEO4A	France
71	GEOAEROSPACE	Germany
72	GEOCLEDIAN GMBH	Germany
73	GEODATA SERVICES LTD.	Greece
74	GEOMATRIX UAB	Lithuania
75	GEOPREDICT GMBH	Estonia
76	GEOPROCESSIT TOMASZ TEMPLIN	Poland
77	GeoScan GmbH	Germany
78	Geospatial Enabling Technologies	Netherlands
79	Geosystems Hellas S.A.	Greece
80	GeoVille	Italy
81	GIM	Luxembourg
82	GISAIA	Latvia
83	GlobEye	Germany
84	GMATICS	France
85	GMV	Spain
86	GREENEO UG	Netherlands
87	GREENVENTORY GMBH	Italy
88	Gridfinder	Finland
89	H4RESEARCH S.R.L.	Germany
90	HEADPOWER OY	Finland
91	HERASPACE	Finland
92	HIDROMOD	Germany
93	Hybrid-Airplane Technologies GmbH	Germany
94	HydroClimat	Italy
95	HYDROLOGIC	Germany
96	HYDROLOGIC SYSTEMS	Czech Republic
97	I Clean my Sea	Finland

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#	Organisation	Country
98	I-EM S.R.L.	France
99	I-SEA	France
100	IBISA SARL	France
101	IMDC	Netherlands
102	Institut D'Estudis Espacials de Catalunya	Spain
103	INSTITUT NATIONAL DE RECHERCHE POUR L'AGRICULTURE, L'ALIMENTATION ET L'ENVIRONNEMENT	France
104	Institute for Environmental Solutions	Netherlands
105	INSTITUTE OF GEODESY AND CARTOGRAPHY (INSTYTUT GEODEZJI I KARTOGRAFII)	Portugal
106	INSTITUTO DE SOLDADURA E QUALIDADE	Netherlands
107	ISTITUTO UNIVERSITARIO DI STUDI SUPERIORI (I.U.S.S.) DI PAVIA	Italy
108	Kanopymed	France
109	KAYRROS SAS	Netherlands
110	Kermap	Italy
111	L&F EnviroConsulting	Germany
112	LANZ GMBH	Portugal
113	Latitudo 40	Netherlands
114	LiveEO	Germany
115	Mallon Technology Ltd	Ireland
116	Marple GmbH	Germany
117	MARTIN-LUTHER-UNIVERSITAT HALLE-WITTENBERG	Germany
118	MATEREOSPACE	France
119	MEOSS	France
120	MESH METRICS SP. Z O.O.	Poland
121	MeteoInsight	Italy
122	MidGard	Austria
123	MINES	France
124	Miramap	Netherlands
125	MOBYGIS S.R.L.	France
126	MUNDIALIS GMBH & CO. KG	Germany
127	MURMURATION	France
128	NATIONAL CENTER FOR SCIENTIFIC RESEARCH	Greece
129	Nelen & Schuurmans	Netherlands
130	NEO B.V.	Germany

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#	Organisation	Country
131	NEXLYS LDA	Denmark
132	OHB Systems AG	Germany
133	OPT/NET B.V.	Netherlands
134	Orbio	Netherlands
135	Orbio Earth	Austria
136	OrbitalEOS	Italy
137	OUTDOORACTIVE	Portugal
138	PLANETEK HELLAS	Germany
139	POWORGANIC	Ireland
140	Pratensis	Slovenia
141	PREDICT SERVICES	Portugal
142	PROEKSPERT AS	France
143	PROVEYE	Italy
144	Quantcube technology	Germany
145	Rasmadan GmbH	Germany
146	Reexplorer	Portugal
147	REMOTE SENSING SOLUTIONS GMBH	Germany
148	Research Institute of Water and Environmental Engineering (IIAMA)	Denmark
149	RESILIENCE BV	France
150	SaferPlaces	Portugal
151	Satim	France
152	SCIENCE [&] TECHNOLOGY CORPORATION (S[&]T)	Belgium
153	SILEX CLOUDS S.R.L.	Luxembourg
154	SINERGISE	France
155	SITO OY	Germany
156	SkyGeo	Germany
157	Skytek	Ireland
158	SMALLGIS	Netherlands
159	SOBOLT	Ireland
160	SoilWatch	Italy
161	Space4Good	Germany
162	SPACEBEL	France
163	Spaceknow	Netherlands
164	SPACENUS GMBH	Italy

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#	Organisation	Country
165	SPATIAL BUSINESS INTEGRATION GMBH	Finland
166	Spire Global Luxembourg sàrl	Luxembourg
167	STEADYSUN	Italy
168	STICHTING VU	Netherlands
169	Studiomapp	Italy
170	SUEZ EAU FRANCE - Center Rivages Pro Tech	France
171	SuperVision Earth	France
172	TAMA GROUP GMBH	Netherlands
173	TechWorks Marine	Germany
174	TELESPAZIO Belgium	Belgium
175	Terradue	France
176	TERRAMONITOR (SATELLIO OY)	France
177	Terranis	Italy
178	TFE ENERGY	Germany
179	Thales Services Numeriques	Belgium
180	TICINUM AEROSPACE	Ireland
181	TRACK32	Germany
182	Treemetrics	Germany
183	Ubivivo	Slovenia
184	Undersee	Italy
185	UNIVERSIDAD CARLOS III DE MADRID	Spain
186	Uptoearth GmbH	Germany
187	Vista GEO	Ireland
188	VITO	Ireland
189	VITROCISET BELGIUM	France
190	VITROCISET BELGIUM - New name: Telespazio Belgium	Romania
191	VORTEX	Germany
192	VTT Technical Research Centre of Finland	Finland
193	WALTR	France
194	WASAT SP. Z O.O.	Germany
195	WASDI sàrl	Denmark
196	Water Insight	Netherlands
197	WAVE FOR ENERGY	France
198	WEATHERFORCE CONSULTING	Belgium

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#	Organisation	Country
199	WITTED SRL	Romania
200	WROCŁAWSKI INSTYTUT ZASTOSOWAŃ INFORMACJI PRZESTRZENNEJ I SZTUCZNEJ INTELIGENCJI SP. Z O.O.	Germany
201	WUUDIS SOLUTIONS OY	Italy
202	YNSAT	Denmark

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ANNEX VI Climate Services mapping – parts 1 and 2

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#	Organisation	Country	City	Type	Name of Service	TRL	Application Domain	Application Subdomain	Subdomain (1) Category	Application Subdomain (2)	Subdomain (2) Category	Application Subdomain (3)	Subdomain (3) Category	Technologies Used	Satellite Data Used	Mitigation/Adaptation
1	Absolut Sensing	France	Toulouse/Grenoble	Small Enterprise	GESat	5	Agriculture and forestry and other land uses	Environmental monitoring	Environmental impact monitoring	Natural resources monitoring	Others	Operations management	Others	Satellites	Copernicus 5P, Self	Mitigation & Adaptation
2	Absolut Sensing	France	Toulouse/Grenoble	Small Enterprise	GESat	5	Energy and utilities	Other	Environmental impact assessment of energy and mineral resources plants	Waste	Climate data and modelling for waste monitoring and management	N/A	N/A	Satellites	Copernicus 5P, Self	Mitigation & Adaptation
3	adwäisEO SA	Luxembourg	Betzdorf	Small Enterprise	HERITAGE	1	Agriculture and forestry and other land uses	Natural resources monitoring	Crop yield forecasting	N/A	N/A	N/A	N/A	Satellites	Sentinel-2	Adaptation
4	AEROSPACELAB SAS	Belgium	Mont-Saint-Guibert	Medium-Sized Enterprise	Soil classification	9	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	Natural resources monitoring	Soil condition monitoring	Operations management	Asset monitoring	Satellites, AI	Sentinels	Mitigation & Adaptation
5	AEROSPACELAB SAS	Belgium	Mont-Saint-Guibert	Medium-Sized Enterprise	Oil pipelines monitoring	9	Energy and utilities	Other	Pipeline monitoring	N/A	N/A	N/A	N/A	Satellites, AI	Sentinels	Mitigation
6	AEROSPACELAB SAS	Belgium	Mont-Saint-Guibert	Medium-Sized Enterprise	Defense/security service	9	Civil security and protection	Early warning	Monitoring and warning services	Post-event analysis	Post-event analysis	Preparedness	Preparedness	Satellites, AI	Sentinels	Mitigation & Adaptation
7	AEROSPACELAB SAS	Belgium	Mont-Saint-Guibert	Medium-Sized Enterprise	Land use Mapping	9	Agriculture and forestry and other land uses	Environmental monitoring	Biomass monitoring	Natural resources monitoring	Vegetation monitoring	Operations management	Forest asset management	Satellites, Aircrafts	VHR	Mitigation
8	Agricolus	Italy	Perugia	Small Enterprise	Agricolus platform	9	Agriculture and forestry and other land uses	Natural resources monitoring	Vegetation monitoring	Operations management	Farm management systems	Weather services for agriculture	Weather forecasting for agriculture	Satellites, IoT	Sentinel-2	Mitigation & Adaptation
9	AIRMO	Germany	Munich	Micro Enterprise	AIRMO	5	Energy and utilities	Other	Environmental impact assessment of energy and mineral resources plants	Renewable energy	Site selection, planning and monitoring for renewable energy	Waste	Climate data and modelling for waste monitoring and management	Satellites	Sentinel-5P	Mitigation & Adaptation
10	AIRMO	Germany	Berlin	Micro Enterprise	AIRMO - GHG monitoring constellation	3	Agriculture and forestry and other land uses	Environmental monitoring	Carbon capture & content assessment	Operations management	Asset monitoring	Weather services for agriculture	Weather forecasting for agriculture	Satellites, IoT, AI	Self	Mitigation & Adaptation
11	Analytics Pika Oy	Finland	Vaasa	Micro Enterprise	SEA Site Environmental Awareness	9	Energy and utilities	Renewable energy	Site selection, planning and monitoring for renewable energy	N/A	N/A	N/A	N/A	Satellites, In-Situ, AI	Sentinel-2, Copernicus atmosphere services	Mitigation
12	ARGANS France	France	Sophia Antipolis	Small Enterprise	Satellite detection and monitoring of Marine Litter	5	Marine and coastal environment	Environmental monitoring	Marine pollution monitoring	N/A	N/A	N/A	N/A	Satellites, AI	Sentinel-2, Copernicus Services	Mitigation & Adaptation
13	ARGANS France	France	Sophia Antipolis	Small Enterprise	AirFresh	8	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	Environmental monitoring	Urban greening	Environmental monitoring	Urban heat islands	Satellites, AI	Sentinel-5P	Adaptation
14	ARGANS France	France	Sophia Antipolis	Small Enterprise	Coastal Erosion from Space	8	Marine and coastal environment	Environmental monitoring	Coastal Erosion from Space	Ports	Climate data and modelling for ports	N/A	N/A	Satellites, Ground Truth Data, VHR Data	Sentinel-2, Sentinel-1, Landsat 5, Landsat 8	Adaptation
15	Arpae SIMC Emilia-Romagna	Italy	Bologna	Public Organisation	HIGHLANDER	7	Agriculture and forestry and other land uses	Natural resources monitoring	Soil condition monitoring	Weather services for agriculture	Climate services for agriculture	N/A	N/A	Satellites, In-Situ, AI	Sentinel-5	Mitigation
16	ASITIS	Czech Republic	Brno	Micro Enterprise	UpGreen	6	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	Urban planning and monitoring	Surveying and mapping of urban areas	Urban mobility	Climate data and modelling for urban mobility monitoring and forecasting	Satellites, IoT, AI, Aircraft, In-Situ	Sentinel-1, Sentinel-2, Sentinel-5p, CAMS, C3S, Landsat	Mitigation
17	AW Software und Technologie GmbH	Austria	Vienna	Micro Enterprise	QA4SM	7	Agriculture and forestry and other land uses	Environmental monitoring	Environmental impact monitoring	Natural resources monitoring	Soil condition monitoring	N/A	N/A	Satellites, in-situ	Level 2 and 3 soil moisture databases (extensible)	Adaptation
18	Big Terra	Czech Republic	Prague	Micro Enterprise	Climate Report	7	Agriculture and forestry and other land uses	Environmental monitoring	Biomass monitoring	Natural resources monitoring	Crop yield forecasting	Weather services for agriculture	Climate services for agriculture	Satellites, AI	Sentinel-1, Sentinel-2, C3S	Adaptation
19	Big Terra	Czech Republic	Prague	Micro Enterprise	Carbon farming monitor	4	Agriculture and forestry and other land uses	Environmental monitoring	Carbon capture & content assessment	Natural resources monitoring	Vegetation monitoring	Operations management	Farm management systems	Satellites, AI	Sentinel-1, Sentinel-2	Mitigation
20	blackshark.ai GmbH	Austria	Graz	Medium-Sized Enterprise	Digital twin platform	8	Sustainable urban communities	Urban planning and monitoring	Urban modelling, 3D modelling, Digital Twins	Urban planning and monitoring	Urban greening	Urban mobility	Climate data and modelling for urban mobility monitoring and forecasting	Satellites, drones, AI	Maxar	Adaptation
21	BlackShore	Netherlands	Wageningen	Micro Enterprise	Cerberus	8	Civil security and protection	Early warning	Monitoring and warning services	Migration and settlement	Monitoring and forecasting the climate impact of migration	Post-event analysis	Post-event analysis	Satellites, drones, Aircrafts, in-situ, IoT, AI	Sentinel-2, Maxar, Airbus	Adaptation

#	Organisation	Country	City	Type	Name of Service	TRL	Application Domain	Application Subdomain	Subdomain (1) Category	Application Subdomain (2)	Subdomain (2) Category	Application Subdomain (3)	Subdomain (3) Category	Technologies Used	Satellite Data Used	Mitigation/Adaptation
22	BlackShore	Netherlands	Wageningen	Micro Enterprise	Cerberus	7	Agriculture and forestry and other land uses	Environmental monitoring	Environmental impact monitoring	Natural resources monitoring	Crop yield forecasting	Operations management	Asset monitoring	Satellites, drones, Aircrafts, in-situ, IoT, AI	Maxar, Airbus	Adaptation
23	CLS	France	Ramonville-Saint-Agne	Large Enterprise	Forest monitoring	9	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	Natural resources monitoring	Vegetation monitoring	Operations management	Forest asset management	Satellites, AI	Landsat, Sentinels, SPOT	Adaptation
24	CLS	France	Ramonville-Saint-Agne	Large Enterprise	GEOCS	8	Sustainable urban communities	Urban planning and monitoring	Urban planning	N/A	N/A	N/A	N/A	Satellites, AI	Pléiades, SPOT 6/7	Adaptation
25	CLS	France	Ramonville-Saint-Agne	Large Enterprise	FLOODAM	7	Agriculture and forestry and other land uses	Environmental monitoring	Environmental impact monitoring	N/A	N/A	N/A	N/A	Satellites, AI	Sentinel-1, Sentinel-2	Adaptation
26	CLS	France	Ramonville-Saint-Agne	Large Enterprise	SARWind	9	Energy and utilities	Renewable energy	Renewable energy assessment potential and forecast	Waste	Climate data and modelling for waste monitoring and management	Other	Pipeline monitoring	Satellites, AI	Sentinel-1	Mitigation
27	CLS	France	Ramonville-Saint-Agne	Large Enterprise	LITTOSCOPE	8	Marine and coastal environment	Ocean services	Future Coastal flood risk estimation due to sea level rise	Ports	Climate data and modelling for ports	N/A	N/A	Satellites	Pleaides	Adaptation
28	CLS	France	Ramonville-Saint-Agne	Large Enterprise	SAMTOOL	9	Marine and coastal environment	Environmental monitoring	Sargassum algae monitoring and forecasting	N/A	N/A	N/A	N/A	Satellites	Sentinel-2, Sentinel-3, GOES, MODIS	Adaptation
29	constellr GmbH	Germany	Freiburg	Medium-Sized Enterprise	HiVE - High-precision Versatile Ecosphere monitoring mission	7	Agriculture and forestry and other land uses	Weather services for agriculture	Climate services for agriculture	Operations management	Operations management	Natural resources monitoring	Crop yield forecasting	Satellites	Self	Mitigation & Adaptation
30	DIGINOVE	France	Aix-en-Provence	Micro Enterprise	TeleCense	8	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	Urban planning and monitoring	Urban modelling, 3D modelling, Digital Twins	Urban mobility	Climate data and modelling for urban mobility monitoring and forecasting	Satellites, AI, In-situ	Sentinel-1, Sentinel-2, Sentinel-5p, CAMS	Mitigation & Adaptation
31	Disaitek	France	Fontenay en Paris	Micro Enterprise	Disaitek Waste Platform	9	Agriculture and forestry and other land uses	Environmental monitoring	Littering and illegal landfills	Natural resources monitoring	Forest vegetation health monitoring	Operations management	Asset monitoring	Satellites, AI	Pleiades, Sentinel 1, Sentinel 2	Mitigation & Adaptation
32	EnduroSat	Bulgaria	Sofia	Medium-Sized Enterprise	Copernicus Contributing Missions	2	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	Natural resources monitoring	Vegetation monitoring	Operations management	Variable rate application	Satellites	Balkan Constellations	Mitigation
33	eOdyn	France	Brest	Micro Enterprise	Omni-Situ surface currents	5	Marine and coastal environment	Environmental monitoring	Marine pollution monitoring	Maritime engineering	Marine surveying and mapping	Fisheries	Fish stock detection	Satellites, In-Situ, AI	CAMS	Adaptation
34	EOMAP	Germany	Seefeld	Small Enterprise	EOMAP Water Quality Online	7	Energy and utilities	Renewable energy	Site selection, planning and monitoring for renewable energy	Drinking Water	Climate data and modelling for drinking water monitoring and management	Other	Environmental impact assessment of energy and mineral resources plants	Satellites, AI	Sentinel-2, Sentinel-3, Planet, Landsat	Adaptation
35	EOMAP	Germany	Seefeld	Small Enterprise	Satellite Seafloor Software Suite	9	Marine and coastal environment	Maritime engineering	Marine surveying and mapping	Aquaculture	Climate data and modelling for aquaculture	Fisheries	Fish stock detection	Satellites, AI, drones	Sentinel-2, Planet, Maxar, Airbus	Mitigation & Adaptation
36	eOnsight	France	Paris	Micro Enterprise	eOnsight	2	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	Smart cities operations	Monitoring of infrastructures (bridges, supporting walls, monuments, specific buildings, roads) fo an optimised maintenance	Urban planning and monitoring	Urban modelling, 3D modelling, Digital Twins	Satellites, AI	Copernicus	Mitigation & Adaptation
37	Foundation for Climate Research	Spain	Madrid	Others	ENSEMBLES	8	Agriculture and forestry and other land uses	Environmental monitoring	Environmental impact monitoring	Natural resources monitoring	Vegetation monitoring	Weather services for agriculture	Climate services for agriculture	Satellites, in-situ	Sentinels, Landsat, MODIS, ERA5, CAMS	Adaptation
38	Foundation for Climate Research	Spain	Madrid	Others	ECCLIPSE	6	Marine and coastal environment	Maritime engineering	Marine surveying and mapping	Ports	Climate data and modelling for ports	N/A	N/A	Satellites, in-situ	Sentinels, Landsat, MODIS, ERA5, CAMS	Adaptation
39	Foundation for Climate Research	Spain	Madrid	Others	CRISI-ADAPT I and II	7	Civil security and protection	Early warning	Forecast	Rapid mapping	Rapid mapping	Critical infrastructure	Emergency assistance	Satellites, in-situ	Sentinels, Landsat, MODIS, ERA5, CAMS	Adaptation
40	FutureWater	Netherlands Spain	Wageningen Cartagena	Small Enterprise	InfoSequia	5	Agriculture and forestry and other land uses	Weather services for agriculture	Climate services for agriculture	Natural resources monitoring	Crop yield forecasting	Environmental monitoring	Environmental impact monitoring	Satellites, in-situ, IoT, AI	Sentinel-2, Sentinel-3, EUMETSAT, MODIS Terra Aqua, GRACE CHIRPS, GLOFAS, EFAS	Adaptation
41	GECOsistema	Italy	Rimini	Micro Enterprise	SaferPlaces	8	Sustainable urban communities	Environmental monitoring	Flood risk	Urban planning and monitoring	Urban modelling, 3D modelling, Digital Twins	Urban planning and monitoring	Surveying and mapping of urban areas	Satellites, IoT, AI	Sentinels, CDS	Adaptation

#	Organisation	Country	City	Type	Name of Service	TRL	Application Domain	Application Subdomain	Subdomain (1) Category	Application Subdomain (2)	Subdomain (2) Category	Application Subdomain (3)	Subdomain (3) Category	Technologies Used	Satellite Data Used	Mitigation/Adaptation
42	GeoKapti	Netherlands	The Hague	Micro Enterprise	GeoFarms	4	Agriculture and forestry and other land uses	Natural resources monitoring	Vegetation monitoring	Operations management	Precision irrigation	Weather services for agriculture	Weather forecasting for agriculture	Satellites, AI	Sentinel-1, Sentinel-2, Sentinel-3	Mitigation & Adaptation
43	GEOMATRIX UAB	Lithuania	Vilnius	Micro Enterprise	CAPCON	9	Agriculture and forestry and other land uses	Operations management	CAP monitoring	Natural resources monitoring	Vegetation monitoring	Weather services for agriculture	Climate services for agriculture	Satellites, AI	Sentinel-1	Adaptation
44	geopredict GmbH	Germany	Greifswald	Micro Enterprise	ESA SEED	6	Energy and utilities	Renewable energy	Renewable energy assessment potential and forecast	N/A	N/A	N/A	N/A	Satellites, In-Situ, AI	CAMS, C3S	Mitigation
45	geopredict GmbH	Germany	Greifswald	Micro Enterprise	ArtiGROW	4	Agriculture and forestry and other land uses	Natural resources monitoring	Crop yield forecasting	Weather services for agriculture	Climate services for agriculture	N/A	N/A	Satellites, In-Situ, AI	CAMS, C3S, CLMS	Adaptation
46	geopredict GmbH	Germany	Greifswald	Micro Enterprise	CLIMFOR	3	Civil security and protection	Early warning	Forecast	Critical infrastructure	Predictive maintenance	N/A	N/A	Satellites, AI	CAMS, CMEMS	Adaptation
47	GeoScan GmbH	Germany	Berlin	Micro Enterprise	Water detection	7	Energy and utilities	Drinking Water	Detection of ground water sources	N/A	N/A	N/A	N/A	Satellites, AI	Any satellite pictures in different spectrums	Mitigation
48	GeoScan GmbH	Germany	Berlin	Micro Enterprise	Deep geothermal drilling	9	Energy and utilities	Renewable energy	Site selection, planning and monitoring for renewable energy	Other	Power plant design optimisation	N/A	N/A	Satellites, AI	Any satellite pictures in different spectrums	Mitigation
49	GeoScan GmbH	Germany	Berlin	Micro Enterprise	Raw materials	9	Energy and utilities	Renewable energy	Identification of electro minerals	N/A	N/A	N/A	N/A	Satellites, AI	N/A	Mitigation
50	GeoVille	Austria	Innsbruck	Medium-Sized Enterprise	BREATHE Project	6	Agriculture and forestry and other land uses	Environmental monitoring	Biomass monitoring	Natural resources monitoring	Biomass monitoring	Operations management	CO2 emission and removals from forest above ground biomass monitoring	Satellites, Aircrafts, AI	Sentinel 2, GEDI, ICESAT 2, airborne LIDAR	Mitigation & Adaptation
51	GeoVille	Austria	Innsbruck	Medium-Sized Enterprise	GHG-KIT	6	Agriculture and forestry and other land uses	Environmental monitoring	Land Use Land Use Change and Forestry (LULUCF)	Natural resources monitoring	Land Use and Land Cover Mapping	Operations management	Carbon Accounting from LULUCF Sector 4	Satellite, In-Situ, AI	Sentinel-1, Sentinel-2, Sentinel-3, Sentinel-5, CLMS	Mitigation & Adaptation
52	GISAIA	France	Blagnac	Small Enterprise	ARLAS.City	9	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	Urban planning and monitoring	Surveying and mapping of urban areas	Urban mobility	Climate data and modelling for urban mobility monitoring and forecasting	Satellites, In-Situ, AI	Copernicus	Mitigation & Adaptation
53	GISAIA	France	Blagnac	Small Enterprise	ARLAS - INSDEX	9	Agriculture and forestry and other land uses	Natural resources monitoring	Biomass monitoring	Operations management	Asset monitoring	Weather services for agriculture	Climate services for agriculture	Satellites, in-situ, IoT, AI	Copernicus	Adaptation
54	Global Smart Rescue	France	Labège	Micro Enterprise	Little Alert Box	8	Civil security and protection	Early warning	Monitoring and warning services	Post-event analysis	Post-event analysis	Preparedness	Preparedness	Satellites, IoT, AI	Galileo	Adaptation
55	GlobeEye	France	Paris	Micro Enterprise	Space-2-Breath	N/A	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	N/A	N/A	N/A	N/A	Satellites, In-Situ, AI	Sentinel-5P	Mitigation & Adaptation
56	GMV	Spain	Tres Cantos	Large Enterprise	EOFOREST	6	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	Natural resources monitoring	Forest vegetation health monitoring	Operations management	Forest asset management	Satellites, IoT, in-situ, AI	Sentinel-1, Sentinel-2, Maxar	Mitigation
57	GMV	Spain	Tres Cantos	Large Enterprise	EOCLIMA	7	Agriculture and forestry and other land uses	Environmental monitoring	Environmental impact monitoring	Operations management	Asset monitoring	Weather services for agriculture	Climate resilience	Satellites, IoT, in-situ, AI	Sentinel-1, Sentinel-2, Copernicus Services	Mitigation
58	GrapeHawk SAS	France	Illkirch-Graffenstaden	Micro Enterprise	GRAPEHAWK	6	Agriculture and forestry and other land uses	Environmental monitoring	Environmental impact monitoring	Operations management	Variable rate application	Natural resources monitoring	Crop yield forecasting	Satellites, drones, AI	Sentinel-1, Sentinel-2	Mitigation & Adaptation
59	HD Rain	France	Paris	Small Enterprise	HD Rain for Agriculture	8	Agriculture and forestry and other land uses	Environmental monitoring	Environmental impact monitoring	Natural resources monitoring	Crop yield forecasting	Operations management	Precision irrigation	In-situ, IoT, AI	N/A	Adaptation
60	HD Rain	France	Paris	Small Enterprise	HD Rain for Energy	8	Energy and utilities	Renewable energy	Renewable energy assessment potential and forecast	Other	Energy network conditions monitoring	N/A	N/A	In-situ, IoT, AI	N/A	Adaptation
61	HD Rain	France	Paris	Small Enterprise	HD Rain for Public Safety	8	Civil security and protection	Early warning	Monitoring and warning services	Post-event analysis	Post-event analysis	Preparedness	Preparedness	In-situ, IoT, AI	N/A	Adaptation
62	Hybrid-Airplane Technologies GmbH	Germany	Baden-Baden	Micro Enterprise	H-AERO2LAPS	7	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	Smart cities operations	Smart waste management	Urban planning and monitoring	Cultural heritage monitoring	Drones, IoT, in-situ, AI	CAMS, Self	Mitigation
63	Hydroclimat	France	Toulon	Micro Enterprise	Ready-to-use climate and hydrological projections	6	Civil security and protection	Infrastructure Planning	Vulnerability Analysis	Insurance for natural disasters	Risk modelling	N/A	N/A	Satellites, AI	C3S, CLS	Adaptation

#	Organisation	Country	City	Type	Name of Service	TRL	Application Domain	Application Subdomain	Subdomain (1) Category	Application Subdomain (2)	Subdomain (2) Category	Application Subdomain (3)	Subdomain (3) Category	Technologies Used	Satellite Data Used	Mitigation/Adaptation
64	I Clean My Sea	France	Tarnos	Micro Enterprise	I Clean My Sea	8	Marine and coastal environment	Environmental monitoring	Marine pollution monitoring	Maritime engineering	Marine surveying and mapping	Aquaculture	Climate data and modelling for aquaculture	Satellites, IoT	Copernicus services	Adaptation
65	InSitu-Systems	France	Draguignan	Micro Enterprise	InSitu-Systems	3	Sustainable urban communities	Environmental monitoring	Water pollution and water treatment	Smart cities operations	Drinking Water Management	Urban planning and monitoring	Surveying and mapping of urban areas	Satellites, IoT, AI, in-situ	Kinèis	Mitigation
66	Kanop	France	Paris	Micro Enterprise	KANOP	5	Agriculture and forestry and other land uses	Environmental monitoring	Biomass monitoring	Natural resources monitoring	Forest Inventory monitoring	Operations management	Forest asset management	Satellites, AI	Sentinel-1, Sentinel-2, Pleaides	Mitigation
67	Kanopymed	France	Clapiers	Micro Enterprise	AIR-MAP	5	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	Urban planning and monitoring	Urban planning	Urban mobility	Climate data and modelling for urban mobility monitoring and forecasting	Satellites, AI	CAMS	Mitigation & Adaptation
68	L&F EnviroConsulting	France	Lyon	Micro Enterprise	ComforMap	7	Sustainable urban communities	Urban planning and monitoring	Urban modelling, 3D modelling, Digital Twins	Environmental monitoring	Urban heat islands	Urban mobility	Climate data and modelling for urban mobility monitoring and forecasting	Satellites, In-Situ, AI	Sentinel-2, Landsat	Mitigation & Adaptation
69	Latitudo 40	Italy	Napoli	Micro Enterprise	Spotted	9	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	Urban planning and monitoring	Surveying and mapping of urban areas	Urban mobility	Climate data and modelling for urban mobility monitoring and forecasting	Satellites, AI	Sentinel-1, Sentinel-2, Pleiades	Mitigation
70	Latitudo 40	Italy	Napoli	Micro Enterprise	URBALYTICS	9	Sustainable urban communities	Environmental monitoring	Urban heat islands	Urban planning and monitoring	Surveying and mapping of urban areas	Environmental monitoring	Air quality monitoring in urban environments	Satellites, AI	Sentinel-1, Sentinel-2, Airbus, Planet	Mitigation & Adaptation
71	Latitudo 40	Italy	Napoli	Micro Enterprise	AI CARBON HUB	7	Agriculture and forestry and other land uses	Environmental monitoring	Carbon capture & content assessment	Natural resources monitoring	Vegetation monitoring	Operations management	Forest asset management	Satellites, AI	Sentinel-1, Sentinel-2	Mitigation
72	Layer Inc.	Germany	N/A	Micro Enterprise	Layer	5	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	Urban planning and monitoring	Surveying and mapping of urban areas	Urban mobility	Climate data and modelling for urban mobility monitoring and forecasting	Satellites, AI	Sentinel-1, Sentinel-2, Landsat	Adaptation
73	Lobelia Earth	Spain	Barcelona	Small Enterprise	High resolution Soil Moisture	9	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	Natural resources monitoring	Soil condition monitoring	Operations management	Precision irrigation	Satellites, AI	SMOS, SMAP, Sentinels	Mitigation & Adaptation
74	MEOSS	France	Colomiers	Micro Enterprise	MEO-Carbon	7	Sustainable urban communities	Environmental monitoring	Carbon capture & content assessment	Urban planning and monitoring	Urban planning	Urban mobility	Climate data and modelling for urban mobility monitoring and forecasting	Satellites	Sentinel-1, Sentinel-2, Pléiades, Copernicus	Adaptation
75	MEOSS	France	Colomiers	Micro Enterprise	MEO-Water management	7	Agriculture and forestry and other land uses	Environmental monitoring	Carbon capture & content assessment	N/A	N/A	N/A	N/A	Satellites	Sentinel-2, SPOT 6/7, Copernicus	Adaptation
76	Meteory	Netherlands	Noordwijk	Small Enterprise	Environment Monitoring	5	Agriculture and forestry and other land uses	Environmental monitoring	Environmental impact monitoring	Natural resources monitoring	Soil condition monitoring	Operations management	Forest asset management	Satellites, In-Situ, AI	Sentinels, Landsat, Pléiades, Planetscope, Copernicus Services	Mitigation & Adaptation
77	MINES Paris	France	Sophia Antipolis	Public Organisation	High photovoltaic penetration at urban scale	8	Energy and utilities	Renewable energy	Solar energy potential	Smart cities operations	Photovoltaic	Urban planning and monitoring	Surveying and mapping of urban areas	Satellites, in-situ	Copernicus Service, EUMETSAT	Mitigation & Adaptation
78	mundialis GmbH & Co. KG	Germany	Bonn	Small Enterprise	INCORA	8	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	Natural resources monitoring	Vegetation monitoring	Operations management	Asset monitoring	Satellites	Sentinel-2	Mitigation & Adaptation
79	mundialis GmbH & Co. KG	Germany	Bonn	Small Enterprise	HERMOSA	8	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	Natural resources monitoring	Vegetation monitoring	Operations management	Asset monitoring	Satellites, AI	Sentinel-1, Sentinel-2, Landsat 7/8, Pleiades	Adaptation
80	MURMURATION	France	Toulouse	Small Enterprise	Murmuration	9	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	Urban planning and monitoring	Cultural heritage monitoring	Environmental monitoring	Urban heat islands	Satellites	Sentinel-2, CAMS, CLMS, C3S, Land Cover	Adaptation
81	MURMURATION	France	Toulouse	Small Enterprise	Sustainable development indicators	9	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	Urban planning and monitoring	Cultural heritage monitoring	Environmental monitoring	Water Stress Modelling	Satellites, IoT, in-situ, AI	Sentinel-1, Sentinel-2, Sentinel-3, Sentinel-5P, CAMS, CLS, C3S	Mitigation & Adaptation
82	Nelen & Schuurmans	Netherlands	Utrecht	Medium-Sized Enterprise	3Di Water Management	9	Sustainable urban communities	Urban mobility	Climate data and modelling for urban mobility monitoring and forecasting	Urban planning and monitoring	Urban modelling, 3D modelling, Digital Twins	N/A	N/A	Others	N/A	Adaptation
83	Netcarbon	France	Mérignac	Micro Enterprise	Netcarbon farming	5	Agriculture and forestry and other land uses	Environmental monitoring	Carbon capture & content assessment	N/A	N/A	N/A	N/A	Satellites, In-Situ, AI	Sentinel-1, Sentinel-2, PlanetScope, C3S	Mitigation

#	Organisation	Country	City	Type	Name of Service	TRL	Application Domain	Application Subdomain	Subdomain (1) Category	Application Subdomain (2)	Subdomain (2) Category	Application Subdomain (3)	Subdomain (3) Category	Technologies Used	Satellite Data Used	Mitigation/Adaptation
84	Netcarbon	France	Mérignac	Micro Enterprise	Netcarbon intelligence	5	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	Environmental monitoring	Thermal auditing	Environmental monitoring	Urban greening	Satellites, In-Situ, AI	Sentinel-2, Sentinel-5P, Pléaides, PlanetScope, OCO-2, OCO-3	Adaptation
85	OHB System AG	Germany	Bremen	Large Enterprise	CityCLIM	9	Sustainable urban communities	Environmental monitoring	Urban greening	Smart cities operations	Heat Island Mitigation	Urban planning and monitoring	Surveying and mapping of urban areas	Satellites, In-Situ, AI	EUMETSAT, Sentinel-3, Sentinel-2	Adaptation
86	Orbio Earth	Germany	Cologne	Small Enterprise	Orbio Earth Methane Platform	5	Energy and utilities	Other	Environmental impact assessment of energy and mineral resources plants	N/A	N/A	N/A	N/A	Satellites, AI	Sentinel-2	Mitigation & Adaptation
87	Orbital Eye	Netherlands	Delft	Small Enterprise	CoSMiC-EYE	9	Energy and utilities	Other	Pipeline monitoring	N/A	N/A	N/A	N/A	Satellites, AI	Sentinel-1, Sentinel-2, Pleaides, Planet	Mitigation
88	Phymer - AIOFAR	Spain	Madrid	Micro Enterprise	AIOFAR	3	Marine and coastal environment	Aquaculture	Climate data and modelling for aquaculture	Fisheries	Illegal, unreported and unregulated fishing (IUU) control	Environmental monitoring	Marine pollution monitoring	Satellites, IoT, AI	Sentinel-2, Sentinel-3, Sentinel-6	Adaptation
89	PREDICT SERVICES	France	Montpellier	Small Enterprise	Early Warning for all (EWS4ALL)	9	Civil security and protection	Early warning	Monitoring and warning services	Insurance for natural disasters	Risk modelling	Infrastructure Planning	Vulnerability Analysis	Satellites, AI	Sentinel, Airbus, Pleiades	Adaptation
90	rasdaman GmbH	Germany	Bremen	Micro Enterprise	EarthServer	8	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	Natural resources monitoring	Biomass monitoring	Weather services for agriculture	Forest asset management	Satellites	Sentinels, CLMS	Mitigation & Adaptation
91	rasdaman GmbH	Germany	Bremen	Micro Enterprise	NATO SPS Cube4EnvSec	5	Civil security and protection	Early warning	Monitoring and warning services	Migration and settlement	Forecasting of climate drivers for migration	Preparedness	Preparedness	Satellites, In-Situ, AI	N/A	Mitigation & Adaptation
92	Remote Sensing Solutions GmbH	Germany	Munich	Small Enterprise	Forest Monitor Germany	9	Agriculture and forestry and other land uses	Environmental monitoring	Environmental impact monitoring	Natural resources monitoring	Forest Inventory monitoring	Operations management	Forest asset management	Satellites, AI	Sentinel-2, NPP-VIIRS, MODIS	Mitigation
93	Research Institute of Water and Environmental Engineering (IIAMA)	Spain	Valencia	Public Organisation	The HuT	5	Sustainable urban communities	Environmental monitoring	Urban heat islands	Urban planning and monitoring	Surveying and mapping of urban areas	Urban mobility	Climate data and modelling for urban mobility monitoring and forecasting	Satellites, in-situ, IoT, AI	Sentinel, C3S	Mitigation & Adaptation
94	SarVision	Netherlands	Wageningen	Small Enterprise	MAIA	5	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	Natural resources monitoring	Biomass monitoring	Operations management	Asset monitoring	Satellites, IoT, AI	Copernicus, GEDI	Mitigation
95	Satelligence	Netherlands	Utrecht	Small Enterprise	N/A	9	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	Natural resources monitoring	Biomass monitoring	N/A	N/A	Satellites, drones, AI	Sentinel-1, Sentinel-2, Landsat	Mitigation & Adaptation
96	SCALIAN	France	Toulouse	Large Enterprise	MONITORPANNING	3	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	N/A	N/A	N/A	N/A	Satellites, AI	Pléiades, Sentinel-1, Sentinel-2	Mitigation & Adaptation
97	SCALIAN	France	Toulouse	Large Enterprise	CFOD - Computer vision FOrest Detection	4	Agriculture and forestry and other land uses	Environmental monitoring	Biomass monitoring	Operations management	Biomass monitoring	Operations management	Forest asset management	Drones, AI	N/A	Mitigation & Adaptation
98	SCALIAN Unmanned Systems	France	Toulouse	Large Enterprise	Land monitoring via fleet of drones	4	Agriculture and forestry and other land uses	Natural resources monitoring	Vegetation monitoring	Operations management	Farm management systems	Weather services for agriculture	Climate services for agriculture	Drones, IoT, in-situ, AI	N/A	Adaptation
99	Silex Clouds srl	Italy	Rome	Micro Enterprise	Dust360	5	Energy and utilities	Renewable energy	Renewable energy assessment potential and forecast	Other	Environmental impact assessment of energy and mineral resources	N/A	N/A	Satellites, In-Situ, AI	Sentinel-5P, CAMS, MODIS, EUMETSAT	Mitigation
100	Spatialise	Netherlands	Noordwijk	Micro Enterprise	SOCMO	5	Agriculture and forestry and other land uses	Environmental monitoring	Carbon capture & content assessment	Natural resources monitoring	Soil condition monitoring	N/A	N/A	Satellites, AI	Sentinel-1, Sentinel-2, PROBA-V, Landsat-5, Landsat-7, Landsat-8, MODIS, Kuva Space, VTT	Mitigation
101	Spire Global	Luxembourg	Luxembourg	Large Enterprise	Spire Maritime	9	Marine and coastal environment	Environmental monitoring	Marine pollution monitoring	Ports	Port activities	Fisheries	Illegal, unreported and unregulated fishing (IUU) control	Satellites, In-Situ, AI	Self	Mitigation & Adaptation
102	Spire Global	Luxembourg	Luxembourg	Large Enterprise	Spire Weather	9	Agriculture and forestry and other land uses	Weather services for agriculture	Weather forecasting for agriculture	Weather services for agriculture	Climate services for agriculture	Environmental monitoring	Environmental impact monitoring	Satellites, AI	Copernicus, Sentinel 1 and proprietary satellite data (GNSS-Reflectometry)	Adaptation
103	SUEZ EAU France - Center Rivages Pro Tech	France	Bidart Pessac	Large Enterprise	Dynamic management of coastal waters	5	Marine and coastal environment	Environmental monitoring	Marine pollution monitoring	Ocean services	Metocean	N/A	N/A	Satellites, In-Situ, AI	Sentinel, Landsat, CMS	Mitigation & Adaptation
104	SYNOMEN	France	Montrouge	Micro Enterprise	PEEKELITE	7	Agriculture and forestry and other land uses	Environmental monitoring	Environmental impact monitoring	Natural resources monitoring	Crop yield forecasting	Operations management	Asset monitoring	Satellites, AI	Sentinel-1, Sentinel-2	Adaptation

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105	TERRANIS	France	Toulouse	Small Enterprise	Greencity	9	Sustainable urban communities	Environmental monitoring	Urban greening	Environmental monitoring	Urban heat islands	N/A	N/A	Satellites, In-Situ, AI	Pléiades, SPOT, Sentinel-2, CAMS & C3S	Mitigation & Adaptation
106	TERRANIS	France	Toulouse	Small Enterprise	Pixagri suite	9	Agriculture and forestry and other land uses	Environmental monitoring	Environmental impact monitoring	Natural resources monitoring	Vegetation monitoring	Weather services for agriculture	Weather forecasting for agriculture	Satellites, AI	Sentinel-2, C3S	Mitigation & Adaptation
107	Thales Services Numeriques	France	Toulouse	Large Enterprise	Flood4Kast	7	Civil security and protection	Early warning	Forecast	Migration and settlement	Monitoring and forecasting the climate impact of migration	Post-event analysis	Post-event analysis	Satellites, drones, in-situ, AI	Sentinel 1, Sentinel 2, SMOS	Adaptation
108	Thales Services Numeriques	France	Toulouse	Large Enterprise	Forest anomaly detection	3	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	Natural resources monitoring	Forest vegetation health monitoring	Operations management	Forest asset management	Satellites, AI	Sentinels	Mitigation & Adaptation
109	Thales Services Numeriques	France	Toulouse	Large Enterprise	FLORIA – FLexible algORIthm for the monitoring and forecasting of Air pollution based on Artificial Intelligence and satellite observations	2	Agriculture and forestry and other land uses	Environmental monitoring	Environmental impact monitoring	N/A	N/A	N/A	N/A	Satellites, AI	Sentinel-2, Sentinel-5P, EUMETSAT	Adaptation
110	Ticinum Aerospace Srl	Italy	Pavia	Micro Enterprise	Deep Property	9	Sustainable urban communities	Environmental monitoring	Urban greening	Urban planning and monitoring	Urban modelling, 3D modelling, Digital Twins	Urban planning and monitoring	Urban planning	Satellites, drones, AI	Airbus, Sentinels	Mitigation & Adaptation
111	Ticinum Aerospace Srl	Italy	Pavia	Micro Enterprise	Saturnalia	9	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	Natural resources monitoring	Vegetation monitoring	Operations management	Asset monitoring	Satellites, AI	Sentinel-2, Landsat, Planet	Mitigation & Adaptation
112	Ubivivo	Slovenia	Ljubljana	Micro Enterprise	Ubivivo Energy	8	Energy and utilities	Renewable energy	Renewable energy assessment potential and forecast	Other	Power forecasting	N/A	N/A	Satellites, IoT, AI	EUMETSAT, Copernicus	Mitigation
113	Undersee	Portugal	Coimbra	Micro Enterprise	Undersee	9	Marine and coastal environment	Environmental monitoring	Marine pollution monitoring	Ocean services	Metocean	Fisheries	Catch optimisation	Satellite, IoT, AI	N/A	Adaptation
114	Uptoearth GmbH	Germany	Darmstadt	Micro Enterprise	CORE	6	Agriculture and forestry and other land uses	Environmental monitoring	Carbon capture & content assessment	Natural resources monitoring	Soil condition monitoring	Weather services for agriculture	Climate services for agriculture	Satellites, IoT	Sentinel-2, Sentinel-1, PRISMA, Landsat, MODIS	Mitigation & Adaptation
115	VisioTerra	France	Champs-sur-Marne	Small Enterprise	MONA	9	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	Natural resources monitoring	Forest Inventory monitoring	Operations management	Forest asset management	Satellites, AI	Sentinel-1, Sentinel-2, Sentinel-3 (OLCI, SLSTR, SRAL) + other altimeters, Sentinel-5P, CAMS, C3S, LU/LC maps, Copernicus DEMs, Landsat-45/7/89, ESA heritage data (ERS, Envisat/MERIS, Envisat/ASAR)	Mitigation & Adaptation
116	VisioTerra	France	Champs-sur-Marne	Small Enterprise	MISBAR	9	Agriculture and forestry and other land uses	Natural resources monitoring	Vegetation monitoring	Operations management	Precision irrigation	Weather services for agriculture	Climate services for agriculture	Satellites, AI	Sentinel-1, Sentinel-2, Sentinel-3 (OLCI, SLSTR, SRAL) + other altimeters, Sentinel-5P, CAMS, C3S, LU/LC maps, Copernicus DEMs, Landsat-45/7/89, ESA heritage data (ERS, Envisat/MERIS, Envisat/ASAR)	Mitigation & Adaptation
117	vorteX.io	France	Toulouse	Small Enterprise	PROTECT	9	Civil security and protection	Early warning	Monitoring and warning services	Post-event analysis	Post-event analysis	Critical infrastructure	Infrastructure monitoring	Drones, IoT, in-situ, AI	N/A	Adaptation
118	vorteX.io	France	Toulouse	Small Enterprise	VorteX.io Micro-station Service	9	Civil security and protection	Early warning	Monitoring and warning services	N/A	N/A	N/A	N/A	In-situ, IoT, AI	Sentinel-3	Mitigation & Adaptation
119	VTT Technical Research Centre of Finland	Finland	Espoo	Public Organisation	F-TEP forest carbon monitoring	7	Agriculture and forestry and other land uses	Environmental monitoring	Carbon capture & content assessment	N/A	N/A	N/A	N/A	Satellites, In-Situ, AI	Sentinel-1, Sentinel-2	Mitigation
120	VTT Technical Research Centre of Finland	Finland	Espoo	Public Organisation	F-TEP "Probability" forest variable estimation	9	Agriculture and forestry and other land uses	Natural resources monitoring	Forest Inventory monitoring	N/A	N/A	N/A	N/A	Satellites, In-Situ, AI	Sentinel-1, Sentinel-2	Mitigation

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121	VTT Technical Research Centre of Finland	Finland	Espoo	Public Organisation	F-TEP Autochange	9	Agriculture and forestry and other land uses	Environmental monitoring	Deforestation/degradation monitoring	N/A	N/A	N/A	N/A	Satellites, In-Situ, AI	Sentinel-2	Mitigation
122	WaltR	France	Toulouse	Small Enterprise	Global Emission Monitoring from Space (GEMS)	5	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	Urban planning and monitoring	Urban planning	Urban mobility	Climate data and modelling for urban mobility monitoring and forecasting	Satellites, drones, IoT, in-situ, AI	Sentinel-5P, CAMS	Adaptation
123	WASDI sàrl	Luxembourg	Dudelange	Micro Enterprise	Floods	9	Civil security and protection	Early warning	Monitoring and warning services	Infrastructure Planning	Vulnerability Analysis	Critical infrastructure	Emergency assistance	Satellites, AI	Sentinel-1, Sentinel-2	Adaptation
124	WASDI sàrl	Luxembourg	Dudelange	Micro Enterprise	Wildfires	7	Civil security and protection	Early warning	Monitoring and warning services	Post-event analysis	Post-event analysis	Preparedness	Preparedness	Satellites, In-Situ, AI	Sentinel-2, Sentinel-3	Adaptation
125	WASDI sàrl	Luxembourg	Dudelange	Micro Enterprise	Urban monitoring	5	Sustainable urban communities	Environmental monitoring	Air quality monitoring in urban environments	Urban planning and monitoring	Surveying and mapping of urban areas	Urban mobility	Climate data and modelling for urban mobility monitoring and forecasting	Satellites, drones, in-situ, IoT, AI	Sentinel-2, Sentinel-3, Landsat	Adaptation
126	Water Insight	Netherlands	Ede	Micro Enterprise	EOMORES	8	Marine and coastal environment	Environmental monitoring	Phytoplankton blooms	N/A	N/A	N/A	N/A	Satellites	Sentinel-2, Sentinel-3	Adaptation
127	Water Insight	Netherlands	Ede	Micro Enterprise	HAB early warning	4	Marine and coastal environment	Aquaculture	Monitoring of harmful algae blooms	N/A	N/A	N/A	N/A	Satellites	Sentinel-2, Sentinel-3	Adaptation
128	WEENAV	France	Bondues	Micro Enterprise	Safe Return to Base	2	Marine and coastal environment	Environmental monitoring	Marine environment data observation	Navigation	Climate data and modelling for navigation	Ocean services	Metocean	Satellites, AI	Copernicus services, Sentinel-1, Galileo services	Mitigation
129	WEO SAS	Luxembourg	Luxembourg	Micro Enterprise	GreenMonitor	5	Sustainable urban communities	Environmental monitoring	Urban heat islands	Environmental monitoring	Urban greening	N/A	N/A	Satellites, Aircrafts, AI	Sentinel-2, Sentinel-3, Lidar	Mitigation & Adaptation

#	Organisation	Country	City	Name of Service	Company Description	Service Description	Use in Adaptation or Mitigation Action	Data Needs
1	Absolut Sensing	France	Toulouse Grenoble	GESat	Absolut Sensing was founded to develop the technologies necessary to monitor, understand and predict climate change. We are currently deploying GESat, a micro-satellite constellation for local methane emissions monitoring.	The conclusion that acting on CH4 emissions and atmospheric concentration will have a effect on global warming in the coming years. Absolut Sensing is developing GESat, a micro-satellite constellation aimed at providing methane detection and quantification capabilities able to answer to the key needs expressed by regulators and economic operators. We will provide both data and analytics (analysed data) to regulators and economic operators, with the goal to set a new industry standard in detection accuracy, revisit frequency and cost-efficiency.	Methane is implicated both in climate warming and air quality. The public and regulation pressure are increasing on these topics, we are thus able to produce data and maps to highlight the concentration and provide a tool for public authorities to manage it. We will alllow regulators to measure data, and so enable some regulation to be implemented.	N/A
2	Absolut Sensing	France	Toulouse Grenoble	GESat	Absolut Sensing was founded to develop the technologies necessary to monitor, understand and predict climate change. We are currently deploying GESat, a micro-satellite constellation for local methane emissions monitoring.	The conclusion that acting on CH4 emissions and atmospheric concentration will have a effect on global warming in the coming years. Absolut Sensing is developing GESat, a micro-satellite constellation aimed at providing methane detection and quantification capabilities able to answer to the key needs expressed by regulators and economic operators. We will provide both data and analytics (analysed data) to regulators and economic operators, with the goal to set a new industry standard in detection accuracy, revisit frequency and cost-efficiency.	Methane is implicated both in climate warming and air quality. The public and regulation pressure are increasing on these topics, we are thus able to produce data and maps to highlight the concentration and provide a tool for public authorities to manage it. We will alllow regulators to measure data, and so enable some regulation to be implemented.	N/A
3	adwäisEO SA	Luxembourg	Betzdorf	HERITAGE	adwäisEO SA is a Luxembourg company specialized in Earth Observation (EO) IT services. The company is one of the major European actors in Space Ground Segment sector.Thanks to cutting-edge expertise in Earth Observed data and ICT the company offers high performing and cost-effective solutions such as multi Petabytes archives, intuitive geoportals and efficient processing solutions in cloud and/or HPC environment.	Develop a reliable crop forecast model based on machine learning approach to be applied everywhere around the world. The challenges are multiple. Access to reliable historical data for model training, identification of the filed extents, reliable meteorological prediction and computing power.	Reliable crop forecast can be used to trigger mitigation actions in case of scarcity of crop yield and famine. The climate change is affecting the global production of primary crop such as rice. This year, due to the current drought conditions the rice production in Italy is expected to be reduced of 50%.	Historical crop data and reliable meteorological predictions.
4	AEROSPACELAB SAS	Belgium	Mont-Saint-Guibert	Soil classification	The company's vision is to improve efficiency in all markets by making location intelligence both actionable and affordable. With the objective of becoming the European leader in satellite intelligence and the provision of microsatellite platforms, Aerospacelab follows a vertically integrated approach, developing expertise in both upstream and downstream markets. Aerospacelab designs and manufactures microsatellites operates satellite constellations. Aerospacelab, therefore, offers solutions to its customers in four distinct markets: satellite components, satellites, satellite images and AI solutions.	This service focuses on identifying evolutionary changes of the soil classification, for various applications such as regional infrastructures development. The uniqueness of the solution is that it has been developed in a tailored way, and that for future applications the customer will benefit from more revisit thanks to Aerospacelab own constellations.	Climate changes definitely affect the lands quality available notably for agriculture, and public authorities need accurate information about what occurs on the ground, over large areas.	At the present moment, our service quality directly depends on the satellite data available from the Copernicus constellation, meaning few revisits and medium resolution. This will change with the introduction of our own satellite Constellation starting 2024.
5	AEROSPACELAB SAS	Belgium	Mont-Saint-Guibert	Oil pipelines monitoring	The company's vision is to improve efficiency in all markets by making location intelligence both actionable and affordable. With the objective of becoming the European leader in satellite intelligence and the provision of microsatellite platforms, Aerospacelab follows a vertically integrated approach, developing expertise in both upstream and downstream markets. Aerospacelab designs and manufactures microsatellites operates satellite constellations. Aerospacelab, therefore, offers solutions to its customers in four distinct markets: satellite components, satellites, satellite images and AI solutions.	This service focuses on monitoring gas/ oil pipelines, for instance to identify natural or human-made threats that could destroy the pipelines. The challenge is that observing pipelines over kilometers is a very challenging task. The uniqueness of the solution is that it has been developed in a tailored way, and that for future applications the customer will benefit from more revisit thanks to Aerospacelab own constellations.	Pipelines ruptures may lead to natural catastrophes, especially when we talk about oil pipelines. Environmental protection also includes the monitoring of potential environmental threats.	At the present moment, our service quality directly depends on the satellite data available from the Copernicus constellation, meaning few revisits and medium resolution. This will change with the introduction of our own satellite Constellation starting 2024.
6	AEROSPACELAB SAS	Belgium	Mont-Saint-Guibert	Defense/security service	The company's vision is to improve efficiency in all markets by making location intelligence both actionable and affordable. With the objective of becoming the European leader in satellite intelligence and the provision of microsatellite platforms, Aerospacelab follows a vertically integrated approach, developing expertise in both upstream and downstream markets. Aerospacelab designs and manufactures microsatellites operates satellite constellations. Aerospacelab, therefore, offers solutions to its customers in four distinct markets: satellite components, satellites, satellite images and AI solutions.	This service focuses on protecting borders or building disaster relief mappings (for emergency evacuation plans). Many other services can be delivered, as for instance situational awareness use cases. The uniqueness of the solution is that it has been developed in a tailored way, and that for future applications the customer will benefit from more revisit thanks to Aerospacelab own constellations.	Borders protection are often linked with migration risks. Also, the emergency evacuations use cases (based on disaster relief maps we make) are often related with climate hazards.	At the present moment, our service quality directly depends on the satellite data available from the Copernicus constellation, meaning few revisits and medium resolution. This will change with the introduction of our own satellite Constellation starting 2024. More than that, complementary sensors such as Radar and SIGINT are essential to conduct maritime safety activities.
7	AEROSPACELAB SAS	Belgium	Mont-Saint-Guibert	Land use mapping	The company's vision is to improve efficiency in all markets by making location intelligence both actionable and affordable. With the objective of becoming the European leader in satellite intelligence and the provision of microsatellite platforms, Aerospacelab follows a vertically integrated approach, developing expertise in both upstream and downstream markets. Aerospacelab designs and manufactures microsatellites operates satellite constellations. Aerospacelab, therefore, offers solutions to its customers in four distinct markets: satellite components, satellites, satellite images and AI solutions.	AI based landcover map generation in an automated manner.	By monitoring the change in landcover, the human impact on natural processes can be identified, planned and quantified.	Proprietary VHR data, we are working on it.
8	Agricolus	Italy	Perugia	Agricolus platform	Agricolus srl is a dynamic and innovative product company founded in 2017 springing out from the synergy of the combined competences of a group of skilled professionals supported by two firms: TeamDev Srl and Aedit Srl. Their knowledge is based on ten-year of international experiences in research, analysis, advice and development of useful applications for agricultural management. Agricolus has a strong focus on technological innovation and a vast experience in precision farming, targeting: agroholding companies, association of farmers, medium-big farms and government in agricultural department.	Agricolus mission is supporting farmers and operators of this sector in optimizing agronomic practices. The value proposition of Agricolus consists of a range of solutions for precision farming that span from field mapping and management, weather forecasting, soil analysis, vegetation monitoring from satellite, disease-specific forecast models, phenological models and prescription maps. This solution is distributed in three different versions (Free, Observa, Plus), depending on the quantity of modules activated.	The services provided by Agricolus platform are related to reduce the environmental impact of the agricultural activities. In particular the crop rotation tool help to optimize crop plan. Moreover, the use of satellite images together with weather information and forecast models help to reduce and optimize treatments. Agricolus platform also offer other tools, like prescription maps and crop scouting support tool, useful to improve the sustainability of farms.	We need huge amount of input data from users to train the AI/ML algorithms.
9	AIRMO	Germany	Munich	AIRMO	Global, near real time monitoring system for CO2 and CH4 emissions via proprietary satellite data.	AIRMO service will deliver data about greenhouse gas emissions concentrations on the predefined location. The goal of the AIRMO is to establish a network of new data sources for GHG monitoring with high temporal and spatial resolution with several passes per day to expand the existing monitoring systems and enable new emissions monitoring applications to combat the climate crisis. This is achieved using a small satellite constellation carrying a set of 3 novel instruments, a LiDAR, spectrometer and camera, for active remote sensing and advanced fusion algorithms.	AIRMO will support independent and highly accurate verification of GHGs estimation and facilitate the process of carbon credits exchange. AIRMO will be the core service enabling GHG emissions measurement, monitoring and reduction projects providing valuable datasets and analytics to direct emitters and governments, as well as companies analysing GHG for various industries. The Platform developed by AIRMO will provide Data as a Service for any organisation or individual.	Precise SWIR datasets with high spatial and temporal resolution.
10	AIRMO	Germany	Berlin	AIRMO - GHG monitoring constellation	AIRMO is a company on the intersection between climate tech and space. Our goal is to set a standard for continuous, global and near-real time greenhouse gas emissions measurement using small satellite constellation and novel LiDAR technology. We have developed a micro-LiDAR solution to complement spectrometer-based measurements to significantly improve the accuracy and sensitivity of CO2 and CH4 measurements and are currently working on the product development.	AIRMO is a company on the intersection between climate tech and space. Our goal is to set a standard for continuous, global and near-real time greenhouse gas emissions measurement using small satellite constellation and novel LiDAR technology. We have developed a micro-LiDAR solution to complement spectrometer-based measurements to significantly improve the accuracy and sensitivity of CO2 and CH4 measurements and are currently working on the product development.	Our service will enable public authorities to monitor C02 and CH4 emissions globally and with the highest possible precision. It will be possible to allocate emissions directly to the specific facility/factory.	Airmo team is currently working on getting feedback from Industry about GHG emissions. It is very important to hear requirements for C02 and CH4 monitoring from direct emitters and ESG stakeholders, which should be implemented in the product.

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11	Analytics Pika Oy	Finland	Vaasa	SEA Site Environmental Awareness	Analytics Pika Oy is a Finnish expert data science company creating and operating situational awareness products for both, marine and land ecosystems with the aim to promote sustainable developments through provision of affordable high-quality insights on global scales. Our products and services utilize satellite imagery, historic climate data and geo-administrative information to create highly accessible and easily actionable location intelligence reports or custom enriched data products. It fosters evidence based planning, development and integration of renewable energy production.	There is an exponential growth of available data thanks to orchestrated efforts across the world to collect and publish climate, environmental and administrative information. The access and transformation of such vast volumes of heterogeneous data plus extraction of actionable insights require considerable investment of time and money bringing it often beyond the rich of smaller developments and bloating the costs of bigger projects. We are passionate about democratization of data – meaning driving the availability of data in a form and at an accessible price.	The contents of the @SEA location intelligence report is available for publication on local authorities webpages driving the informed uptake of renewables in the area.	Publicly available short-term forecasts that include windspeed.
12	ARGANS France	France	Sophia Antipolis	Satellite detection and monitoring of Marine Litter	ARGANS offers satellite mission solutions across a range of Climate Change and Environmental services, including development of ground segment algorithms and applications, data quality assessment and validation, or operations on behalf of space agencies, while keeping a strong scientific expertise in remote sensing science.	This service provides users with a warning of when marine plastic litter is predicted to be present in a defined coastal region, through a web service and accompanying app. Warnings can be provided as customised alerts when a pre-defined threshold of identified plastic particles is predicted to enter the user's defined region of interest. This service also provides tailored reports and analysis on trends and patterns of plastic identified and predicted in an area, and volume estimation and hindcasting of identified plastic waste.	For pollution mitigation actions, the service will enable an early warning of incoming plastic debris to be provided to coastal authorities and government organisations. This can allow for preventative measures to be organised for the incoming plastic, or for clean-up events to be better targeted towards areas likely to be more heavily affected by the plastic pollution. It also provides information of the source of the marine litter for preventative action. Both parts of this processor have been developed and verified as part of ESA exploration project. These processors were tested over both the Mediterranean Sea and Black Sea.	Having a partner with ground-based sensors in the regions which this service is to be deployed would enable further verification of detection data, and an improvement of both the accuracy of the predictions and plastic input positions to the service.
13	ARGANS France	France	Sophia Antipolis	AirFresh	ARGANS offers satellite mission solutions across a range of Climate Change and Environmental services, including development of ground segment algorithms and applications, data quality assessment and validation, or operations on behalf of space agencies, while keeping a strong scientific expertise in remote sensing science.	Urban reforestation, can help improve air quality and meet clean air standards and reduce heat in cities. We selected the front-runner cities Aix-en-Provence and Florence as living labs. AIRFRESH: 1) estimates the air pollution removal capacity by urban trees and shrubs by a reforested test area in both cities; 2) estimates and quantifies the environmental and health benefits provided by a new reforested test area; 3) proposes recommendations for reforestation policies for attainment of the air quality standards in cities.	Benefits: - Each reforested area will remove annually at least 3.0 tons O3, 2.5t NO2, 1.5t PM10, 0.8t PM2.5, 10t CO2, ambient air 2°C cooler and increase carbon stocks (2t per ha); - We expect a minimum benefit for healthcare of €9.1 million each year from 2024. Each new reforested area will prevent damages valued at €173,000 per year; – AIRFRESH contributes to implementation, updating and development of local Climate and Air Quality Plan, EU environmental policy e.g. Urban Agenda for the EU, EU 2030 Biodiversity Strategy and European Smart City initiatives; - AIRFRESH will improve health of citizens in an indirect way.	In-situ, ground truthing data and health data.
14	ARGANS France	France	Sophia Antipolis	Coastal Erosion from Space	ARGANS offers satellite mission solutions across a range of Climate Change and Environmental services, including development of ground segment algorithms and applications, data quality assessment and validation, or operations on behalf of space agencies, while keeping a strong scientific expertise in remote sensing science.	i. The waterline processor extracts a line corresponding to the boundary land/ water. The processor extracts specific bands from a multispectral image and applies a spectral index calculation to these image bands. ii. The detected waterline is processed to take into consideration the beach profile and adjust to a tidal datum. iii. To understanding the intertidal region we developed a technique to measure sunlight reflected from the seabed through the water column. iv. Coast dynamics and their response to climate change rely on the coastal geology and morphology.	The service and data products, developed with authoritative end-users, help clients manage the coastal zone and identify locations with the greatest change or risk and therefore prioritise the allocation of resources to manage and mitigate risks of coastal erosion and climate change. ARGANS delivers a range of products that have a global applicability to help public authority's coastal zone managers and policy makers better understand their areas of responsibility and also enable them to plan how they will mitigate the effects of coastal change.	VHR, beach slope and in situ data.
15	Arpae SIMC Emilia-Romagna	Italy	Bologna	HIGHLANDER	Arpae is the Regional Agency for Prevention, Environment and Energy of Emilia-Romagna, Italy. SIMC (Hydro Meteo Climate Service) is a unit of the Agency.	The sub-seasonal (4 weeks) irrigation forecasts are the result of the combination of different data sources such as information on agricultural land use from satellite data, Emilia-Romagna Region soil map, observed weather data and HIGHLANDER sub-seasonal forecast (by ECMWF), by means of a soil water balance model. Provided data are irrigation and precipitation forecasts (+4 weeks) expressed as a statistical distribution, of which 5th, 25th, 50th, 75th and 95th percentiles are available.	Water allocation and water management in agriculture.	Real irrigation data to calibrate/validate the service.
16	ASITIS	Czech Republic	Brno	UpGreen	Our experts are ready to help you adapt to climate change. We help in the fight against drought, floods, water and wind erosion, overheating of cities and in mitigating the negative impacts of human activity on the climate. We improve the landscape and human settlements in a manner that respects nature and is economically feasible. We prevent the problems caused by climate change by promoting energy savings, energy efficiency and renewable sources. We will also help you develop a sustainable environment and the future of your community and your company.	1. Providing a complex analysis of actual urban green spaces and their past vitality/performance based on EO and available city data will provide predictive scenarios of future urban green space development for 10/20 years ahead. 2. The service will propose the optimal placement, extent and type of urban green or nature-based solutions based on actual & historical data combined with dendrology, landscape and garden architects expert knowledge. 3. Providing cities with annual updates on the current situation in urban green and progress evaluation based on specific KPIs.	Supporting data driven decision making, best value for money and clear evaluation criteria.	Standartized data like green inventories and tree passports.
17	AW Software und Technologie GmbH	Austria	Vienna	QA4SM	AWST is an Austrian SME developing software in a range of scientific contexts including Earth observation. The company has a 25 years track record of providing development and support services for Vienna based United Nations organisations as well as for ESA. More information is available at www.awst.at.	The Quality Assurance for Soil Moisture (QA4SM) initiative aims to become the international benchmark service for validating satellite soil moisture products. To achieve general acceptance, QA4SM endorses maximum transparency, traceability, and reproducibility. This is facilitated through the use of the latest community-based validation best practices, endorsed by the Committee on Earth Observation Satellites (CEOS) and the Global Climate Observing System (GCOS), the use of open source software, algorithms and reference data.	QA4SM provides statistical information about uncertainties and other validation metrics in datasets by comparison to selected references. Results are provided in the form if graphs, color coded maps and text summaries.	Support for additional data is added based on user requests and within continuous service evolution.
18	Big Terra	Czech Republic	Prague	Climate Report	Big Terra is a startup focused on benchmarking and reporting in crop agriculture. We focus on the big picture, analysing the history, present and possible future of a field, a region or even a whole country. Our approach is based on data from satellites, weather observation databases and climate data, which we combine this with various modelling approaches including machine learning, mathematical statistics and numerical modelling to assess crop condition, estimated yield potential, growth trends and various risk factors. We also provide feedback to carbon farming actors.	We provide comprehensive data analytics for any given crop field, including yield potential history, present and future trends and vulnerabilities to climate risks. Our information is based on climate data, weather information, satellite data. We employ intensive use of crop modelling to provide scenarios for different crop choices. The whole approach is designed in a way that it can be scaled from particular location to region, country or even globally.	Public authorities can receive quantified information to support decision making on agricultural policies and interventions - whether they will lead to better sustainability, greater efficiency or improved food resilience and security for a country, region or municipality.	Field specific crop yield history for the better model callibration.
19	Big Terra	Czech Republic	Prague	Carbon farming monitor	Big Terra is a startup focused on benchmarking and reporting in crop agriculture. We focus on the big picture, analysing the history, present and possible future of a field, a region or even a whole country. Our approach is based on data from satellites, weather observation databases and climate data, which we combine this with various modelling approaches including machine learning, mathematical statistics and numerical modelling to assess crop condition, estimated yield potential, growth trends and various risk factors. We also provide feedback to carbon farming actors.	We are prototyping the system for support of carbon farming monitoring, benchmarking and reporting. The system is able to quickly analyze given set of fields, classify according to practices used for given season based on satellite data. It can detect the fields which do not fit into reported category and which might be candidates for further inspection.	Any carbon transfer system, including carbon farming, needs to have some data feedback. We can provide the feedback in the form of quantitative data and satellite-based evidence to support and verify the transfer of carbon credits to regenerative agriculture.	Unified international crop field delineation data. Up-to-date and large enough training data to improve AI algorithms for crop field delineation and classification.

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20	blackshark.ai GmbH	Austria	Graz	Digital twin platform	We Put The Whole World In Your Hands. The blackshark.ai geospatial platform extracts insights about the planet's infrastructure from current satellite and aerial imagery via machine learning at global scale. Missing attributes are enriched by AI to provide a photorealistic, geo-typical, or asset specific digital twin. Results can be used for visualization, simulation, mapping, mixed reality environments, and other enterprise solutions. Massive cloud-computing capability enables rapid updates at any time.	Synthesized procedural terrain textures and building generation delivers the entire globe 100% offline — providing a unique network-free high-res training environment. Blackshark.ai global 3D maps consist of global buildings (with accurate heights), global vegetation coverage, and much more. Our HD 3D city models include highly detailed building volumes, footprint splits, rooftop reconstruction, and tree positions. Automated updates ensure the most recent data for applications in urban planning, mapping, AEC, finance, insurance, mixed reality, and the metaverse.	Large-scale geo-intelligence enables change detection for efficient 3D mapping services, risk analysis, telecom signal propagation planning, or disaster relief planning.	All kind of digital twin meta data that can enable or boost semantic 3D reconstructions are helpful.
21	BlackShore	Netherlands	Wageningen	Cerberus	BlackShore delivers accurate, up-to-date and low-cost map products based on the crowd-sourced interpretation of satellite data and aerial imagery. We map topics range from forest monitoring to disaster relief and food security. Our tailor-made maps or data labels as a service typically cover a large area thoroughly, yet they are very affordable and can be created in a matter of just a few days. This is achieved through a mapping concept unique in the market: We use game-based crowdsourcing to create our maps through our crowdsourcing platform Cerberus having over 110 000 minds at the ready!	Cerberus her own community of gamers (the crowd) to create maps and data-labels from very high-resolution satellite imagery. The use cases vary by client. For example, an organization interested in food security may ask players to map wheat stocks. They've mapped various other crops, water infrastructure, and energy grids. They also do crisis mapping for disasters and human conflict in Iraq, where they created direct situational assessments which helped target aid to locations where it was most needed.	1: We identify the goal of the user (e.g. a dam has been installed, is the area improving down stream); 2: We acquire the relevant satellite imagery, and do required calibrations for being inserted in the game to have maximum image quality; 3: With the user we agree the map features (layers) to be labeled or mapped. For example: rivers, farms, wells, roads, healthy vegetation etc.; 4: We activate the game and run a social media campaign; 5: The players get to work, and after days or weeks, we download the results from our game servers and generate the end products.	Keep improving the VHR missions.
22	BlackShore	Netherlands	Wageningen	Cerberus	BlackShore delivers accurate, up-to-date and low-cost map products based on the crowd-sourced interpretation of satellite data and aerial imagery. We map topics range from forest monitoring to disaster relief and food security. Our tailor-made maps or data labels as a service typically cover a large area thoroughly, yet they are very affordable and can be created in a matter of just a few days. This is achieved through a mapping concept unique in the market: We use game-based crowdsourcing to create our maps through our crowdsourcing platform Cerberus having over 110 000 minds at the ready!	Crowd generated data labels to understand threats for Europe and our planet with Cerberus.	1: We identify the goal of the user (e.g. a dam has been installed, is the area improving down stream); 2: We acquire the relevant satellite imagery, and do required calibrations for being inserted in the game to have maximum image quality; 3: With the user we agree the map features (layers) to be labeled or mapped. For example: rivers, farms, wells, roads, healthy vegetation etc.; 4: We activate the game and run a social media campaign; 5: The players get to work, and after days or weeks, we download the results from our game servers and generate the end products.	More affordable VHR data.
23	CLS	France	Ramonville-Saint-Agne	Forest monitoring	CLS, a subsidiary of the French Space Agency CNES and of CNP, is a worldwide company. Its mission is to deploy innovative space-based solutions to understand and protect our planet, and to manage its resources sustainably. The company works in 5 strategic areas of activity: sustainable fisheries management, environmental monitoring, maritime surveillance, mobility and energies & infrastructures monitoring. CLS process environmental data and positions from 80,000 beacons per month , ocean and inland waters observations . In addition we monitor land and sea activities by satellite.	The objective of this product is to provide local authorities with solutions to quickly and easily monitor the state of their forests using only EO data.This work was carried out using multi-sensor approach combining optical and radar to maximise precision and ensure continuity of observations. We also provide capacity building to make local authorities competent in monitoring their forests. We carry out Change detection and near-real time forest disturbance detection: deforestation and degradation; Statistical indicators of forest cover changes, production of bulletins.	Our solutions are robust and enable low-cost monitoring of forest condition over large areas, monitoring of replanting projects and training of the relevant authorities in better knowledge and management of their natural heritage.	Optical VHR data.
24	CLS	France	Ramonville-Saint-Agne	GEOCS	CLS, a subsidiary of the French Space Agency CNES and of CNP, is a worldwide company. Its mission is to deploy innovative space-based solutions to understand and protect our planet, and to manage its resources sustainably. The company works in 5 strategic areas of activity: sustainable fisheries management, environmental monitoring, maritime surveillance, mobility and energies & infrastructures monitoring. CLS process environmental data and positions from 80,000 beacons per month , ocean and inland waters observations . In addition we monitor land and sea activities by satellite.	The objective of GEOCS is to use optical satellite data to automatically and rapidly provide a map of new constructions in a territory. Our solution can use optical satellite data at different resolutions and thus provide a precise state of the dynamics of urbanisation and land pressure on agricultural and natural environments.	Our service enables a community to monitor both the urban dynamics and the consistency between building permits and the reality on the ground.	Optical VHR data.
25	CLS	France	Ramonville-Saint-Agne	FLOODAM	CLS, a subsidiary of the French Space Agency CNES and of CNP, is a worldwide company. Its mission is to deploy innovative space-based solutions to understand and protect our planet, and to manage its resources sustainably. The company works in 5 strategic areas of activity: sustainable fisheries management, environmental monitoring, maritime surveillance, mobility and energies & infrastructures monitoring. CLS process environmental data and positions from 80,000 beacons per month , ocean and inland waters observations . In addition we monitor land and sea activities by satellite.	This project implements an automated service to reliably detect, monitor and assess floods on a global scale. In order to understand and anticipate these extreme events, a sensor fusion approach is deployed, aiming at incorporating multiple satellite and terrestrial sensors and a combination of computational fluid dynamics models.	Our service allows near real-time mapping and database editing of flood monitoring even under cloudy conditions.	VHR images.
26	CLS	France	Ramonville-Saint-Agne	SARWind	CLS, a subsidiary of the French Space Agency CNES and of CNP, is a worldwide company. Its mission is to deploy innovative space-based solutions to understand and protect our planet, and to manage its resources sustainably. The company works in 5 strategic areas of activity: sustainable fisheries management, environmental monitoring, maritime surveillance, mobility and energies & infrastructures monitoring. CLS process environmental data and positions from 80,000 beacons per month , ocean and inland waters observations . In addition we monitor land and sea activities by satellite.	CLS has validated a 3rd complementary method for the precise evaluation of the offshore AEP: SARWind SARWind is a methodology for calculating winds at the height of wind turbines from measurements coming from SAR (Synthetic Aperture Radar) satellites to deduce the AEP. This methodology, which combines SAR data, atmospheric model results, in situ data and machine learning techniques has been the subject of a scientific article (https://wes.copernicus.org/articles/7/1441/2022/).	SARWind can be either directly or indirectly used to assess the wind field intensity differences from climatological historical data in relation to wind speed and direction in the future, helping improving the knowledge on how climate change can affect offshore wind energy in the coming years.	In situ offshore wind measurements available for comparaison and validation.
27	CLS	France	Ramonville-Saint-Agne	LITTOSCOPE	CLS, a subsidiary of the French Space Agency CNES and of CNP, is a worldwide company. Its mission is to deploy innovative space-based solutions to understand and protect our planet, and to manage its resources sustainably. The company works in 5 strategic areas of activity: sustainable fisheries management, environmental monitoring, maritime surveillance, mobility and energies & infrastructures monitoring. CLS process environmental data and positions from 80,000 beacons per month , ocean and inland waters observations . In addition we monitor land and sea activities by satellite.	An assessment of coastal areas at risk of future coastal flooding due to Sea Level Rise and extreme events until 2100. Hazard and risk maps,at respectively 10/50m resolution, are accessible trough an interactive web platform. The service relies on satellite altimetry sea level trends observation, climate scenarios, local data and digital land elevation and land use estimation from satellite optical images having a cost that depends on the size of the targeted coastal area. It is for coastal cities and ports for the decision makers and coastal managers.	The interactive web platform assists public authorities in discovering the potential areas at risk in the future to be flooded by the sea taking into account several climate scenario and current observed trends of the mean sea level. It is a first-level estimation which supports decision to go further in refined risk assessment.	No critical need. Local data to better estimate risks. VHR satellite optical images are also a key point to get accurate Digital Elevation Model. But we can rely on Pleaides Neo, Worldwiew satellites . A reduced procurement cost could help in reducing the service price.
28	CLS	France	Ramonville-Saint-Agne	SAMTOOL	CLS, a subsidiary of the French Space Agency CNES and of CNP, is a worldwide company. Its mission is to deploy innovative space-based solutions to understand and protect our planet, and to manage its resources sustainably. The company works in 5 strategic areas of activity: sustainable fisheries management, environmental monitoring, maritime surveillance, mobility and energies & infrastructures monitoring. CLS process environmental data and positions from 80,000 beacons per month , ocean and inland waters observations . In addition we monitor land and sea activities by satellite.	Daily detection of sargassum at 300m and 20m resolution State of the art and operational combination of satellite data using 7 optical sensors and SAR sensors. A proven operational drift model for landing prediction. A user-friendly web platform to access the information.	SAMtool helps: Monitor daily the Sargassum situation over the Caribbean area; Raise awareness on the upcoming sargassum influx; Prepare the mitigation plan in advance to reduce the devastating effects of sargassum stranding on local economies; Prepare and support timely sargassum collection operations.	High-resolution (<1Km) accurate ocean currents forecasts.

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29	constellr GmbH	Germany	Freiburg	HiVE - High-precision Versatile Ecosphere monitoring mission	At constellr, we support food security by enabling high-precision smart farming services across the globe. Using our own proprietary satellite constellation and data infrastructure, constellr leads the way in measuring water, temperature, and carbon to assess vegetation and soil health at an unprecedented level. Our vision is to bring accountability to tackling climate change.	constellr's mission is to support global food security by enabling efficient water use for every field on the planet. constellr has developed a solution which can precisely measure crop water needs from space: a constellation of microsatellites with unique sensing capability and global coverage. We use high-quality data from our constellation to provide affordable global crop health monitoring services to the smart farming sector. constellr provides the only solution for crop health monitoring, which is both globally scalable, accurate and timely enough to be actionable.	Water is the single central driver for nearly all of humankind's food production. Today, more than 70% of all freshwater is used in irrigation. As water use and water need is currently not quantifiable reliably in an economically scalable way, more than 60% of this water is wasted. With an increasing population nearing 10 billion by 2050, water usage will increase by more than 30% by the end of the decade, potentially leading to a global agricultural breakdown. The inability to efficiently manage water poses a major challenge across the entire value chain: from the livelihood of farmers via the supply chain management.	The future hyperspectral missions as well high precision LST mission will contribute to our own data products. In that view, we are currently developing hyperspectral payloads for our HiVE constellation, planning to launch the first joint thermal and hyperspectral satellite generation in 2025.
30	DIGINOVE	France	Aix-en-Provence	TeleCense	DIGINOVE is an expert and an innovative company in processing or visualization tools for satellite or aerial images. Diginove has developed TeleCense product that combines satellite image processing and demographic expertise to integrate the decision-making process in many fields (Climate Change, Energy, Telecom, Insurance, Governance, etc.).	TeleCense service assesses and anticipates population growth and migration in emerging countries for Companies, Authorities, International Organizations and Labs. This is one of the major issues that humankind has to face in a very near future. TeleCense evaluates population distribution and trends with efficient, up-to-date and accurate results, at low cost. Knowing where people live is a fundamental element of many decision making processes : INFRASTRUCTURE & NETWORK ; INSURANCE AND REINSURANCE ; SMART CITIES; GOVERNANCE AND INTERNATIONAL ORG.	Diginove's TeleCense is a service that identifies and characterizes settlements and performs population estimates based on satellite images and AI demographic models. In case of a climate event (flood, water elevation, erosion), the basis for such estimates is a detailed hazard information layer. If many services are now focused on different climate scenarios, TeleCense can assess the impact of such events on people and cities.	For some usecases it could be valuable to provide population movement inside the city within a day or a month. The mobile data from telecom operators or mobile positionning could help to improve TeleCense with a dynamic vision.
31	Disaitek	France	Fontenay en Paris	Disaitek Waste Platform	Disaitek's mission is to fight against environmental damage and climate change using satellite imagery and artificial intelligence. We have developed cutting-edge technologies that leverage the combination of multiple sensors including optical, multispectral, hyperspectral, SWIR, radar with different spectral and spatial resolutions. Advanced deep learning techniques help to automate the detection of sources of pollution and GHG emissions from large volumes of data with very high accuracy.	We developed a first-of-its-kind platform that automates the detection and monitoring of littering (5m2) and illegal landfills by satellite in very hi-res optical images (50cm). The satellites can provide images of the monitored areas 1/2 a month and the results are integrated on a GIS to locate the polluted sites. The innovation lies in the size of the pollution event we can detect, the early detection of illegal activities, the assessment of risks due to the waste nearby the watercourses, assessing fraud against the permits and the process' digitalisation.	Littering and illegal landfills have a dramatic impact on soil pollution, groundwater contamination, air pollution and GHG emissions. Identifying contaminated sites as early as possible is key to reducing environmental impacts.	Additional layer to identify the type of property (private, public and owner) in which we identify pollution events.
32	EnduroSat	Bulgaria	Sofia	Copernicus Contributing Missions	EnduroSat is on a mission to transform the complex satellite industry into a streamlined data service, enabling instant access and transactions with space data on the cloud from hundreds of sensors in orbit.	Balkan is a satellite constellation for EO. It provides high resolution optical data with very high revisit time of 90 minutes. It will provide the ability for users to perform on-demand image acquisitions for emergency applications. The spectral bands of the satellite allow for vegetation monitoring, land use and land cover mapping and change detection. The satellites will perform continuous surface monitoring through AI based data analytics on-board for detection of vessels and large vehicles on land.	The satellite data will provide European public authorities with easier access to very high resolution satellite data to improve the environmental governance and monitoring practices at local level. The Balkan mission can complement and build upon the data provided by Copernicus.	The Balkan constellation does not cover any other non-space data specific for the various use cases (e.g., insitu).
33	eOdyn	France	Brest	Omni-Situ surface currents	eOdyn develops since 2015 a transformative technology to derive surface currents from ship motion and Automatic Identification System (AIS) data (Guichoux et al., 2016). Currents, derived from AIS data, a complementary in-situ observing system so far under-exploited, have the potential to complete surface current picture with high-frequency part of ocean dynamics in the areas with intensive marine traffic activities. Thanks to this technology, eOdyn provides services for end-users to secure their decision making for maritime ventures.	The OS technology was validated during more than 7 years and we plan to go real time in a near future to solve operational issues raised by the maritime sector. This will include to develop a fully automated processing chain able to produce real-time OS data. We will also need to collect and process a large amount of data from Copernicus to enhance the quality of our main product.The project will require to develop advanced data-fusion techniques, including AI-based algorithms. We plan to demonstrate the contribution of the OS technology to decarbonize the Shipping industry.	The Omni-Situ (OS) technology help our customers to reduce their environmental footprint. Our solution based on maritime traffic makes the ships themselves actors in the ecological transformation of the maritime sector.	More AIS data from the public sector, and more frequent EO data for OS product operational validations and data fusion (mainly altimetry measurements, SST and Chl-A).
34	EOMAP	Germany	Seefeld	EOMAP Water Quality Online	EOMAP is the leading global service provider of satellite-derived aquatic information for maritime and inland waters providing the following products and services: Satellite Derived Bathymetry (SDB), Satellite Lidar Bathymetry (SLB), Shoals database, Digital Elevation Models (DEM), Water quality monitoring (turbidity, suspended matter, harmful algal blooms, chlorophyll), Shoreline and erosion mapping, Seafloor characterisation and benthic habitat maps. Key topics addressed are Marine and Coastal Environment as well as Energy (Hydropower optimisation, Blue offshore energy decision support).	- Operational Monitoring of reservoirs and river systems - Near-real time hydrological and sediment status - Near-real time Monitoring of sediment management activities - Baseline environmental information based on historical data	This assists public authorities in climate change adaptation or mitigation actions as all aspects can be seen and complex data is transformed into actionable information for decision makers. The ready to use information is tailored to the needs of public authorities, in this case mainly the provision of catchment properties, impact assessment, and lifetime calculations of reservoirs for a sustainable energy use. With regard to drinking water in lakes and reservoirs an alert component is available that provides timely information if water quality is degrading.	Energy production and costs of sediment management strategies.
35	EOMAP	Germany	Seefeld	Satellite Seafloor Software Suite	EOMAP is the leading global service provider of satellite-derived aquatic information for maritime and inland waters providing the following products and services: Satellite Derived Bathymetry (SDB), Satellite Lidar Bathymetry (SLB), Shoals database, Digital Elevation Models (DEM), Water quality monitoring (turbidity, suspended matter, harmful algal blooms, chlorophyll), Shoreline and erosion mapping, Seafloor characterisation and benthic habitat maps. Key topics addressed are Marine and Coastal Environment as well as Energy (Hydropower optimisation, Blue offshore energy decision support).	4S addresses a current data and solution gaps from coastal and offshore stakeholders, which are the ability to generate and access spatial and recent information on seabed, such as benthic habitat, morphology, depth and change and trends. 4S addressed this gap by developing an online, cloud based software, named 4S – Satellite Seafloor Survey Suite – which empowers the users to benefit from satellite capabilities and specific aquatic EO algorithms. The first version of the suite is online and ready to be used by stakeholders from public entities to industry clients.	By enabling the stakeholders to map and monitor their coastal bathymetry and seafloor habitats, they can detect and track changes, identfy potential causes and take suitable measures. Such causes are often boosted by climate change like increased erosion rates through more frequent storm surges and floods.	Sentinel-2 continuation, Hyperspectral missions and the continuation of MAXAR WorldView satellites.
36	eOnsight	France	Paris	eOnsight	eOnsight develops an EO data-based decision support system to monitor infrastructures and optimise their maintenance in the context of climate change.	eOnsight develops an online platform to monitor infrastructures and optimise their maintenance in the context of climate change. The service creates a digital catalog of infrastructure assets, with individual health status and maintenance logs, monitors the various assets and provides respective alerts to prioritise maintenance and inspections. The service also requires a free or economical access to the relevant data, the understanding of advanced EO data and the mastery of big data analytics tools to enable extraction of relevant insights.	The service will generate a digital catalog of a municipal / regional authority's infrastructure assets, supporting the digital transition of public services and optimising the management of public budgets. The deployment of the service will gradually allow to run predictive scenarios, in particular with respect to Climate Change. Such scenarios typically cover temperature changes, but also risks of floodings, droughts as well as landslides and other geologic events. The inclusion of such predictive scenarios into the service will allow the public authority users to anticipate and mitigate the respective risks.	Free SAR/inSAR data.
37	Foundation for Climate Research	Spain	Madrid	ENSEMBLES	The FIC, Foundation for Climate Research, is an entity specialized in research, innovation and the development of solutions in the field of climate change, as well as in the areas of climatology, meteorology, environment and sustainable development. We develop climatic and meteorological solutions to face challenges related to: climate, agriculture, biodiversity and natural resources, cities and infrastructure, international cooperation. Climate services: local projections of climate change, seasonal and decadal prediction, climate change impact assessment, extreme events prediction.	The project aims to: Develop an ensemble prediction system for climate change based on the principal state-of-the-art, high resolution, global and regional Earth System models developed in Europe, to produce for the first time, an objective probabilistic estimate of uncertainty in future climate at the seasonal to decadal and longer timescales; Maximise the exploitation of the results by linking the outputs of the ensemble prediction system to a range of applications, including agriculture, health, food security, energy, water resources, insurance and weather risk management.	Developing tools to identify climate change impacts on several activities. Developing software for risks assessments and Early Warning Systems. Developing future clima scenarios.	Data available have improved since the EMSEMBLE project was developed. Now, services based on this project wil be updated with the latest available data.

#	Organisation	Country	City	Name of Service	Company Description	Service Description	Use in Adaptation or Mitigation Action	Data Needs
38	Foundation for Climate Research	Spain	Madrid	ECCLIPSE	The FIC, Foundation for Climate Research, is an entity specialized in research, innovation and the development of solutions in the field of climate change, as well as in the areas of climatology, meteorology, environment and sustainable development. We develop climatic and meteorological solutions to face challenges related to: climate, agriculture, biodiversity and natural resources, cities and infrastructure, international cooperation. Climate services: local projections of climate change, seasonal and decadal prediction, climate change impact assessment, extreme events prediction.	ECCLIPSE focuses on analyzing the impact of climate change on seaports, developing prevention and action strategies that can minimize its effects. The objective of ECCLIPSE is to develop a common framework for assessing the impacts associated with climate change and the adaptation to such impacts of ports in the SUDOE space.	Developing tools to identify climate change impacts on several activities. Developing software for risks assessments and Early Warning Systems. Developing future climate scenarios.	N/A
39	Foundation for Climate Research	Spain	Madrid	CRISI-ADAPT I and II	The FIC, Foundation for Climate Research, is an entity specialized in research, innovation and the development of solutions in the field of climate change, as well as in the areas of climatology, meteorology, environment and sustainable development. We develop climatic and meteorological solutions to face challenges related to: climate, agriculture, biodiversity and natural resources, cities and infrastructure, international cooperation. Climate services: local projections of climate change, seasonal and decadal prediction, climate change impact assessment, extreme events prediction.	CRISI-ADAPT II aims to monitor and improve the adaptation planning through a real-time implementation and validation according to near and seasonal range forecast of climate risks.	Developing tools to identify climate change impacts on several activities. Developing software for risks assessments and Early Warning Systems. Developing future climate scenarios.	N/A
40	FutureWater	Netherlands Spain	Wageningen Cartagena	InfoSequia	FutureWater offers high-quality research and consulting services throughout the world to combine scientific research with practical solutions for water management. FutureWater uses state-of-the-art, open-source quantitative methods for practical solutions in water resource assessments. FutureWater is closely linked to leading universities and research institutes, ensuring the use of the latest and most advanced techniques and tools for water resources analyses, hydrological simulation models, Geographic Information Systems, hydro-informatics and Remote Sensing.	InfoSequia is an expert-based operational climate service that aims to support the correct implementation of Water Scarcity & Drought risk prevention and management at local level. InfoSequia provides early warnings of impact risk, narratives and recommendations on the combination of EO, modelling and reanalysis datasets, climate and in-situ ground measurements, and ML techniques available. Early seasonal forecasts of risk of impact, Local and scalable solution, High reliability & performance, Enhanced monitoring capabilities, Agile configuration.	InfoSequia can assist public authorities in several ways: for water agencies, in the early activation of drought management-phases and contingency actions; for humanitarian-aid purposes, in supporting early response frameworks against the onset of droughts impacts on crop yield and food security of vulnerable regions; for agro-cooperatives and large agrobusiness, in the early adoption of strategic decisions; for agro-insurance, in the optimizing allocation of insurance needs, and field-inspections. InfoSequia provides monthly-basis of seasonal forecasts, up to 6-months ahead, of risk of impact due to drought or water scarcity.	-Accurate characterization of Land-use and Land-cover dynamics, moderate-spatial resolution, 10-100 m. Frequent revisit times. - Medium-range and seasonal weather/climate forecasts - In-situ (historical) observations of crop yield or water availability (river streamflow, and water levels in reservoirs) at spatial scales of interest for InfoSequia (district and basin).
41	GECOsistema	Italy	Rimini	SaferPlaces	EO/AI-based Digital Twin Solution for Flood Risk Intelligence in cities.	The SaferPlaces Global Platform is a Cloud-based and Digital Twin Platform able to support multiple users in assessing flood risk for cities worldwide and making flood smart data-driven decisions. Open Data and AI-based models combined into a cloud-computing environment, to provide incredible insights on flood risk intelligence. In real-time, forecasting or climate projections mode, our solution helps users to assess the risk, the extent and the damage on city infrastructures caused by coastal/pluvial/fluvial floods and it helps in building preparedness and climate resilience.	SaferPlaces unique value proposition releys on the possibility to quickly generate and deploys appropriate flood risk intelligence for any city worldwides, reducing time and costs, exploiting open big climate and geospatial data and the power of cloud computing within needs to install specific software and hire a flood expert. SaferPlaces satisfies the needs of different public and private actors: Local Administrations, cities and urban planners (main market); Insurance and Reinsurance companies; Multi-utility and transportation companies; Civil Protection and Emergency Agencies; Climate Tech Companies; Finance institutions.	Lidar data acquisition.
42	GeoKapti	Netherlands	The Hague	GeoFarms	Geokapti B.V. is a company based in The Netherlands that provides specialized software for two important industries: Earth Observation technologies and High Tech Systems.	Geokapti has developed an automated platform for agricultural applications that uses satellite data and field sensors to produce useful metrics. The platform is geared towards regional governments, cooperatives and municipalities to assess the state of agricultural production in their respective areas. GeoFarms is a fully automated platform that processes, analyzes and visualizes the information for decision makers.	By monitoring production along years and after mitigation actions, users can see the differences in agricultural biomass. It also enables the monitoring of deforestation due to agricultural practices.	Ground truth and more frequent satellite captures.
43	GEOMATRIX UAB	Lithuania	Vilnius	CAPCON	The company is focusing on applied research in eco- and geo-informatics, development of Copernicus downstream services and provides automated spatial data processing services. The main business of the company is related to development of automated work-flows for parallel computing systems powered by standard open source software components which are used to process large amounts of geo-spatial data in short time and at low cost. The company is actively investing into RTD, recognizing innovation as the main advantage of its service portfolio related to Big Data geo-computing.	Operational (TRL9) CAP subsidies control service based on Copernicus EO data (mostly Sentinel-1 SAR imagery) implemented in Lithuania during ESA (PECS) CAPCON project and currently expanding into Latvia and Poland. Based on SAGRIS (http://www.sagris.eu) back-end service and advanced machine learning algorithms. Famous for being completely based on all-weather SAR imagery and capability to deliver CAP monitoring and control results with extremely high accuracy even in poor weather conditions.	Monitoring long-term crop rotation, arable land, permanent grassland and woody vegetation cover, assessment proportions of no-till and ecological farming, monitoring soil moisture, etc.	Annual field boundaries and crop codes.
44	geopredict GmbH	Germany	Greifswald	ESA SEED	geopredict is a geo-forecasting knowledge factory run by a team with a proven track record in key areas like self-organizing modeling and forecasting of complex systems from observation data under incomplete information, climate and energy forecasting, and management of enterprise-wide business and technology programs. The company develops next-generation forecasting services and products at the intersection of satellite earth observation, high-performance computing, and AI.	There are difficulties in curtailment of power and also the problems with energy storage and grid stability due to increase of renewable energy share in the energy mix. We have developed and demonstrated an energy forecasting platform called SEED. The core technology is to model the solar or wind site atmosphere using Satellite EO data and plant SCADA data for energy generation and resources forecasting with accuracies above 96% for energy resources forecasting and demonstrated savings of above 27€/MW/month in a pilot study at an energy plant in India.	Our services can assist public authorities through information on: 1. Helping in forecasting the energy production from various renewable energy plants from shorter (~15 min) to medium (months, years) to longer (decades); 2. Forecasts of effects of climate events on the renewable energy production; 3. Forecasts of renewable energy resources like GHI, DNI, wind speed etc. for short, medium and long terms.; 4. In future give inputs for the Stability of the Grid system well ahead of time for mitigation of power loss.	We would some time require geo-stationary satellite data with higher resolution for some parts in Asia, especially India as service.
45	geopredict GmbH	Germany	Greifswald	ArtiGROW	geopredict is a geo-forecasting knowledge factory run by a team with a proven track record in key areas like self-organizing modeling and forecasting of complex systems from observation data under incomplete information, climate and energy forecasting, and management of enterprise-wide business and technology programs. The company develops next-generation forecasting services and products at the intersection of satellite earth observation, high-performance computing, and AI.	The goal is to develop, integrate and demonstrate our innovative and scalable prototype of a precision agriculture data analytics platform (FEED) for crop growth and yield forecast, that is fully relying on high-resolution EO data and crop type and soil reference data. The service will be to provide a one stop shop for various users an optimal solution to increase crop yield, efficiency in water and fertilizer management and providing climate and weather intelligence.	- It provides the months ahead forecasts on crop growth and yield based on modelling the data from Earth observation satellites, and databanks of soil, water resources and crops; - It provides good information on optimal water and fertilization requirements for the crop and thus avoid over using of them and also help in water management for farming. This information is useful for public authorities to plan for their actions for water; - It can also provide climate influence on crop yield, thus helpful in risk management to projects like "Farm to Fork" analysis to different public climate agencies, insurance, and banking agencies.	- High resolution satellite images - Soil
46	geopredict GmbH	Germany	Greifswald	CLIMFOR	geopredict is a geo-forecasting knowledge factory run by a team with a proven track record in key areas like self-organizing modeling and forecasting of complex systems from observation data under incomplete information, climate and energy forecasting, and management of enterprise-wide business and technology programs. The company develops next-generation forecasting services and products at the intersection of satellite earth observation, high-performance computing, and AI.	The goal is to develop a generic digital twin (5D-TWIN) solution using EO data with our data driven AI modelling and in-house HPC facility, which will be useful for modelling lower atmosphere, upper atmosphere, land or the ocean. With the help of this various EO applications and services can be derived in different sectors: early warning systems, Disaster Risk Management and extreme events, weather dependent crops yield and growth in agriculture, different local marine applications, space weather forecasting, modeling/forecasting of local wildfire risk.	Impact in risk analysis, policy decision making, financial analysis, climate tipping points, actionable feedback loops, in use cases of this technology ranging from GHG, renewable energy, agriculture, heat waves, wildfire risk, space weather, and many other applications requiring climate modelling and forecasting.	We would need high resolution, low latency global EO data for 5D modelling and forecasting.

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47	GeoScan GmbH	Germany	Berlin	Water detection	We analyse existing satellite pictures with a mathematical/statistical algorithm in Kombination mit traditionellen Remote Sensing technologies. Our inhouse geologists create subsurface maps, 1D,2D,3D X-Sections in order to locate the most promising sites for rawmaterials (hydrocarbons, precious metals, electro minerals), deep geothermal sites, water down to 10.000 m. After receiving laboratory results of concentration results and exact geolocation, we take this as a calibration in order to do a quantification of the target material and to provide a 3D model.	Adoption of our gScan methodology to the target material detection of: water in desert areas.	Localisation of drinking water and irrigation sources down to deep level.	Existing geological surveys and maps from previous analyses.
48	GeoScan GmbH	Germany	Berlin	Deep geothermal drilling	We analyse existing satellite pictures with a mathematical/statistical algorithm in Kombination mit traditionellen Remote Sensing technologies. Our inhouse geologists create subsurface maps, 1D,2D,3D X-Sections in order to locate the most promising sites for rawmaterials (hydrocarbons, precious metals, electro minerals), deep geothermal sites, water down to 10.000 m. After receiving laboratory results of concentration results and exact geolocation, we take this as a calibration in order to do a quantification of the target material and to provide a 3D model.	Identification of best location for deep geothermal site drilling, including identification of existance of water in target debth and possible obstacles on the drilling site (e.g. natural gas).	Increasing success rate of deep drill geothermal sites.	Existing maps and geographical informations.
49	GeoScan GmbH	Germany	Berlin	Raw materials	We analyse existing satellite pictures with a mathematical/statistical algorithm in Kombination mit traditionellen Remote Sensing technologies. Our inhouse geologists create subsurface maps, 1D,2D,3D X-Sections in order to locate the most promising sites for rawmaterials (hydrocarbons, precious metals, electro minerals), deep geothermal sites, water down to 10.000 m. After receiving laboratory results of concentration results and exact geolocation, we take this as a calibration in order to do a quantification of the target material and to provide a 3D model.	Remote sensing for the exploration of countries, regions and license areas for target material.	Detection of raw materials for electro roll out.	Reference data for target material.
50	GeoVille	Austria	Innsbruck	BREATHE Project	GeoVille has the vision to remap the unknowns of human activities around the world and are one of the main service providers of Copernicus Land Monitoring Services. GeoVille is dedicated to providing a wide range of value-added services for Earth observation data and GIS applications. Our mission is to provide turnkey geospatial intelligence solutions enabling efficient client operations and management. GeoVille successfully manages to lead (and/or adapt to) innovation processes through substantial resources allocated to in-house competence building.	The vision of BREATHE is to simplify the data gathering process for the targeted markets, provide them with detailed and continuous information on forest area, forest status and biomass emissions, enable the integration of field independent (satellite) data source in their businesses and support the verification of their reported data. The objective of BREATHE is to develop a Proof-of-Concept and prototype the first operational EO monitoring and verification services for GHG emissions reporting.	Assist national (Austrian and Turkey) GHG inventories.	Field data on biomass from national forest inventories.
51	GeoVille	Austria	Innsbruck	GHG-KIT	GeoVille has the vision to remap the unknowns of human activities around the world and are one of the main service providers of Copernicus Land Monitoring Services. GeoVille is dedicated to providing a wide range of value-added services for Earth observation data and GIS applications. Our mission is to provide turnkey geospatial intelligence solutions enabling efficient client operations and management. GeoVille successfully manages to lead (and/or adapt to) innovation processes through substantial resources allocated to in-house competence building.	"GHG-KIT: Keep it traceable" is to develop methods and prototype a supporting system for integrated Greenhouse gas accounting and monitoring based on satellite information products. The main objective is to design the baseline for an overall GHG satellite-based reporting system and develop prototypes for integrated GHG accounting and monitoring using EO-based information and specifically targeting the LULUCF sector. To tackle the various challenges and aspects within the inventory process, the idea is to design and develop of a modular system (Tool-KIT-System).	Assist national (Austrian and Turkey) GHG inventories.	CO2 measurement stations for atmospheric modelling, reference data for LULUCF.
52	GISAIA	France	Blagnac	ARLAS.City	Gisaia is a geospatial intelligence company that helps; entrepreneurs, policy makers, and scientists draw valuable insights from massive and diverse geospatial data. Gisaia is a software publisher: ARLAS Exploration is an open-source platform built on big-data frameworks. It facilitates analysis and exploration of all data with spatial-temporal dimensions. Gisaia is a technology provider: we provide cutting-edge geo-analytics solutions that help adopters to strengthen their market positions.	Gisaïa creates new uses and new values by exploiting large volumes of spatial data, from integration to visualisation and processing. GISAÏA makes data richer, accessible and understandable by everyone. With ARLAS, people can visualise, explore and analyse structured or unstructured, real-time or historical data. They are able to collect all of its added value whatever your business area. As an example, ARLAS handles millions of geo-tracked objects such as trucks or maritime vessels which generate billions of geo points every year.	Gisaia is a technology provider, ARLAS has a systematic approach to leverage satellite data which fits infrastructural challenges on the ground and that it is; scalable, reliable, affordable, continuously generates and updates data, and has limited human interventions. ARLAS highlights the value of big-data under powerful analytics to facilitate timely and reliable decision- making for public good: mobility, pollution, environment, agriculture, climate impacts, etc.	Our service uses any kind of satellite data, we widely use Copernicus data. We sometimes miss full extent coverage data, we are sometimes limited in our ambition to provide a worldwide service. We also spend time in additional researches to know what is really available in Copernicus data : it is not always easy to know if there is data available on an area at a particular date and time.
53	GISAIA	France	Blagnac	ARLAS - INSDEX	Gisaia is a geospatial intelligence company that helps; entrepreneurs, policy makers, and scientists draw valuable insights from massive and diverse geospatial data. Gisaia is a software publisher: ARLAS Exploration is an open-source platform built on big-data frameworks. It facilitates analysis and exploration of all data with spatial-temporal dimensions. Gisaia is a technology provider: we provide cutting-edge geo-analytics solutions that help adopters to strengthen their market positions.	Gisaïa creates new uses and new values by exploiting large volumes of spatial data, from integration to visualisation and processing. GISAÏA makes data richer, accessible and understandable by everyone. With ARLAS, people can visualise, explore and analyse structured or unstructured, real-time or historical data. They are able to collect all of its added value whatever your business area. As an example, ARLAS handles millions of geo-tracked objects such as trucks or maritime vessels which generate billions of geo points every year.	Gisaia is a technology provider, ARLAS has a systematic approach to leverage satellite data which fits infrastructural challenges on the ground and that it is; scalable, reliable, affordable, continuously generates and updates data, and has limited human interventions. ARLAS highlights the value of big-data under powerful analytics to facilitate timely and reliable decision- making for public good: mobility, pollution, environment, agriculture, climate impacts, etc.	Our service uses any kind of satellite data, we widely use Copernicus data. We sometimes miss full extent coverage data, we are sometimes limited in our ambition to provide a worldwide service. We also spend time in additional researches to know what is really available in Copernicus data : it is not always easy to know if there is data available on an area at a particular date and time.
54	Global Smart Rescue	France	Labège	Little Alert Box	We are currently developping a patented iot resilient communication solution to increase the speed, improve the coordination of rescue teams in their disaster management and help to save lifes. We propose to build a network of small connected alert boxes (LABTM) on site. The LAB can be placed in buliding or vehicles, they monitore 24/7 environmental key data to our server before, during and after a disaster, first via regular networks (Wifi and GSM) and then via satellite if the networks are down. Our solution allow anyone to contact via text message (SBD) authorities anywhere at anytime.	We offer to build on site a network of connected Little Alert Boxes (LABTM) that collect and send non-stop to our server key important data before, during and after a disaster, first via regular networks and then via satellite if the networks are down. Our solution has the advantage to offer realtime monitoring combined with an intelligent data analysis, helps reduce management costs. The system can be transferred to multiple applications including: industry, insurance, government, remote system operations, energy saving etc.	The solution proposed by Global Smart Rescue can anticipate events thanks to AI. Implementation of AI technologies (neural networks) to find weak signals to anticipate and manage particular events by jointly processing multiple physical parameters. The aim is to anticipate events through automatic cross- referencing of collected data. For example, in the case of an explosion (followed or preceded by a fire): more than 10 parameters will be analysed to determine the variations in pressure and temperature, as well as the speed at which this disaster spreads.	Our goal is to gather more and more information from sensors, imagery, satellite.
55	GlobeEye	France	Paris	Space-2-Breath	GlobeEye develops satellite-powered applications for environmental monitoring and sustainable finance, leveraging state-of-the-art AI and data fusion.	High resolution, high frequency mapping of air pollution.	Monitoring air pollution in urban and remote area to assess environmental risks, climate risks, health risks and outcome.	N/A
56	GMV	Spain	Tres Cantos	EOFOREST	GMV is a multinational technology company headquartered in Spain, with experience in the design, development, and implementation of software, hardware, and systems engineering solutions in various fields, including space, defense, security, transportation, telecommunications, and healthcare. The company's services include consulting, engineering, system integration, software development, and maintenance, as well as turnkey solutions. In the space industry, GMV provides a range of solutions, including satellite ground systems, satellite control centers, and mission control systems.	Eoforest is GMV's catalogue of forestry-related geo-information products. Eoforest supports active management: inventory, protection, restoration, mitigation, and adaptation. The Eoforest team has worked on forestry-related projects over the past 15 years and in more than 20 countries for international clients. Based on the knowledge acquired, Eoforest has been co-designed with forest owners and wood industry stakeholders to provide technical support for sustainable forest operations.	- Identifying forest cover changes; - Quantifying carbon storage; - Monitoring forest health; - Assessing the effectiveness of climate policies;	More in-situ data for traning and calibration.

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57	GMV	Spain	Tres Cantos	EOCLIMA	GMV is a multinational technology company headquartered in Spain, with experience in the design, development, and implementation of software, hardware, and systems engineering solutions in various fields, including space, defense, security, transportation, telecommunications, and healthcare. The company's services include consulting, engineering, system integration, software development, and maintenance, as well as turnkey solutions. In the space industry, GMV provides a range of solutions, including satellite ground systems, satellite control centers, and mission control systems.	Eoclima is GMV's catalogue of climate-related geo-information products, derived from satellite Earth Observation data. Eoclima climate services include climate change risk assessment and monitoring, support for climate change adaptation solutions, and contributions to climate adaptation-mitigation synergistic approaches for land use and forestry regulation. Eoclima is aligned with REDD+ and supports the Paris Agreement, the Sendai Framework for Disaster Risk Reduction, SDG 13 for climate action, and the pledges from UNFCCC climate summits.	Climate risk management and adaptation. Climate adaptation and mitigation synergies. Sustainable forest management and conservation practices. Nature-based solutions. Tracking forest logging. Monitoring deforestation in supply chains. Forest monitoring. Lobbying and advocacy. Forestry project monitoring and evaluation. Land use planning.	In-situ data for calibration.
58	GrapeHawk SAS	France	Illkirch-Graffenstaden	GRAPEHAWK	Products and Services for precision agriculture.	The startup has a commercial drone for imaging and a platform for processing drone and satellite images, both in TRL 9. Drones developed by the company for imaging and application at variable rates are prototypes that have already been field-tested, but will be updated and customized with French government resources already available. The company has the exclusive representation in Europe for the sale and application of organic fertilizers with embedded nanotechnology.	The use of our technologies allows the daily monitoring of the health of the soil and plants, the perception of changes, and the reduction of the impact of human activities on a large and small scale. Our technologies allow the precise application of both fertilizers and phytosanitaries only where and when they are needed. Our fertilizers are competitively priced, may be manufactured in France, are organic and can be applied with an application drone. Our suite of technologies greatly reduce human impact as well as fast and accurate reaction to changes and needs in agricultural production.	There is no IoT sensor available in the market to measure NPK, other nutrients within the soil and pH. It could or should be developed in partnership.
59	HD Rain	France	Paris	HD Rain for Agriculture	HD Rain is high-resolution weather data operator. We provide an API and a web app solution that visualize, analyze, forecast and download weather data with a resolution of 500 meters and 1 minute by combining a unique network of proprietary frequency sensors, deep-learning, and data assimilation techniques.	What HD Rain offers to the agriculture sector is ultra-local data of rain, temperature, humidity, pressure, and sunlight with 500 meters precision, minute-by-minute observations, and up to 2h forecast - this level of precision is missing in the market.	Our services enable public authorities as well as farmers, insurers, and energy workers to have very precise and reliable information on weather which affects 80% of businesses worldwide.	For farmers around the world to have everything they need to anticipate their crop's production quantity and quality, we would need to develop other weather parameters such as snow or hail.
60	HD Rain	France	Paris	HD Rain for Energy	HD Rain is high-resolution weather data operator. We provide an API and a web app solution that visualize, analyze, forecast and download weather data with a resolution of 500 meters and 1 minute by combining a unique network of proprietary frequency sensors, deep-learning, and data assimilation techniques.	HD Rain solution answers directly the energy sectors' need for weather monitoring and forecast. We help energy companies with solar panels, agri-voltaic, or even wind parks to monitor weather parameters (rain, humidity, pressure, temperature, and sunlight) for their energy production/consumption forecasting models. This level of precision is missing in the market.	Our services enable public authorities as well as farmers, insurers, and energy workers to have very precise and reliable information on weather which affects 80% of businesses worldwide.	For the energy sector to have everything they need to anticipate their energy production quantity, we would need to develop other weather paramaeters such as snow or hail.
61	HD Rain	France	Paris	HD Rain for Public Safety	HD Rain is high-resolution weather data operator. We provide an API and a web app solution that visualize, analyze, forecast and download weather data with a resolution of 500 meters and 1 minute by combining a unique network of proprietary frequency sensors, deep-learning, and data assimilation techniques.	HD Rain solution for security and civil protection offers information to the operations teams to match the resources needed for the flood and fire risks. In addition to our spacelized data on rain, temperature, humidity, pressure, and sunlight, they have access to sensor-by-sensor information - enabling them to gain the granularity needed for successful interventions. Since we started our collaboration with firefighters, each fire station in the South of France is equipped with our on-the-groud sensors.	Our sensors are installed in a network, enabling us to have different points of data generation and therefore increasing the overall quality of our data and information shared. Today, public services use our weather data to observe, analyze, forecast, and prepare for fires and floods. In addition to this, our technology has been able to connect cities and fire workers that had in the past not been known to collaborate during interventions to work together and access the same data.	Today, we would need to develop other weather parameters such as snow or hail.
62	Hybrid-Airplane Technologies GmbH	Germany	Baden-Baden	H-AERO2LAPS	The purpose of the company is the R&D activity, production and distribution of sustainable flight systems and communication platforms, in the field of airborne autonomous robotics and cybernetics. The company invented a new way to fly and the flight systems can be powered by renewable energy sources and serve as carrier systems for a variety of sensors for different applications, from live event broadcasting to earth observation. The flight systems are used in many fields, such as human and nature protection, public and industrial, infrastructure, as well as environmental.	At h-aero, we take a targeted approach to each of our use cases by carefully defining the geographical groups where our solutions are relevant. We recognize the importance of understanding both public and private sectors as potential customers, and take a comprehensive approach to evaluating the needs and preferences of each group. By taking this thorough and strategic approach to each of our BVLOS use cases, h-aero is able to position ourselves effectively in the market and provide high-quality solutions that meet the specific needs of our customers.	By leveraging our expertise in unmanned aerial vehicle technology and data analytics, we can help make our cities smarter, safer, and more sustainable. Our innovative h-aero® offers several advantages over traditional drones, small aircraft, and helicopters, making it a unique and competitive solution in the market. Thanks to unique and future oriented technology and scalable business model, we will realize our vision of making sustainable high resolution aerial data and connectivity providing aerial platforms available globally.	Micro Electronics, Battery Technologies, Long Range Low Power Transponders, Sensors, IoT, SatCom.
63	Hydroclimat	France	Toulon	Ready-to-use climate and hydrological projections	HydroClimat is a DeepTech start-up specializing in climatology and numerical hydrology. We develop solutions for industry (insurance, buildings, agriculture, energy) and communities for the robust management of climatic risks and vulnerabilities, as well as the agile design of adaptation solutions to climate change. Our solutions make it possible to secure and orient infrastructure investments, economic and industrial strategies in the medium and long term.	The M3E tool, developed by HydroClimat, is a high space (until 30 m) and temporal (sub-daily) resolution fully coupled system of hydrological and flood simulations at the local scale. M3E relies on a multi-model multi-ensemble approach ensuring 95% accuracy through artificial intelligence (AI) algorithms. HydroClimat develops disruptive solutions based on the state of the art of scientific research for reducing uncertainty.	We create innovative services and products to support : - long-term infrastructures operation (Smart Infrastructures & Buildings), - resilient community planning (Smart Cities), and - sustainable and optimal crop management (Smart Agriculture). Together, we improve infrastructures and buildings resilience as well as the adaptation of cities to climate change.	World-wide discharge or water level of rivers.
64	I Clean My Sea	France	Tarnos	I Clean My Sea	I Clean My Sea provides coastal environment managers with an integrated participatory and optimized pollution management service for floating debris and oil spills.	For coastal decision makers, I Clean My Sea has setup an action plan to manage FD with optimized efficiency: 1-Detect: Taking advantage of growing awareness of coastal communities for plastic pollution, I Clean My Sea has developed 2 mobile applications. By simply taking a picture of the FD they encounter, individuals generate FD detections. These detections include a picture, a location, and a time stamp. 2-Collect: Collecting efficiently FD comes down to collect more floating debris, spending as little resources as possible.	Coastal and Public Administrations need to deploy visible and cost-effective action plans to manage plastic pollution in a sustainable way on their shorelines. The technological challenge is to bring efficiency to the collection strategy by lowering the need for financial resources (Investment and variable costs) and raising the quantity of collected FD. Lowering the energy consumption of the ships we deploy while increasing their motion capacity is the main technological challenge behind our innovation.	High resolution coastal hydrodynamic forecast data.
65	InSitu-Systems	France	Draguignan	InSitu-Systems	InSitu-Systems is to provide innovative, cost effective and flexible water monitoring solutions for small urban communities thanks to a plug&play, autonomous and intelligent micro-station. The InSitu-Systems solution advantageously integrates a satellite link to guarantee full coverage of the territory and redundancy. This will offer the possibility to efficiently monitor installations of small cities and could help regional water agencies developing a global and coherent water management network.	To meet the need for remote management of water networks, InSitu-Systems develops ready-to-use IoT solutions for each type of installation: catchment, drilling, metering station, reservoir, pumping station, water treatment. The use of a dual GSM&Satellite communication system will ensure the continuity of transmission in white areas; an autonomous and reliable solution for isolated sites or with constraint environment. The possibility of coherent international deployment thanks to "anytime/anywhere" transmission capacity and to the cost-effective "plug&play" feat.	This solution will allow local authorities and operators to remotely and large-scale supervise different types of water installations. The objective is to ensure the continuity of service of these installations while optimizing water resources and electricity consumption. The impact of rainy episodes on the network can be measured and partly anticipated. InSitu-Systems is developing an ultra-low consumption solution which can be powered by a photovoltaic panel. Data hosting is done by non-air-conditioned servers and powered by renewable energy. All elements are interchangeable. The envelope is recyclable and will be recycled.	There is an interest for urban communities in being able to cross-check information seen from the ground with information seen from the sky but use-cases have not yet been formally defined.
66	Kanop	France	Paris	KANOP	Kanop is a SaaS platform for measurement, reporting, and verification of nature-based projects. We apply artificial intelligence models to satellite images to produce indicators up to the singular tree level, such as species, height, carbon sequestered and other biodiversity indicators. Our self-service web app delivers results quickly, accurately, and transparently, and allows users to aggregate and view data as they choose. Our solution empowers project developers of all sizes to scale their measurement activities.	Kanop aims at improving the monitoring of forestry projects and of the ecosystem services that they provide. In practice, Kanop offers forestry project holders the possibility to map their projects to faithful digital twins. Such faithful digitals twins can be used either (1) to monitor and monetize the ecosystem services provided by these projects, or (2) to enhance the management and productivity of these projects. In addition to the spatial precision, the technology is also scalable as it is solely based on remote sensing data.	Our software allows nature-based project developers of all sizes to scale MRV without cost overruns, making it easier to pinpoint success metrics and replicate these findings for future projects. These benefits will increase the global development and number of the most impactful nature-based projects resulting in more carbon removal to combat climate change and biodiversity restoration in ecosystems where these projects are implemented. The problem of MRV is well known to public decision-makers.	Ground truth is the main blocker to improve the accuracy of our services: forest inventory, biomass plots, etc. On the remote sensing side of things, we would enjoy having more archive imagery in VHR, and also more hyperspectral imagery. We don't see real blocker though as we know that all those data are coming to the market in the quarters to come.

#	Organisation	Country	City	Name of Service	Company Description	Service Description	Use in Adaptation or Mitigation Action	Data Needs
67	Kanopymed	France	Clapiers	AIR-MAP	KanopyMed was founded in 2018 by Grégoire Mercier, a public health physician, and Ulysse Rodts, an economist, as a spin-off from the Montpellier University Hospital's innovation center. We are a multidisciplinary team passionate about improving health care and public health. We develop digital medical devices to improve health care and population-based decision support tools for public health using artificial intelligence and big data. Kanopymed places ethics at the heart of its values. The company is based in Montpellier, France and has four employees.	AIR-MAP is a web application allowing local decision makers to visualize, analyse and forecast the public health impact of air pollution. Based on several data sources including demographics, health status and EO data and a rigorous AI tool based on international guidelines, AIR-MAP is estimating the mortality and morbidity burden oh air pollution at a granular geographic level. AIR-MAP is the first step towards a comprehensive digital twin dedicated to public health.	Local authorities have potentially powerfull action levers to reduce the public health burden of air pollution. For instance, they might design urbanization, mobility and air quality surveillance policies more favorable to health. However, they need to prioritize these policies and, sometimes, to target the geographic areas having the highest needs. Currently, such tools are lacking. AIR-MAP will be the leading tool to help European local public authorities. We have succesfully tested and co-designed the beta version of AIR-MAP with 10 potential users working in 5 different local authorities in France and Germany.	AIR-MAP is fueled by various data layers; demographics, health status (premature mortality), and air pollution. The current beta version is covering France and we plan to scale up to cover the whole European area. Regarding demographics and health status, we rely on official European open data sources such as Eurostat. Regarding air pollution, we plan to use Earth Observation data (namely, the Copernicus Atmosphere Monitoring Service). To that end, we have just been selected in the ESA-BIC.
68	L&F EnviroConsulting	France	Lyon	ComforMap	A mobile application to move in soft mode by a comfortable journey, with the least pollution, traffic and allergic risk, and in safety.	A mobile application to move in soft mode by a comfortable journey, with the least pollution, traffic and allergic risk, and in safety : www.comformap.com	We are therefore addressing employers and local authorities who wish to to promote soft modes of transportation in order to reduce their carbon tax, reduce parking spaces and parking spaces and increase the physical and mental well-being of their employees or citizens and their safety on the way. We contribute to increase the number of days of use of soft modes for a person and the number of the number of days a person uses soft modes and the number of people who use soft modes daily.	To improve our models, we could use very precise data like Pleiades and precise hourly traffic data.
69	Latitudo 40	Italy	Napoli	Spotted	Latitudo 40 is a spin-off company of University of Naples and has a team with experience on the market of remote sensing technologies. Latitudo 40 has concentrated its efforts in research and development on space applications and in particular in the downstream sector of earth observation, to launch on the market a cloud-based solution. This solution combines the experience in information technology and big data with the new skills related to applying AI algorithms and deep learning to better understand our planet's phenomena through the images produced by earth observation satellites.	Latitudo40 offers an innovative Urban Data Platform that uses satellite imagery (SAR and optical) to create a digital twin of the city, identifying trends (urbanisation, green areas, heat islands, cooling capacity, Co2 sequestration) and environmental and hydrogeological risks. A powerful tool that simplifies the use of remote sensing in urban and environmental planning, with the ability to use a simulation tool (based on ML/AI) to predict the future effects of current choices.	This outcome will be at the service of customers of the Public Administrations and Real Estate market to improve the territory knowledge, to activate new business processes based on smart geo-information in the field of monitoring quality and evolution of urban spaces and to start continuous and proactive processes to improve the quality of services to citizens. The service will be a useful support tool for urban planners, social and economic services offices and the environment /territory offices, to make "evidence-based" decisions.	We are creating our own datasets with sentinel 2 super resolution.
70	Latitudo 40	Italy	Napoli	URBALYTICS	Latitudo 40 is a spin-off company of University of Naples and has a team with experience on the market of remote sensing technologies. Latitudo 40 has concentrated its efforts in research and development on space applications and in particular in the downstream sector of earth observation, to launch on the market a cloud-based solution. This solution combines the experience in information technology and big data with the new skills related to applying AI algorithms and deep learning to better understand our planet's phenomena through the images produced by earth observation satellites.	The company, with provided datasets and services, will develop specific pilots on Barcelona to analyze evolution of the quality of life index over a time horizon of 3/5 years; creation of thematic urban maps for the planning of new investments; identification of Urban Climate Risks and selection of mitigation solutions using NBS.	Latitudo 40 is used by several European municipalities to analyze the main climate risks in urban areas (UHI, green shortage, over urbanization, pollution) with the philosophy of learning from the past, monitoring the present and designing the best strategies for the future. Through our algorithms, our clients can very easily identify areas of the city with high climate risks, identify priorities for action (through combination with population density and age classification), and identify the best mitigation strategies.	We have enough data, we need data about real time people mobility.
71	Latitudo 40	Italy	Napoli	AI CARBON HUB	Latitudo 40 is a spin-off company of University of Naples and has a team with experience on the market of remote sensing technologies. Latitudo 40 has concentrated its efforts in research and development on space applications and in particular in the downstream sector of earth observation, to launch on the market a cloud-based solution. This solution combines the experience in information technology and big data with the new skills related to applying AI algorithms and deep learning to better understand our planet's phenomena through the images produced by earth observation satellites.	AI Carbon HUB is an innovative platform that enables carbon credit trading on a voluntary basis through the integrated management of the service cycle, from the analysis and quantification of the CO2 sequestered by a forest area to the management of the exchange between a landowner and a private company interested in improving its environmental footprint. The AI Carbon HUB experiment makes use of the experience and skills in remote sensing and big data analysis of Latitudo 40.	AI CarbonHUB represents a solution that is fully in line with the new European strategy for forests (which cover over 43.5% of Europe's land area), launched in July 2021, which sees these resources as a fundamental tool for sustainable development and for supporting policies to fight climate change. This new EU Forest Strategy aims to overcome these challenges and unlock the potential of forests for our future, in full respect for the principle of subsidiarity, best available scientific evidence and Better Regulation requirements.	High resolution data on forestry.
72	Layer Inc.	Germany	N/A	Layer	Layer is a spatial orchestration platform with global data coverage — it empowers teams to govern through tactics and patterns while leveraging machine learning and artificial intelligence.	Integration of open source public domain geospatial data, integration of open source crowdsourced data. Consistent update of datasets. Resilient software architecture. Instantly scalable cloud based hosting of infrastructure. Local-government and Individual-level access to data and spatial analytics typically reserved for corporations and governments.	Identify history of heat concentration and mitigate urban heat island effect at a high resolution level. Monitor and analyze forest loss from a historical perspective. Monitor historical and future land use / land cover change. Etc.	Focus has been on global coverage datasets. Much more could be done with a focus on EU by using EU specific data from Eurostat etc.
73	Lobelia Earth	Spain	Barcelona	High resolution Soil Moisture	Lobelia Earth is specialized in high resolution climate risks assessment and quantification by combining satellite data, climate modeling and computational intelligence. Lobelia is a pioneering company integrating climate analysis in decision-making both in public and private sectors, grounded on scientific knowledge and radically new software technologies. Lobelia also provides ecosystem monitoring services including CO2 sequestration at tree level, tree survival, vegetation health indices, etc. Our team builds and operates products that people use and engage with on a regular basis across the world.	High resolution soil Moisture Global coverage 1km resolution and 100m under advanced R&D Evapo-transpiration information available L-band passive microwaves SAR based: Weather, light and RFI independent No need of in-situ infrastructure Consistent time coverage every 2/3 days Historical time series from 2010	Soil moisture satellite-based data, independent from precipitation- and vegetation-based indexes (e.g. SPDI, NDVI) serve as input variables for runoff, precipitation, evapotranspiration, and climate models, with effective applications in hydropower, precision irrigation, disaster prevention and climate monitoring among the others.	N/A
74	MEOSS	France	Colomiers	MEO-Carbon	MEOSS (Earth monitoring services) is a Start-Up, created in 2018, which offers innovative solutions based on the processing and analysis of satellite imagery and various data. Positioned on the challenges of climate change, its objective is "to help in the efficient management of territories and their development in respect of the environment". It is particularly active in the fields of land use planning, water ressource management, agriculture and carbon stocks analysis. Based on the analysis and processing of geographical data, MEOSS offers operational cartographic decision making tools.	As carbon neutrality is at the heart of all current ecological debates, institutions must implement actions to know their trajectory. This is where the MEO-Carbon tool comes in intuitive mapping to visualise carbon stocks and flows, up-to-date data using the latest available satellite images, quantitative information on the carbon stocks and flows of your territory. For public actors, environmental managers and agricultural actors, MEO-Carbon assists its clients in the implementation of a low carbon strategy and the analysis of their actions.	MEO-Carbon is a decision support tool that enables the various stakeholders to measure, analyse and act on carbon capture and biological sequestration capacities in order to better understand and control the processes in place and achieve climate change adaptation objectives.	At this stage, the data we need to improve our service would be in-situ data.
75	MEOSS	France	Colomiers	MEO-Water management	MEOSS (Earth monitoring services) is a Start-Up, created in 2018, which offers innovative solutions based on the processing and analysis of satellite imagery and various data. Positioned on the challenges of climate change, its objective is "to help in the efficient management of territories and their development in respect of the environment". It is particularly active in the fields of land use planning, water ressource management, agriculture and carbon stocks analysis. Based on the analysis and processing of geographical data, MEOSS offers operational cartographic decision making tools.	To support water stakeholders, MEOSS is developing a range of services based on spatial imagery and capable of providing complete, homogenous, centralized and up-to-date data. Today, the range includes MEO-WaterReserve for the inventory and monitoring of water bodies, MEO-Irrigation for the inventory of irrigated and no-irrigated plots and their rotation, MEO-WaterColor for monitoring water quality. The joint analysis of the various cartographic indicators allows users to be supported in their decision-making.	MEOSS helps public authorities to diagnose territories, identify action levers and measure the effects of public policies. The services allow to : - A better understanding of agricultural water use; - Better understand reservoirs and water bodies; - Monitor the main trends in water quality on the scale of catchment areas; - Joint analysis of the various cartographic indicators to support the implementation of integrated water management.	In-situ data for model calibration and validation; satellite images with very high resolution, temporal and spectral available free of charge or at an acceptable cost to clients; bathymetric data.
76	Meteory	Netherlands	Noordwijk	Environment Monitoring	Meteory helps decision-makers monitor the environment using the latest satellite monitoring technology.	We combine data from many different satellites and create a platform to visualize all environmental indicators. This is a challenge as there is so much data coming in from satellites with different resolutions and different formats. We want to abstract those challenges so that our users can jenjoy the insights from the best monitoring technology.	With our service, public authorities can monitor the health of their territory and its evolution in the last 40 years. They can also see what actions can be done to improve this health and long-term resilience. Many datasets are available like carbon sequestration, landcover evolution, forests health, soil health, irrigation, etc. With better data at their disposal, they can make the best decisions.	We always enjoy having more radar, multispectral and hyperspectral data. A better frequency as well as resolution is always better for us.

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77	MINES Paris	France	Sophia Antipolis	High photovoltaic penetration at urban scale	An engineering school founded in 1783, it offers high-level training (master's degree, specialized master's degree, doctorate) and proposes cutting-edge research. The concept of research “orientated” towards the industry is at the base of the creation of ARMINES in 1967. With more than 600 employees ARMINES is a structure for contractual research with 90% of its personnel in research centres and has held on to the top spot amongst private contract research institutions affiliated to higher education with a total turnover of nearly of €40 million per year.	Provision of bankable data and business model analysis in the area of energy production from distributed photovoltaic systems in urban and peri-urban areas.	European Rooftop initiative with the incentive to plan for PV systems on all new public and commercial buildings with a surface area of 50 m2 or more, starting in 2026 and all existing public and commercial buildings with a surface area of 250 m2 or more from 2027 onwards.	DSM (Digitl Surface Models).
78	mundialis GmbH & Co. KG	Germany	Bonn	INCORA	mundialis is involved in generating maps using freely available satellite imagery and geospatial data, which are used as a basis for making decisions related to environmental issues, such as changes in forest cover over time. To achieve this, they develop open source computer programs that are freely accessible, distributable, and adaptable by the public, enabling the efficient study of large areas and reducing time and cost. The company works scientifically and collaborates with regional and international project partners.	This landcover map was produced as an intermediate result in the course of the project incora (Inwertsetzung von Copernicus-Daten für die Raumbeobachtung, mFUND Förderkennzeichen: 19F2079C) in cooperation with ILS (Institut für Landes- und Stadtentwicklungsforschung gGmbH) and BBSR (Bundesinstitut für Bau-, Stadt- und Raumforschung) funded by BMVI (Federal Ministry of Transport and Digital Infrastructure).	Quantifying land-use dynamics helps public authorities understand the use of limited resources.	Hyperspectral sensors delivering continuous data in space and time.
79	mundialis GmbH & Co. KG	Germany	Bonn	HERMOSA	mundialis is involved in generating maps using freely available satellite imagery and geospatial data, which are used as a basis for making decisions related to environmental issues, such as changes in forest cover over time. To achieve this, they develop open source computer programs that are freely accessible, distributable, and adaptable by the public, enabling the efficient study of large areas and reducing time and cost. The company works scientifically and collaborates with regional and international project partners.	The ecosystem and landscape restoration process is an inherently spatial and complex process that requires the support of modern spatial data management systems, especially when large areas are under consideration. Using satellite data can help to identify areas in need of restoration, quantify measures to be implemented and create the transparency and traceability and thus trust once the project is underway. Especially when it comes to carbon credits uncorruptable satellite data is invaluable.	The web-based service is accessible by any number of stakeholders and utilizes satellite data to monitor activities anywhere in the world.	Satellite data with a higher spatial resolution and with additional spectral bands could improve the service.
80	MURMURATION	France	Toulouse	Murmuration	Murmuration is deploying the use of satellite Earth Observation data on a global scale and merging this data with other data sources (statistical data, in-situ measurements, geolocated databases, etc.) to provide clear, reliable, transparent, and precise information regarding the tourism pressure and the environmental state of any point on the globe. We have a catalog of about twenty environmental indicators derived from satellite data, which measure parameters on four main themes: air, water, biodiversity and soil.	Our solution addresses the issues of land management and environmental quantification. We have exceeded 5 of the 7 planetary limits, it is essential to provide tools that allow us to measure these limits on a territory scale. Our ambition is to provide the necessary data for this resource management. We also manly address the tourism industry : Murmuration was created with the aim of introducing the environmental dimension into the management of tourism activity.	Our role is to provide them with a scientific quantitative measure of the environmental status of their territory. With this data, territories can understand the environmental state and make decisions to preserve natural areas and adapt to climate change.	Human activity data: reliable, exploitable (following format and metadata standards), with extended temporal and spatial coverage; especially related to the tourism activity for the use-case we are currently tackling, however the lack of quality data would be quite similar for other kinds of human activities Environmental data: for some domain (air quality, water quality) the low resolution limits the use-cases; EO data for carbon emission monitoring at a coverage level and resolution that would allow to link human activities with emissions.
81	MURMURATION	France	Toulouse	Sustainable development indicators	Murmuration is deploying the use of satellite Earth Observation data on a global scale and merging this data with other data sources (statistical data, in-situ measurements, geolocated databases, etc.) to provide clear, reliable, transparent, and precise information regarding the tourism pressure and the environmental state of any point on the globe. We have a catalog of about twenty environmental indicators derived from satellite data, which measure parameters on four main themes: air, water, biodiversity and soil.	Our service responds to this challenge. Uniqueness: bringing the environment assessment to the scale of the individual. We have developed models, building on Copernicus data and services, to scale down most of the environment quantities to the scale of individual, providing decision makers with fine reading grid for effective management of their territores. Moreover, the solution has a fixed price, and is available on a global scale.	Building on the Copernicus Climate Change datasets, we are able to assess the impact of different cliamte projections on a territory and link this, for instance, to critical infrastructure, to the population profile, etc.	We are waiting with great interest several thermal missions that are under construction that would allow to move from the 30m scale that we have today to the 5-10m range. We are also expecting with great interest the development of the CO2 monitoring satellites that shall complement the tools we are providing with a global view regarding emissoins.
82	Nelen & Schuurmans	Netherlands	Utrecht	3Di Water Management	We provide leading climate technology to take on water management and environmental challenges. Our mission: To develop and apply the best software for data driven water management and climate adaptation.	3Di is hydrodynamic simulation software to gain better insight into water systems.The computational core is carefully designed to create an optimal balance between accuracy, robustness and speed. 3Di consists of a 1D, 2D and a ground water flow domain.The advantages of 3Di Hydrodynamic Simulation Software: with 3Di you can take up larger hydrodynamic challenges; 3Di is fast, and always try to be faster.; 3Di is highly visually, communicate model outcomes with clients/stakeholders via the live site.	3Di Water Management support public authorities in gaining better insights into waterrelated risks for raising awareness, urban design, crisis management, etc.	Most critical data users of 3Di are looking for are e.g. highly accurate elevation data, bathymetries of rivers and canals, data about sewerage and drainge systems, soil data and hydrological measurements.
83	Netcarbon	France	Mérignac	Netcarbon farming	netcarbon makes carbon measurement by satellite accessible to all to provide the necessary response to the fight against climate change. Our solution calculates the state of play of carbon sequestration and of our environment. Based on your environment our artificial intelligence is identifying the optimal scenario to increase your capacity to store carbon. Then with one click, you can track the impact of your actions. netcarbon solution is designed with territories, agriculture companies, and carbon project developers to provide pertinently and clear information about your project and your actions.	netcarbon makes carbon measurement accessible to all by combining satellite data and ground sensors thanks to our artificial intelligence model. Our algorithms are designed by netcarbon’s team in collaboration with world-class laboratories INRAE and CESBIO. This is allowing netcarbon to already provide insights to farmers and carbon developers.	Our service assists public authorities to create carbon storage strategies on a large scale. Indeed netcarbon delivers key information on the state of play and scenario to improve its carbon storage. Carbon storage has an impact on climate adaptation, indeed agricultural practices, that are storing CO2, seem to be more resilient to climate change. Moreover as explained, using nature to store more co2 has a direct impact on mitigating climate change by removing co2 from the atmosphere. (As an example we worked with INRAE to estimate the impact of an agroecological farming transition in Nouvelle Aquitaine and Occitanie.)	netcarbon is mostly laking ground sensor data to verify our model on new areas (co2 flux sensor). We are also lacking satellites to measure CO2 concentration (like OCO-2). Moreover, replacing sentinel 2 data with a hyperspectral satellite could improve our model. However, it’s important to keep around the same revisit and resolution to fit our delivery product resolution (around 10m and around 5 days revisit).
84	Netcarbon	France	Mérignac	Netcarbon intelligence	netcarbon makes carbon measurement by satellite accessible to all to provide the necessary response to the fight against climate change. Our solution calculates the state of play of carbon sequestration and of our environment. Based on your environment our artificial intelligence is identifying the optimal scenario to increase your capacity to store carbon. Then with one click, you can track the impact of your actions. netcarbon solution is designed with territories, agriculture companies, and carbon project developers to provide pertinently and clear information about your project and your actions.	Cities and territories have to act against climate change by fulfilling clear objectives in terms of carbon emission and carbon sequestration. In order to reach those objectives netcarbon has developed a SaaS tool to help territories globally manage their carbon sequestration based on precise measurement tools, improvement scenarios, and objective indicators to measure the impact of their actions.	Our service assists public authorities to create carbon storage strategies on a large scale. Indeed netcarbon delivers key information on the state of play and scenario to improve its greening strategy. Greening the city has an impact on climate adaptation, indeed greener city will be more resilient to heat waves, floods, and more generally to climate change. Moreover, adding vegetation has a direct impact on the population and is beneficial for the quality of life. Moreover as explained, adding more nature in the city will store more co2. It has a direct impact on mitigating climate change by removing co2 from the atmosphere.	netcarbon lack thermal data with a resolution better than 60meters and a revisit of one data every month.
85	OHB System AG	Germany	Bremen	CityCLIM	Space hardware constructor also contribution to offer EO downstream services.	The strategic objective of CityCLIM is to significantly contribute to delivering the next-generation of City Climate Services based on advanced weather forecast models enhanced with data both from existing, but insufficiently used, sources and emerging data sources, such as satellite data or data generated by Citizens Science approaches for Urban Climate Monitoring etc. The CityCLIM framework is unique in terms of applying a process-based weather model on 100m resolution for cities (previous operational approaches downscaled coarser models).	For instance, one Service within the portfolio of the CityCLIM services is able to simulate the land surface temperature (LST) on 50m spatial resolution based on urban characteristics. Therefore, a citizen or city administration user can modify the urban configuration by for instance creating a park at the location of a currently sealed surface, and explore the connected changes in LST. This supports city administrations in finding appropriate heat and climate change mitigation measures.	Land surface temperature provided on a small resolution (e.g., such as would be provided by the LSTM mission planned for 2028), wider meteorological station networks or citizen science measurement networks.

#	Organisation	Country	City	Name of Service	Company Description	Service Description	Use in Adaptation or Mitigation Action	Data Needs
86	Orbio	Germany	Cologne	Orbio Earth Methane Platform	Orbio leverages the power of satellite data and data fusion algorithms to provide trustworthy and actionable methane intelligence for emission reductions and benchmarking efforts. Our proprietary algorithms analyse non-methane-specific remote sensing data to create a world-first combination of high-frequent, asset-level and global scale methane emissions detection and quantification for any location on earth.	We have build a physics-based, proprietary set of algorithms that is capable of analysing non-methane specific satellite instruments (most notable Sentinel-2 and Landsat-8) to show methane emissions on global sites. We have managed to build adequate filtering mechanisms that allow us to scale the models up to global asset databases in a variety of land cover domains (deserts, shrubland, agricultural, urban). As a result, Orbio is the only player capable of quantifying methane emissions at asset level (ie well), at global scale and with highly frequent observation (every 4 days).	Government agencies can leverage on Orbio datasets to track their net Zero & Commitment Alignments.	MethaneSAT mission will help us detecting both concentrated point sources and dispersed area sources, improving further the accuracy of Orbio aggregated totals.
87	Orbital Eye	Netherlands	Delft	CoSMiC-EYE	Orbital Eye was founded in 2012 in Delft, The Netherlands by remote sensing and machine learning enthusiasts. Orbital Eye leverages its unique capabilities to provide earth observation based services to keep assets, infrastructure and the environment safe, using both radar and optical satellite imagery. Orbital Eye can detect, analyse and report changes in your area of interest. Orbital Eye's core service, CoSMiC-EYE is aimed at detecting Third Party Interferences close to critical infrastructure such as oil- and gas pipelines.	The largest cause of damages to critical infrastructure (e.g. gas/oil/water pipelines) is Third Party Interferences. Owners of this critical infrastructure therefore monitor this frequently, traditionally by car patrol or by plane/helicopter. Orbital Eye has developed a monitoring solution based on satellite data, caused CoSMiC-EYE. We use radar, multispectral, and optical data to detect activities that can potentially damage the pipelines. Detected activities are reported to our customers in the CoSMiC-EYE application, a GIS platform available for Desktops and Tablets.	Mitigates the risks of damage to pipeline, with potential consequence as environmental pollution, hindrance in supply, repair costs.	Higher frequency of SAR and Multispectral data. Hyperspectral.
88	Phymer - AIOFAR	Spain	Madrid	AIOFAR	Our project improves the performance of aquaculture farms and minimises their production and economic losses. With our solution based on satellite and insitu data processing combined with Machine Learning, we contribute to increase food security and support Sustainable Development Goals 2, 9, 12, 13 and 14.	One of the challenges addressed is the need of multidisciplinar expertise for the implementation of our solution. Our technological barriers are found in the availability of satellite data which is a limitation in the quality of the services that we can offer to aquaculture farms. Our project designs a solution that combines theoretical scientific analysis with machine learning algorithms to offer a robust prediction and monitoring of the farms. After having studied the market, we see a high potential of growth in Europe and Africa.	Our solution minimises the aquaculture production and economic loss many environmental events risks by an improved early detection and prediction of those events through the assessment of critical key performance indicators provided by Earth Observation programs such as Copernicus and insitu data processed by our advanced scientific techniques and Machine Learning. Public authorities of the European countries and beyond would be encouraged to pursue a stronger aquaculture industry.	Satellite data from sources that provide more frequency and even greater resolution to measure key parameters of the aquaculture farms.
89	PREDICT SERVICES	France	Montpellier	Early Warning for all (EWS4ALL)	For nearly 20 years, PREDICT Services has developed a concept that includes the analysis and expertise of climate risks for early warning and early action. It's expertise and tools have been employed for the analysis and improvement of local organization facing risks. The final goal is the prediction of consequences and the transmission of recommendations for early action and resilience improvement. Its 35 on call engineers team provide help in decision expertise and data, 365/7/24 to 20 million French citizens, 25 000 French communities, hundreds of companies, and many national and international insurers. This concept has been adapted through methodology and technology transfer, as well as a transfer of softwares and data internationally with conclusive and positive feedback.	PREDICT solution's are adapted to different users facing risks as they integrate help in decision services, tools, softwares, technology and methodology transfer. Its uniqueness consist in the combination of 3 components : First upstream organization conception and training, second the real time help in decision expertise and risk monitoring, and last return of experience, feedback and improvement. The integrated solutions can be adapted to the needs of users and levels of developments of countries in which they are deployed.	Initially develop to assist French local communities facing floods, the solutions have been deployed over 30000 french communities, regional and national institution to help them to anticipate the activation of their safety plans for more than 17 years. The methodology have been adapted to enhance capacity building of international government such as Morocco and the ones previously mentioned. Thanks to these solutions they have been able to prevent major risks and protect population, economic stakes and environment.	Stakes data - frequent satellite image for rapid mapping.
90	rasdaman GmbH	Germany	Bremen	EarthServer	Mission of the German-based academia hitech spinoff is to enable providers of spatio-temporal sensor, image (timeseries), simulation, and statistics data to offer spatio-temporal information in a user-friendly, fast, scalable, and flexible way with highest service quality. The company offers 360° support around datacubes, from on-premise licenses over managed services in clouds over zero-coding "datacubes to go" on Copernicus and other archives to on-board cubesat services, all connectable through completely location-transparent federation.	The EarthServer federation is a free, open, democratic, transparent group of Earth data providers offering SAR and optical satellite data, weather/climate data, as well a manifold thematic data (such as for land governance). Based on the enabling rasdaman datacube technology, EarthServer standads out through the volume and variety of data, unrivalled performance and scalability, zero-coding flexibility, location- transparent federation, fine-grain security, and standards compliance (OGC, INSPIRE, etc).	Based on the insights gained through timeseries evaluation authorities can make fact-based decisions and recommendations.	Datacubes on board smallsats can boost data availability, as shown in-orbit in the ORBiDANSe project. Constellations can form in-space federation, and also can get integrated into the on-ground EarthServer federation.
91	rasdaman GmbH	Germany	Bremen	NATO SPS Cube4EnvSec	Mission of the German-based academia hitech spinoff is to enable providers of spatio-temporal sensor, image (timeseries), simulation, and statistics data to offer spatio-temporal information in a user-friendly, fast, scalable, and flexible way with highest service quality. The company offers 360° support around datacubes, from on-premise licenses over managed services in clouds over zero-coding "datacubes to go" on Copernicus and other archives to on-board cubesat services, all connectable through completely location-transparent federation.	NATO SPS flagship project Cube4EnvSec showcases the benefits of federated Earth datacubes for "all mission partners operating off the same map" with "data at the right time, in the right place, and the right shape", to quote central information challenges NATO has spotted. A diverse, geographically dispersed set of security-relevant services is being established forming a single source of truth, including fixed and moving data sources and sinks. In particular, Copernicus and INSPIRE data can be seamlessly integrated this way.	Fixed and moving data sources can provide their assets in realtime, and fixed and moving clients (human or autonomous devices) can extract the view they need for situational awareness, derived in realtime from the existing and incoming data.	N/A
92	Remote Sensing Solutions GmbH	Germany	Munich	Forest Monitor Germany	RSS – Remote Sensing Solutions GmbH, founded in 1999, is one of the leading earth observation companies in Germany, specializing in satellite image processing and interpretation, environmental monitoring, application development for geographical information systems (GIS) and development of Software as a Service (SaaS) applications. RSS provides one-stop services for satellite data processing and comprehensive earth observation data analyses and offers customized solutions for a wide range of clients.	Remote Sensing Solutions GmbH has published the first satellite-based forest monitor for Germany online. By analyzing a long Sentinel-2 time series using AI approaches, a national map of the dominant tree species was produced, it also includes forest status assessments for the period 2016-2022 and it provides a continuous monitoring of active fires. This open satellite-based forest monitor, makes it possible to analyze the development of forest stands at high resolution in terms of their vitality and water content.	The range of geodata provided through the monitoring system, offers forest owners, municipalities and ministries up-to-date information on the state of the forest at a national scale. With the vast areas of forest losses in the recent years, authorities face now the challenge to plan, finance and coordinate the transition in forestry towards a climate-resilient forest. The forest monitor Germany provides detailed geoinformation to spatially target and prioritize these activities.	For the scale-up to other European countries, access to the data from national in-situ forest inventories is essential. To have more accurate forest biomass estimates, new missions such as ESA Biomass or spaceborne LiDAR missions would be crucial.
93	Research Institute of Water and Environmental Engineering (IIAMA)	Spain	Valencia	The HuT	The Institute is very much aware of the existence of the needs of society, the public administration and industry for the services it can provide, and also of the possibilities of improving industrial processes and competitiveness through the development of technology and innovation. The need to respond to the new challenges in the fields of Water and the Environment have opened up new opportunities of cooperation for which the Institute is totally prepared, as the IIAMA has long experience in the transfer of results to businesses, public organisations and to society in general.	The service -in development- aims at locating areas within the city of Valencia were the heat island effect is more prominent given the current and expected climate conditions, and propose nature-based alternatives to aleviate the effects. It also plans to develop a system for drought anticipation and to reduce the impact that it has on the water quality of the urban water supply to the city under climate change conditions.	Makes the city of Valencia more robust and resilient against future heatwaves and drought.	Improved satellite images and refined forecasts and climate data.
94	SarVision	Netherlands	Wageningen	MAIA	We are frontrunners in developing and implementing automated monitoring systems for natural resources management. SarVision integrates data from multiple satellite constellations with other sensors, using cutting-edge algorithms and environmental economic accounting models. We have developed automated near real time systems for monitoring agricultural crops (crop growth), forests (deforestation and forest degradation), floods (also under the tree canopy), biomass and carbon, and for soil compaction.	Using RS derived data with high spatial and temporal resolution for ES and Natural Capital Accounting. SarSentry methodology is able to monitor and quantify forest degradation and biomass near real time and with a high spatial accuracy (>95%). With the SarCarbon methodology biomass and carbon are assessed and monitored over time based on free-of-cost Sentinel-1, S2 and Gedi data. By increasing the number of biomass related vegetation classes in SarCarbon, much less biomass related field is required work than other existing methods, while still meeting VERRA requirements.	Quantifying biomass and carbon over time, to provide required information for carbon related initiatives.	Financial mechanisms that allow implementing the systems in order to meet the demands of government institutes that would like to use the systems to support their monitoring task.

#	Organisation	Country	City	Name of Service	Company Description	Service Description	Use in Adaptation or Mitigation Action	Data Needs
95	Satelligence	Netherlands	Utrecht	N/A	Satellite based environmental supply risks monitoring like deforestation and carbon emissions.	Minimize your global environmental footprint, achieve sustainability commitments and comply with regulations. Identify where and when deforestation is happening in real-time in your supply chain. Monitor deforestation across sourcing landscapes with real-time notifications inside and outside your supply chain, historical and current deforestation risk analysis and progress towards sustainability commitments. We combine satellite data with supply chain linkage data to provide insights on performance of agricultural production and supply chain risks.	There is a new EU regulation stating that 6 agricultural commodities cannot be imported into the EU anymore if they are sourced from deforestation landscapes. Satelligence deforestation monitoring can serve as an independent trusted source of evidence to proof commodities were produced in non-deforested landscapes.	L-band radar at 5 - 15m pixel size.
96	SCALIAN	France	Toulouse	MONITORPANNING	Created in 1989, Scalian is a specialist in business transformation through its dual mastery of business processes and digital technologies. Ranked in the top 10 of French engineering consulting firms, the group provides services in industrial project management, supply chain, architecture & development of embedded digital systems, information system applications, and AI. It also deals with project optimisation and organisational performance issues, as well as digital transformation challenges for leaders in industry and the service sector.	This project aims to locate and monitor deforestation using spatiotemporal analysis of remote sensing data. The innovative aspect of the project consists in correlating SAR (Sentinel-1) images with optical images of the same regions using machine learning algorithms. This is performed over time series of images of the same region in order to improve resolution and strengthen classification. This approach enables prediction of deforestation events from the earliest signs.	This project helps identifying causes of deforestation such as panning sites. In Ivory Coast, for example, the Ministry of Geology and Mines is intent on preventing illegal panning.	A dataset of correlated optical and radar images will need to be built to train the learning algorithm.
97	SCALIAN	France	Toulouse	CFOD - Computer vision FOrest Detection	Created in 1989, Scalian is a specialist in business transformation through its dual mastery of business processes and digital technologies. Ranked in the top 10 of French engineering consulting firms, the group provides services in industrial project management, supply chain, architecture & development of embedded digital systems, information system applications, and AI. It also deals with project optimisation and organisational performance issues, as well as digital transformation challenges for leaders in industry and the service sector.	The CFOD project consists in building a solution allowing a drone equipped with a stereoscopic camera and a LiDAR to automatically navigate in a forest of planted trees in order to automate data collection and provide a real-time semantic mapping service for the operator. This project aims to remove several scientific barriers, namely the real-time and semantic analysis of the camera flow on the embedded for the realization of a cartography as well as a fusion of data from different heterogeneous sensors.	The management of public and private forest resources is a strong issue on the ecological, energetic, economic and societal levels. CFOD's objective is to provide an innovative 3D mapping solution of forest parcels associated with algorithmic modules (detection of pruning areas, estimation of biomass on the parcel, state of health of the parcele etc.). The automation of the drone acquisition mission relieves the forestry management services, which can focus on the administration of the plots and the management of maintenance actions.	The project will be the subject of acquisition campaigns on forest plots by the use of drones equipped with LIDAR and stereoscopic cameras. Any volume of similar data is likely to improve the performance of the system. Recent biomass estimation data on identified plots are also likely to help calibrate the biomass estimation algorithm.
98	SCALIAN Unmanned Systems	France	Toulouse	Land monitoring via fleet of drones	In the Top 10 Engineering consulting companies in France, the Group operates in France and abroad in service activities in the management of industrial projects, supply chain (costs, quality, deadlines, performance), architecture and development of embedded digital systems and applications of information systems, big data and AI. It also deals with the issues of optimizing projects or the performance of organizations as well as the challenges of digital transformation for leaders in industry and the tertiary sector.	Land monitoring via fleet of drones.	Land monitoring via fleet of drones.	Land monitoring via fleet of drones.
99	Silex Clouds srl	Italy	Rome	Dust360	Silex Clouds S.R.L. is an innovative italian start-up focused on the design, development and delivery of services related to the exploitation of Earth Observation (EO) satellite data. The company offers Near-Real-Time and Real-Time applications based on optical and radar satellite imagery, to speed up impact assessment analysis; and delivery of EO added value products guaranteeing an easy ingestion of EO information in end-users systems. One of our services is focused on the Near Real Time monitoring of Dust Storms in MENA Region (Middle East and North Africa).	Dust360 project is based on the Real Time monitoring of Dust Storms in MENA Region, and the impact assessment in diferent kind of infrastructures, as roads, railroads, agricultural areas, refugee camps, and mainly in solar parks.	Dust360 service assists the authorities, identifying potential areas under risks, extracted not only from real time data, but from a historical database including more than 15 years of satellite imagery in MENA Region. In case of public authorities regarding renewal energies, the feedback underlyed the importance to identify potential zones for future solar parks developments, and to evaluate on-time the decrease on energy production of solar parks under soiling conditions. Energy distributors they enphatize the utility of the proper identification of best zones in terms of solar radiation with less soiling probabilities.	To improve the service, would be required more Aeronet stations with consistent and accessible data, and ground based soiling sensors, to enrich our machine learning algorithms.
100	Spatialise	Netherlands	Noordwijk	SOCMO	Spatialise developed a soil organic carbon monitor. The product estimates the soil organic carbon content of farmland topsoils, using satellite data and AI. This information is valuable for monitoring and evaluating the carbon footprint of food value chains: from farm to fork. Next to that, the data provides insights and analytics of regenerative agriculture, such as land restoration initiatives. A scalable solution that saves time and cost, and ultimately accelerates restoration initiatives and allows corporations and governments to achieve their sustainability goals.	Setting up a scalable one-stop shop solution where data from several EO providers is fused to provide input for the machine learning model. The innovation in this project, SOCMO, lies in its state-of-the-art technology: with robust satellite monitoring and advanced machine learning modelling of soil carbon trends, SOCMO is able to measure SOC remotely, reliably, accurately, in a timely manner, and at a fraction of the current cost. SOCMO can provide information reliably, at a faster pace and with great flexibility.	Assists by providing scalable Monitoring & Evaluation of land restoration and regenerative agriculture. Contributes to NDCs. Assists public servants with recommendations for compliance with certification of carbon removals (EU rules), the CSRD and the EU Soil Health Law. Spatialise has developed a state-of-the-art model that can remotely, accurately and reliably measure the SOC of plots by using different sources of (satellite) data. The final service Spatialise wants to offer is a turnkey solution that can measure and keep track of SOCchanges over time. The output is provided as tonnes of CO2 equivalent (CO2eq)/ha.	More soil samples (to continue train and learn the artificial intelligence model with big data and increase model robustness). Hyperspectral data (to have more spectral signatures at our disposal).
101	Spire Global	Luxembourg	Luxembourg	Spire Maritime	Spire Global is a leading global provider of space-based data, analytics, and space services, offering access to unique datasets and powerful insights about Earth from Space so that organizations can make decisions with confidence, accuracy, and speed. Spire uses one of the world's largest multi-purpose satellite constellations to source hard-to-acquire data and enriches it for the maritime, aviation, and weather industries.	Spire Maritime provides comprehensive and reliable maritime AIS data solutions combining Satellite AIS, Terrestrial AIS, and Dynamic AISTM. Our technology enables the maritime industry to locate and track seafaring vessels by transmitting and recording three main categories of data, including static information, navigational information, and voyage-specific information. Our Satellite-AIS solution integrates a network of satellite receivers with existing AIS platforms, allowing for global mapping of maritime data and worldwide transmission of AIS data via satellite.	Global Fishing Watch (GFW) uses satellite automatic identification system (AIS) tracking data collected by Spire Global to promote ocean sustainability through increased transparency and to detect illegal, unreported, and unregulated (IUU) fishing. Through machine learning, GFW has been able to develop powerful monitoring tools to automatically spot fishing vessels within the vast volume of data. GFW's partnership with Spire Global has helped promote ocean sustainability, expose illegal fishing activities, and provide a better understanding of fishing activity globally.	Real-time collection of L/X/S-band signals emitted by maritime radars from vessels to be able to geolocate those signals and enhance tracking in the maritime domain.
102	Spire Global	Luxembourg	Luxembourg	Spire Weather	Spire Global is a leading global provider of space-based data, analytics, and space services, offering access to unique datasets and powerful insights about Earth from Space so that organizations can make decisions with confidence, accuracy, and speed. Spire uses one of the world's largest multi-purpose satellite constellations to source hard-to-acquire data and enriches it for the maritime, aviation, and weather industries.	Spire generates a global picture of weather observations throughout the atmosphere through techniques called GNSS-RO and GNSS Reflectometry, which we utilize to generate multiple enhanced weather products, including global weather forecasting capabilities. Spire provides weather forecasts and data to a wide variety of industries including agriculture, renewable energy generation, commodities traders and logistics and supply chain companies, with a focus across the board on improving outcomes like better crop yields and better predictability of energy output.	Our satellites gather information on environmental factors, such as radio occultation for weather, sea ice, and soil moisture, that can be used in research and solutions to fight climate change. Specifically, RO-based weather data is a substantial contributor to weather model skill given how those data are truly global leading to better information and forecasts as storms cross oceans and develop into potentially threatening hurricanes, typhoons, or high-wind events over a week later when those systems eventually make landfall. The data on weather collected arm organizations with real-time information.	Weather forecasting is primarily an initial conditions problem - there are still a lot of assumptions that need to be made when generating a weather forecast due to the globally connected nature of weather patterns. Therefore, additional globally available weather observations, whether surface based or satellite based, that can help improve the global weather observation network, would absolutely be welcomed by Spire and the broader weather community.
103	SUEZ EAU France - Center Rivages Pro Tech	France	Bidart Pessac	Dynamic management of coastal waters	SUEZ group is a major player in water, waste and environment management worldwide. Inside the Business Unit Smart & Environmental Solutions and the Sea & Water Environment Division, Rivages Pro Tech is the monitoring and forecasting center of SUEZ dedicated to the management of river and coastal water environments. Located in Bidart (France), Rivages Pro Tech operates science-based services with applications to water quality, marine litter, coastal flooding and marine renewable energy.	Coastal ocean monitoring based on coupled satellite observation, numerical ocean modelling and data-driven modelling (Artificial Intelligence). Real time monitoring and forecasting on the coastal ocean, nearshore area, land-sea interface. High-resolution, beach scale is targeted. Decision-support is provided for water quality, marinne litter management and marine flooding management.	Public administrations are the main use of our services, especialy municipalities and agglomerations. The service proposed supports local authorities in adopting new management approaches for coastal waters tkaing benefit of an improved, real time and predictive knowlegde of nearshore dynamics.Issues targeted are directly linked to climate change, especially water quality (increase in extreme rainfall events intensity and frequency) and marine flooding (sea level rise, increase in frequency and intensity of ocean storms).	Spatialized observations of surface coastal ocean properties, continuous, high-frequency satellite imagery products in the coastal ocean (gap-free, hourly to daily, high-resolution close to the shoreline).

#	Organisation	Country	City	Name of Service	Company Description	Service Description	Use in Adaptation or Mitigation Action	Data Needs
104	SYNOMEN	France	Montrouge	PEEKELITE	Our SaaS solution delivers near real-time estimates on crop yield forecasts and on crop losses due to weather events such as flooding, drought, storm. Our solution has: - a web version that delivers yield and losses estimates aggregated at mid and large spatial scales; - a mobile version that delivers yield and losses estimates at the plot scale. Our state-of-the-art services combine real-time tracking with satellite imagery, artificial intelligence, eco- physiological crop modelling and high-performance computing to identify the damaged areas and simulate crop yields and losses.	Our solution allows a near real time monitoring of yield forecasts and losses all over the cropping season. Our service is based on a disruptive innovation in the crop insurance market, and is unique in the market as our strong expertise in combining data science and satellite imaging for agriculture, and more specifically for the crop insurance sector is unrivalled. SYNOMEN assesses crop yield decreases coming both from extreme and recurring weather events such as small-scale seasonal droughts or water excesses.	Our service enables public authorities to evaluate early in the season the severity of the weather event and the compensation based on homogeneous methodology over the whole territory. Our service is a huge help for public authorities for cash management, crop production monitoring and to prepare mitigation actions related to agriculture.	A higher frequency (temporal resolution) in Sentinel 1 and Sentinel 2 data would allow a great improvement of our service.
105	TERRANIS	France	Toulouse	Greencity	Design and development of climate and environment services based on Earth Observation for farmers, winegrowers and local authorities.	Thanks to our dual expertise in satellite image processing and land use planning, we have created Greencity: a tool for assessing vegetation in cities. This observatory allows, via an online platform, to visualize updated and spatialized data and analysis on urban vegetation. Indicators and dashboards are built from images and field data. These tools make it possible to target priority areas for action, monitor and track vegetation, and communicate with residents. All Observatories are customized according to the needs of each municipality and data available internally.	By analysing urban morphology including green infrastructures, it allows decision makers to identify actionable leverages for reducing the exposure of urban population to heat waves. Greencity allows locating heat and fresh islands, as well evaluating a level of vulnerability with spatial insight. We are currently developping a version of the tool to assist policy makers in designing urban development projects for both mitigation and adaptation to Climate Change.	High resolution infra-red thermal images would be really appreciated compared to what exists today at 30 or 60m resolution. In-situ sensors would also greatly help improving our services e.g. air pollution, soil temperature etc.
106	TERRANIS	France	Toulouse	Pixagri suite	TerraNIS is an SME of 18 employees, created in March 2014. The company is located near Toulouse, has a subsidiary in Chile and a Sale representative in Spain. Our team includes agronomists, ecologists, remote sensing experts and data scientists. The mission of TerraNIS is to design and provide decision support services, based on Earth Observation, to public and private customers, specifically in the fields of agriculture and environment. To date, TerraNIS offer is three folds and delivers services internationally, generally under yearly subscriptions mode, for vineyards monitoring, precision agriculture and forest monitoring, land and environmental management.	To optimize the irrigation process and quantity used by farmers over a certain territory. Customers can be either the farmers organizations (current customers of the service), water agencies and regional authorities (targeted).	To allow the farmers to minimize their needs for water.	How institutional bodies can "sponsor" the use of services which minimize the use of water.
107	Thales Services Numeriques	France	Toulouse	Flood4Kast	Thales SIX is a French company and part of Thales Group, a world leader in critical information systems and secure communications. Its main experience is in space applications development for ground segment activities. Thales' state-of-the-art technologies allow providing governments and companies with safety and security solutions in critical information systems and challenging environments, in particular in the space domain. Thales activities range from consulting to outsourcing, including system and software engineering, development and integration.	A more reliable and automated forecast system combining in-situ & satellites imagery data and artificial intelligence for reliable forecasts of flood events. An automatic flood forecast tool combining two kinds of information used as input of a ML algorithm: the set of flows forecasted with data assimilation at the basin outlet of the watershed of interest; and the soil state observation from multi-sensor satellite products extracted mainly from Copernicus. The prototype allows for forecasting time series of flood occurrence for a 5-day flood forecast with 1 h time-step.	Our Early-Warning System aims to protect people and their property, by providing reliable and located flood forecasts.	Addition of groundwater upwellings detection with IRT satellite observation requires data with better spatial and temporal resolution. Geostationary satellite observations with better spatial resolution.
108	Thales Services Numeriques	France	Toulouse	Forest anomaly detection	Thales SIX is a French company and part of Thales Group, a world leader in critical information systems and secure communications. Its main experience is in space applications development for ground segment activities. Thales' state-of-the-art technologies allow providing governments and companies with safety and security solutions in critical information systems and challenging environments, in particular in the space domain. Thales activities range from consulting to outsourcing, including system and software engineering, development and integration.	Our service aims at the detection of forest degradation via data from space and AI. It is a generic tool to detect diseases, pests, fires and deforestation byanalysing the evolution of the NDVI (Normalized Difference Vegetative Index) which indicates the plants' health. An alert system is activated once an anomaly is detected, based on latest satellite image acquisition and it mesures the damage in the affected zone over a certain period of time by running an annual time series.	Our service is capable of alerting public services in the event of abnormal behavior within a forest (deforestation, defoliation, fires) and quantifying the damage caused.	We are lacking in situ (drone) data which would allow us to have feedback on the observations reported by satellite.
109	Thales Services Numeriques	France	Toulouse	FLORIA – FLexible algORIthm for the monitoring and forecasting of Air pollution based on Artificial Intelligence and satellite observations	Thales SIX is a French company and part of Thales Group, a world leader in critical information systems and secure communications. Its main experience is in space applications development for ground segment activities. Thales' state-of-the-art technologies allow providing governments and companies with safety and security solutions in critical information systems and challenging environments, in particular in the space domain. Thales activities range from consulting to outsourcing, including system and software engineering, development and integration.	FLORIA, from one hand, it monitors in near-real time surface concentrations of air pollutants using satellite observations, and from the other hand, it forecasts the transport of pollution at fine spatial scale. One of the major impacts of our tool is its added value for the air quality market with positive social impacts regarding the environmental risk factor.	Our service: a) will give information on how human activities and natural phenomena impact emissions; b) allows for monitoring areas with no in-situ measurements; c) allows smart management of events (like the Olympic Games) regarding the environmental risk factors; d) it is a decision support tool to reduce emissions.	The future missions MetOp-SG, 3MI and CO2M will help to get the high resolution AOD data we need for a better service.
110	Ticinum Aerospace Srl	Italy	Pavia	Deep Property	Ticinum Aerospace (TA) is a spin-off company from the University of Pavia, Italy founded in early 2014 and focused on analyzing large amounts of geospatial data through smart and effective use of machine learning and computer vision techniques. The mission of the company is to provide reliable, customer-oriented solutions taking advantage of heterogeneous, Big Geospatial Data, with the final aim of "cutting the cost of uncertainties" for its customers in the insurance business.	Deep Property is a framework capable of ingesting different geospatial datasets to automatically derive property data as well as neighborhood indicators in urban areas. Deep Property allows to cutoff 90% of expenses on building analysis by replacing in-situ inspections with AI-based image interpretation. Its action is beneficial in several fields of the insurance. The capability of processing at global scale, on-demand over a cloud-based framework, allows Deep Property to process just the required locations/buildings by reducing costs, and increasing its efficiency.	Deep Property can support public authorities to identify the areas most prone to risk of natural disasters, and thus support for example, risk mitigation activities.	Missions involving thermal, hyperspectral sensors and flood hazard data.
111	Ticinum Aerospace Srl	Italy	Pavia	Saturnalia	Ticinum Aerospace (TA) is a spin-off company from the University of Pavia, Italy founded in early 2014 and focused on analyzing large amounts of geospatial data through smart and effective use of machine learning and computer vision techniques. The mission of the company is to provide reliable, customer-oriented solutions taking advantage of heterogeneous, Big Geospatial Data, with the final aim of "cutting the cost of uncertainties" for its customers in the insurance business.	Saturnalia is a service that collects, processes and distributes data and information with the main focus on agriculture. In detail, Saturnalia allows you to monitor the vegetative activity of crops globally, to have updated weather data and to combine these measurements with additional sources (e.g. market prices). The information is made available via a web platform or via API. In addition, the skills and data available allow us to extend the analyzes to different purposes. For example, Saturnalia has been used to estimate damage from hail and frost.	Saturnala can support public authorities to monitor/assess crops most prone to risk of natural disasters (e.g. drought), and thus even provide countermeasures in risk mitigation activities. In the aftermath of a natural disasters, Saturnalia allows to easily identify the damaged areas, in few days, over large geographical areas thanks to satellite coverage.	Weather-related data at higher spatial resolution.
112	Ubivivo	Slovenia	Ljubljana	Ubivivo Energy	Ubivivo is a next-generation analytics and forecasting platform.We cover environmental and socio-economic variables, which are measured through a wide range of airborne and ground-based servers. These particularly build on the use of AI/ML and HPC techniques. This holistic approach provides for excellent situational awareness and forecasts (Digital Twin),characterised by: better accuracy and high spatial granularity, multiple time scales - from nowcasting, short-term, seasonal to decadal projections, global geographical coverage, minimal refreshing periods and low latency.	One of our flagship data products (DaaS) is solar power and price forecasting for the short- to long-term perspective. On shorter-term scales, from the next 2 hours to 8 days, we do accurate predictions by fusing satellite imagery, NWP and solar power data. The forecasts are provided with a high spatial resolution (5 km2), temporal resolution of 15 minutes and at low latency - updated within 15 minutes. We complement it with climate forecasts on solar radiation and other environmental variables at the sub-seasonal, seasonal and longer-term time scales, at a 10 km2 res.	By focusing on our energy offer, accurate simulations would allow public authorities and citizens to maximise the use of renewable energy and lower costs - in the short- and long-term. The following areas directly benefit from the solutions: Planning; Energy communities; Grid stability; Pricing; Competitiveness of the European renewables industry.	Local IoT data can be used to further improve accuracy, however, with incremental improvements - the current solutions already does the job.

#	Organisation	Country	City	Name of Service	Company Description	Service Description	Use in Adaptation or Mitigation Action	Data Needs
113	Undersee	Portugal	Coimbra	Undersee	UNDERSEE enables environmental agencies and oceanographic researchers to calibrate and validate EOD products and ocean models under a simple data subscription. We use vessels with routes in the clients area of interest to collect near surface water quality data with our state of the art monitoring instrumentation (Undersee FerryBox). To connect our clients projects with end users as aquaculture companies, ports and municipalities, we launch Undersee forecast a dashboard to access EOD and forecast models in the same way check the weather forecast. Our mission is to facilitate the access of data.	Our approach is to use vessels that are in our clients area of interest and use them as a monitoring platform for near surface ocean monitoring. To do this, we developed a smart water quality monitoring instrument that enables any vessel to become a ocean monitoring platform. Combined with our data as a service business model Undersee provides a unique service with 4 times less cost per campaign compared to traditional instrumentation. Our clients are environmental institutions and oceanographic researchers.	Data is the foundation of knowledge. With more and accurate data, oceanography and climate researchers can provide better insights to public authorities and measure the impact of their mitigation actions.	New sensor technologies to measure pCO2 in marine environments.
114	Uptoearth GmbH	Germany	Darmstadt	CORE	UptoEarth is a Start-up with the goal of creating economic gain for farmers, through the storage of carbon in the soil. UptoEarth provides consultancy and develops hardware and software for services in the areas of aerospace, earth observation, agriculture, environmental protection and smart city. Aware that there is no Planet B, UptoEarth aims at providing effective solutions to mitigate and reverse Climate Change effects and promoting more sustainable approaches and practices. Uptoearth mission is to image the entire Earth every day and make global change visible, accessible, and actionable.	Our service proposes to create an index, called the SCENARIO Index, to facilitate understanding, discussion, setting ambitions and investments for soil carbon protection and restoration. The service will use satellite data to create a method or performance parameter that will allow us to look at historical carbon losses, visualise projections of soil carbon storage in the present, and make choices to pursue sustainable management or soil restoration in the future.	Our service can assist public authorities in climate adaptation and mitigation actions by providing them with a tool to better understand the potential for carbon storage in their regions. This will help policymakers set ambitious targets to maintain and increase the amount of carbon in the ground, which is a key part of mitigating climate change. The SCENARIO Index can also help public authorities align agricultural subsidies to the purpose of soil carbon protection and restoration, which can encourage farmers to adopt sustainable management practices.	To improve the service, it may be helpful to have access to more high-quality (SAR-Hyperspectral) satellite data, particularly data that can provide more detailed information about soil characteristics, such as soil texture, organic matter content, and other factors that can influence soil carbon storage. In addition, ground-truth data, such as measurements of soil carbon levels, can help validate the accuracy of the satellite-derived information and improve the overall quality of the service.
115	VisioTerra	France	Champs-sur-Marne	MONA	Founded in May 2004, VisioTerra is oriented towards Science Consulting for Earth Observation. This includes not only expert support, training and communication for EO programs, technical studies, geoservices, software development of applications using virtual globes, scientific documentation editing, quality control assessment and reporting, instruments and products verification/control, new products and instruments specification and prototyping, audits, but also production of cartographic products to be ingested by GIS.	The FLEGT Watch project was initiated in 2016 to monitor logging and monitor deforestation by independent observers. Surveillance is carried out in near real time (NRT) by automatically analyzing Sentinel-1 radar images when satellites pass over one of the 186 areas located in 7 Central and West African countries representing more than 45 million hectares. Automated remote sensing techniques have been improved by Machine Learning methods in a CAFWS project under the GMES & Africa program. Active fires and burned areas are also detected from Sentinel-2 optical satellites.	Deforestation has a direct impact on the abundance of GHG. It is essential to monitor forests and their degradation. Conversely, the results of reforestation works, tree planting and protection of areas shall be evaluated in order to measure their effectiveness. We developed and continues to work on soil degradation indicators. We work in collaboration with several organizations dependent on the Ministries of Water, Forests and Sustainable Environment. They are presented with climate change forecasts in their country, showing the evolution of precipitation, night and daytime temperatures from 1950 to 2100.	Data with a spatial resolution better than 3 metres: (1) Radar high-resolution images (TerraSAR-X, ICEye) (2) Optical high-resolution images (Planet, NEMO-HD, WorldView).
116	VisioTerra	France	Champs-sur-Marne	MISBAR	Founded in May 2004, VisioTerra is oriented towards Science Consulting for Earth Observation. This includes not only expert support, training and communication for EO programs, technical studies, geoservices, software development of applications using virtual globes, scientific documentation editing, quality control assessment and reporting, instruments and products verification/control, new products and instruments specification and prototyping, audits, but also production of cartographic products to be ingested by GIS.	VisioTerra assisted the Moroccan company AfEOS for the supply of a geoservices platform dedicated to seasonal agriculture and irrigation. A data center has been installed in Tunis in the premises of the consortium's leading OSS. MISBAR calculates several indices of vegetation, foliage, surface humidity, free water, soil degradation to provide dashboards and periodic bulletins. Geoservices are triggered automatically in near real-time whenever a Sentinel-2 satellite passes over user-defined areas of interest.	Public authorities can use MISBAR to map agricultural activity every 5 to 10 days on a set of plots, at the level of a province or even the country. These authorities can monitor water use by comparing MISBAR indicators with the volumes of water that have been allocated to farmers. MISBAR can be used to detect soil degradation as well as soil restoration efforts.	In-situ data that are mandatory to develop a crop yield forecasting model.
117	vorteX.io	France	Toulouse	PROTECT	vorteX.io provides water intelligence, everywhere, anytime. The goal of the company is to set up digital twins of the whole rivers at risk for floods and droughts and thus improve worldwide our knowledge concerning water resources management and our resilience to natural disasters.	vorteX.io is setting up the widest hydro-meteorological database, based on the large-scale deployment of smart and innovative instruments inherited from space altimetry. vorteX. io provides added-value products and services for hydrology with a large number of applications, from prevention of populations from flood and droughts risks to real time water resources management. This is made possible thanks to the unique combination of satellite remote sensing Earth observations and the vorteX.io in-situ constellation over the rivers.	The vorteX.io micro-station service is a scalable early warning system for flood risk to prevent populations from such extreme events and secure goods.	API for the whole hydrological European database over rivers.
118	vorteX.io	France	Toulouse	VorteX.io Micro-station Service	vorteX.io provides water intelligence, everywhere, anytime. The goal of the company is to set up digital twins of the whole rivers at risk for floods and droughts and thus improve worldwide our knowledge concerning water resources management and our resilience to natural disasters.	vorteX.io offers an innovative and intelligent service for monitoring hydrological surfaces, using in-situ remote sensing instruments based on compact space-based altimeter. It provides in real time, with high frequency and accuracy, hydrological parameters of the observed watercourses. The light altimeter developed is composed of a processor, a positioning system, an attitude sensor, a transmission beacon, a LiDAR solution, and a smartphone-like camera and a battery. This is optimal for services related to the water big cycle: water resources management, flood/drought risks.	The vorteX.io Micro-station Service answers the need for a precise, scalable, and digitalized hydrological database to provide water parameters, anytime, anywhere. With the vorteX.io turnkey service, our customers gains are: access to a large dataset of high-quality in-situ measurements points (real-time but also historical data); homogeneity and quality of the data thanks to micro-stations (technology transfer from space sensor onboard Earth observation satellites); pay-on-demand commitment thanks to a non-binding service.	New space missions like SWOT or Sentinel-3 Next Generation missions will help answering market needs thanks to the complementarity between space and in-situ technologies and the creation of added-value downstream services for creating digital twins of all watercourses in Europe and worldwide.
119	VTT Technical Research Centre of Finland	Finland	Espoo	F-TEP forest carbon monitoring	VTT is one of Europe's leading research institutions, owned by the Finnish state. VTT advances the utilisation and commercialisation of research and technology in commerce and society. Through scientific and technological means, VTT turns large global challenges into sustainable growth for businesses and society, bringing together people, business, science and technology to solve the biggest challenges of our time. This is how VTT creates sustainable growth, jobs and wellbeing and bring exponential hope.	Carbon storage and flux services provide information about biomass, carbon, and primary production and their development over time. Growing stock volume increment and primary production development can also be forecast for a selected time period.	The services give timely information on the state of forest resources, carbon and their development over time. They thus improve the profitability of forestry and information on the value of forest asset while help ensuring its ecological sustainability.	Forestry field data.
120	VTT Technical Research Centre of Finland	Finland	Espoo	F-TEP "Probability" forest variable estimation	VTT is one of Europe's leading research institutions, owned by the Finnish state. VTT advances the utilisation and commercialisation of research and technology in commerce and society. Through scientific and technological means, VTT turns large global challenges into sustainable growth for businesses and society, bringing together people, business, science and technology to solve the biggest challenges of our time. This is how VTT creates sustainable growth, jobs and wellbeing and bring exponential hope.	Forest structural variable services provide information on forest area and forest status and their changes. The inventory services concern one target year, the monitoring services several years and changes between the years.	The services are driven by sustainable forest management, EU forest strategy, the Bioeconomy Action Plan, and the demands of environmentally aware end-users of wood industry products.	Forest field data.
121	VTT Technical Research Centre of Finland	Finland	Espoo	F-TEP Autochange	VTT is one of Europe's leading research institutions, owned by the Finnish state. VTT advances the utilisation and commercialisation of research and technology in commerce and society. Through scientific and technological means, VTT turns large global challenges into sustainable growth for businesses and society, bringing together people, business, science and technology to solve the biggest challenges of our time. This is how VTT creates sustainable growth, jobs and wellbeing and bring exponential hope.	Change detection between two multispectral images from (preferably) the same satellite system; based on VTT-developed AutoChange methodology, which utilizes K-means clustering and subdivision of clusters of the first image.	The services are driven by sustainable forest management, EU forest strategy, the Bioeconomy Action Plan, and the demands of environmentally aware end-users of wood industry products.	Forest field data.

#	Organisation	Country	City	Name of Service	Company Description	Service Description	Use in Adaptation or Mitigation Action	Data Needs
122	WaltR	France	Toulouse	Global Emission Monitoring from Space (GEMS)	Founded in 2018, WaltR is a startup that exploits EO expertise, as well as a patented technologies that enable the precise mapping of gaseous and particulate pollutant emissions from a city, an industrial site, intensive agriculture activities, airport or port infrastructures, etc. WaltR's mission-driven services aim to contribute directly to the environmental transition (climate) and to the improvement of air quality (health). Our expertise in Deep-tech applied to space and ground imagery is aimed at customers that wish to control and reduce their environmental impact.	GEMS is a space-based downstream service targeting to provide Air Pollutants and GHG detection, identification, and monitoring (DIM) including hotspots and diffuse sources. The service value chain consists of: a "back office" that is based on trustworthy space Copernicus EO data, and scientific grounded algorithms; a "front-office" that is implemented through a webservice that provides an easy to use, interactive access to processed final emission data of the mentioned pollutants, as well as key indicators.	This service answers different challenges identified from our B2G customers: timeliness & accuracy gap of emission data; high-resolution mapping updated on a regular basis; cost-effective MRV to get payback from emission reduction; simulate policy options; transparent methodologies and algorithms - no more black-box!; all GHG and air pollutant matters as climate and air quality issues are interlinked.	Future missions with better global coverage (visiting time, area, gaps, etc) as well as improved resolution of monitoring instruments will improve the service greatly and will foster the development of solutions that will fit the needs of wider markets and sectors.
123	WASDI sàrl	Luxembourg	Dudelange	Floods	WASDI is a startup that offers services in Remote Sensing using it's homonymous cloud platform. WASDI is an enabling technology that helps experts in Earth Observation turn their algorithms in applications in the cloud, removing the IT-related obstacles, so that the professionals can concentrate their time and resources on developing meaningful and valuable processors. On top of this technology, WASDI and its partners tackled several projects, in the topics of floods, wildfires, air and water pollution, thanks to several applications developed in house or by the value-adders that use the platform.	Floods extent and depth: monitoring or mapping on demand using Sentinel-1 and Sentinel-2. Available also in urban areas.	1) Daily monitoring: the countries can adopt a parametric insurance model of the financial risks associated with floods, as in the Seadrif initiative; 2) on demand mapping supports planning the humanitarian interventions. It also allows damage assessment; 3) historical archives of observed floods allow a more precise risk estimation.	1) Ground truth would allow a more extensive adoption of AI-based models 2) ancillary data, especially about builtup and the role of the buildings (schools, homes).
124	WASDI sàrl	Luxembourg	Dudelange	Wildfires	WASDI is a startup that offers services in Remote Sensing using it's homonymous cloud platform. WASDI is an enabling technology that helps experts in Earth Observation turn their algorithms in applications in the cloud, removing the IT-related obstacles, so that the professionals can concentrate their time and resources on developing meaningful and valuable processors. On top of this technology, WASDI and its partners tackled several projects, in the topics of floods, wildfires, air and water pollution, thanks to several applications developed in house or by the value-adders that use the platform.	Active fire mapping and burned areas mapping.	In the short term, active fire detection allows to design operations, and burned areas allow for damage assessment. In the mid term, satellite data can be fed to fire risk models to have higher resolution and accuracy. We have an active research line on this topic. In the long term, historical archives allow to train AI models to reverse engineer fires and improve the risk mapping.	1) in-situ measurements 2) ground truth (e.g. datasets of controlled burns).
125	WASDI sàrl	Luxembourg	Dudelange	Urban monitoring	WASDI is a startup that offers services in Remote Sensing using it's homonymous cloud platform. WASDI is an enabling technology that helps experts in Earth Observation turn their algorithms in applications in the cloud, removing the IT-related obstacles, so that the professionals can concentrate their time and resources on developing meaningful and valuable processors. On top of this technology, WASDI and its partners tackled several projects, in the topics of floods, wildfires, air and water pollution, thanks to several applications developed in house or by the value-adders that use the platform.	WASDI has a suite of applications for air quality and liveability of cities, deriving from previous initiatives: 1. downscaling of air quality data; 2. urban areas mapping: this is the scope of an ongoing project using VHR data to assess changes and vulnerabilities; 3. thermal performance of cities: this is at an earlier stage, but we are exploring the usage of AI4EO to address heat stress and energy efficiency of cities.	Having a better knowledge of the state and behaviour of the cities allows for better management (especially with short term measures) and mid and long term planning (e.g., optimize the design nature-based solutions).	In-situ measurements and ground truth.
126	Water Insight	Netherlands	Ede	EOMORES	Water Insight (WI) is an expert in innovative high quality water quality monitoring with in situ with scanners and based on satellite data. WI is well-known for its satellite data processing for water quality purposes. At the same time, WI develops its own in situ water quality scanners, such as the WISPstation. A WISPstation measures important parameters such as chlorophyll, suspended matter, transparency and cyanobacteria presence real-time and semi continuously, and also serve the validation of satellite based maps.	Water quality monitoring based on satellite data provides much more insight in patterns or processes that are going on than traditional point measurements, while the service costs are smaller and does not cause CO2 as shipping for traditional sampling needs. For parameters which cannot be sampled by satellite, the satellite based maps help to provide representative locations within the area. Therefore, we combine the satellite-based monitoring services with in situ optical monitoring with WISPstations.	Public authorities need to adjust regulations for the use of ecosystem services based on the new patterns and protect the ecosystem. For example, the allowed locations for aquaculture might need to adjust to food availability, while protected sea areas require space too. Their traditional monitoring networks are often not suitable to provide the necessary information, spatially, with a high enough frequency and in time. Our services help them with providing such services, which also provide a 'back in time' option based on historic satellite data.	High resolution data with more spectral bands.
127	Water Insight	Netherlands	Ede	HAB early warning	Water Insight (WI) is an expert in innovative high quality water quality monitoring with in situ with scanners and based on satellite data. WI is well-known for its satellite data processing for water quality purposes. At the same time, WI develops its own in situ water quality scanners, such as the WISPstation. A WISPstation measures important parameters such as chlorophyll, suspended matter, transparency and cyanobacteria presence real-time and semi continuously, and also serve the validation of satellite based maps.	Climate change and eutrophication increase the number of reported Harmful Algae Blooms (HABs). Satellite data are used to trace upwelling events; when these are followed by high phytoplankton biomass there is a large change of a HAB. By noticing these on larger distances from the aquaculture farmer, the farmers can be warned in time that a potentially dangerous bloom is approaching, allowing them to take mitigation measures.	It assists aquaculture farmers to take mitigation measures. They can e.g. harvest their shell fish before the HAB arrives. This saves their harvest, since shellfish are not suitable for human consumption when they have ingested algae toxines (only after passing by of the HAB they are edible again, which might take weeks).	Higher resolution optical satellites with more spectral bands and daily overpass.
128	WEENAV	France	Bondues	Safe Return to Base	Weenav transforms thermal boats into electric or hybrid ones with Safe Return to Base. We adapt to all types of boats, from sailboats to shuttles. Our Safe Return to Base application ensures safe autonomy at sea through real-time satellite data. There is no reason to fear electricity at sea anymore. For thermal boats, intelligent routing suggestions via satellite can reduce consumption by more than 30%.	The main feature is a system that limits the boat's capacity based on the time remaining to return safely to the nearest charging point. Our system will incorporate artificial intelligence that will calculate the safest route back to the charging station. Thanks to real-time satellite data, this will allow us to create navigation routing that uses marine currents, which can reduce their consumption by up to 30%.	Consumption reduction for thermal boats. Incentives to switch to electric.	Ocean currents, swell, tides, wave height, wind, etc.
129	WEO SAS	Luxembourg	Luxembourg	GreenMonitor	WEO seeks to disrupt the status quo by leveraging openly available data and deep learning algorithms to provide an API to access environmental analytics through maps and indicators allowing clients such as municipalities to anticipate climate change impacts by greening the streets and city spaces. The company provides key metrics that help to identify where the risks of flood and heat waves are located.	WEO is developing an integrated platform for monitoring blue and green infrastructure to tackle climate change and increase the liveability of our cities. WEO utilise the European Space Agencies Copernicus Satellite mission data as our primary base data. WEO has invested to create sophisticated deep and machine learning models trained on centimetre resolution aerial-based data to provide regular updates at an affordable price. Our products range from TRL of 3 – 7.	We provide satellite and machine learning driven analytics for city authorities and private industry to manage urban green – street trees, parks and vegetation near critical infrastructure. Cities are provided with near real-information in medium to high resolution. We have worked with several municipalities where we identify hot spots in their neighborhoods in order justify budgets for greening or other solutions for cooling down these areas.	We are lacking higher spectral resolution which would help to improve our products greatly. We know there are high spectral resolutions which can be commissioned but these are very costly and thus the end products are not affordable to our clients at the regularity that they require (at least once per year, but mostly seasonally or monthly). We are also requiring sensors that can get the depth information (e.g. penetrating through the TOA) so that we can more easily extract the height of trees for example without having to rely on expensive LIDAR technology.

ANNEX VII Review and analysis of Member States' innovation procurement legal frameworks (T1.4)

PROCURING INNOVATIVE CLIMATE CHANGE SERVICES

Task 1.4. Review and analysis of Member States' innovation procurement legal frameworks

CORVERS PROCUREMENT
SERVICES B.V.

August 2023

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

This report covers the analysis of 11 EU Member States' innovation procurement legal frameworks in force when the study was conducted and validated at the High-level Conference of PROTECT in November 2022.

The PROTECT Consortium intended to update this document to include an additional country. However, no additional EU Member State was included in the analysis based on the input received, as the potential lead procurers in the context of PROTECT come from the countries already analysed.

Additionally, a new EC benchmarking of innovation procurement investments and policy frameworks across Europe is ongoing. The country profiles will be updated by the new study.

Nevertheless, given that the new Italian public procurement law entered in force on April 2023, a general overview of the new legal framework in Italy has been provided, in addition to the analysis performed to the previous legal framework to compare the differences.

August 2023

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1. Introduction

Work Package 1 of the PROTECT project aims to provide a cross-cutting analysis to assess demand drivers and barriers with the purpose to prepare the future implementation a Pre-Commercial Procurement of climate change services, and entails the following activities:

1. A review of relevant legislation for climate and upcoming requirements for climate change adaptation and mitigation that will drive the demand.
2. **An overview of EU Member States' enabling framework for Innovation Procurement, focussing on Pre-commercial Procurement (PCP).**
3. A taxonomy of Climate Service (CS) understandable for Public Procurement (PP) professionals.
4. An updated State-Of-The-Art (SOTA) analysis of current and upcoming EU CS supply side.
5. An overview of main climate challenges and unmet needs for CS.

The output of these activities will provide a snapshot of the "lay of the land" of the demand and supply of Climate Change services, as a basis to identify common needs and regulatory conditions to be complied with.

Task 1.4 focuses on point 2 above and provides an overview and analysis of the Member States (MS)' procurement legal and regulatory frameworks that provides a base line to identify the most friendly and conducive innovation procurement frameworks that would enable upcoming PCPs.

In this regard, it is important to note that this report – even though PCP is exempted from its scope - takes as a baseline the EU Public procurement Directives from 2014:[1]

- Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC.
- Directive 2014/25/EU of the European Parliament and of the Council of 26 February 2014 on procurement by entities operating in the water, energy, transport and postal services sectors and repealing Directive 2004/17/EC.
- Directive 2014/23/EU of the European Parliament and of the Council of 26 February 2014 on the award of concession contracts.

And their transposition to the national laws of the selected Member States.

[1] Please note that Public Procurement Directives exclude from their scope the purchase of R&D services under certain conditions (i.e., PCP). This exclusion is actually on the basis of the exclusion made by the General Procurement Agreement of the World Trade Organization. As PCP is excluded from these two regulations, public authorities, contracting authorities/entities may (but are not mandated to) exclude participants that are not European Members States or have signed a Trade Agreement including PCP. In practical terms this translates to more R&D developments in Europe, which fosters European companies, resilience and autonomy. It also means that the subaward criteria and its weighting can be modified during the different phases of a PCP, so that the final solution fulfills the public buyers' needs.

Nevertheless, PCP must always comply with the principles of the TFEU: transparency, equal treatment, non-discrimination and proportionality. Moreover, in 2007 the EU Commission published a communication explaining what is PCP and how it should be implemented: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0799:FIN:EN:PDF

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2. Acronyms

AgID - Agency for Digital Italy

AQuAS - Catalonian Agency for Health Quality and Evaluation

ANAC - National Anti-Corruption Authority in Italy

AVI - Valencian Agency for Innovation

BMWK - Federal Ministry for Economic Affairs and Climate Action in Germany

BAAINB – Federal Office of Bundeswehr Equipment, Information, Technology and In-Service Support in Germany

BAM – Federal Institute for Materials Research and Testing in Germany

BeschA - Federal Procurement Office of the Ministry of Interior in Germany

BFD Südwest - Federal Financial Directorate Southwest in Germany

CDTI - Center for Industrial Technological Development in Spain

COAR - Government Administration Service Centre in Poland

CPB – Central Purchasing Body

CPO - Central Purchasing Organisation

CPV – Common Procurement Vocabulary

CS - Climate Service

EU – European Union

GAIN - Galician Innovation Agency

ICT - Information and Communication Technologies

IACS - Aragonese Institute for Health Sciences

IPR – Intellectual property Right

KEINO – Competence Centre for Sustainable and Innovative Public Procurement in Finland

KOINNO - Competence Centre for Innovative Procurement in Germany

LVPA - The Lithuanian Business Support Agency

NCBR - National Centre for Research and Development in Poland

MS – Member State

MEAE - Ministry of Economic Affairs and Employment of Finland

MITA - Agency for Science, Innovation and Technology in Lithuania

OCPI - Innovative Public Procurement Office in Spain

OCSE - Organization for Security and Co-Operation in Europe

PARP - Polish Agency for Entrepreneurship Development

PCP - Pre-commercial Procurement

PIO - Programme for Innovation Procurement

PMC – Preliminary Market Consultation

PP - Public Procurement

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PPI – Public Procurement of Innovative solutions

PPL - amended Public Procurement Law in Poland

PPO - Public Procurement Office

SYKE -Finnish Environment Institute

SME – Small and Medium Entreprise

SOTA - State-Of-The-Art

R&D – Research&Development

UGAP - Union of Public Purchasing Groups in France

UVO - Public Procurement Office in Slovakia

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3. Methodology

In order to assess the procurement legal framework, the first step was to do a pre-selection of the countries to be analysed. The selection was based on: (i) the relative weight of the country's economy in Europe; (ii) its positive predisposition towards Innovation Procurement; and (iii) the participation in the consortium of a partner belonging to the Member State.

Consequently, the countries selected to be assessed in this report are:

1. Belgium
2. Finland
3. France
4. Germany
5. Greece
6. Italy
7. Lithuania
8. Netherlands
9. Poland
10. Slovakia
11. Spain

The methodology comprised the following steps:

1. Firstly, a desk research was conducted to identify and assess existing regulations, policies, and practices related to Innovation Procurement (and in particular to PCP).
2. This desk research was complemented by input from relevant actors in the PROTECT-CSA consortium and a questionnaire aimed at gathering additional information and identifying potential legislative obstacles to the implementation of a PCP.
3. The questionnaire was translated into several languages – the languages of the selected countries - to maximise the response rate.
4. The networks of the partners, as well as other procurers, Public Procurement national contact points and Public Procurement competence centres were reached out in order to have an accurate and complete overview of each of the procurement legal frameworks and their inclination towards innovation.
5. Finally, the findings were validated during the high-level conference the 17th of November and during the online workshops in January. Additional information was gathered from procurers attending the conference and the workshops.

This report includes the outcomes of all these steps and concludes on the most innovation friendly legal frameworks of the ten countries assessed.

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4. Analysis of the selected legal frameworks

In this section, the legal framework of the selected Member States will be analysed based on the desk research performed and complemented with the received responses to the translated questionnaire. This will help to identify the most favourable legal frameworks for a potential subsequent PCP.

In the wake of the invasion of Ukraine, the European Union has imposed a set of restrictive measures (sanctions) against Russia. At the time of writing this paper – 10/10/2022 - there is a general restriction to award (or continue the execution of) public contracts and concessions above EU thresholds to the following entities:

(a) Russian nationals, or natural or legal persons, entities or bodies established in Russia.

(b) Legal persons, entities or bodies whose proprietary rights are directly or indirectly owned for more than 50 % by an entity referred to in the previous point.

(c) Natural or legal persons, entities or bodies acting on behalf or at the direction of one of the above-mentioned entities.

These three scenarios include subcontractors, suppliers or entities whose capacities are being relied on within the meaning of the public procurement Directives, where they account for more than 10 % of the contract value. This is a barrier faced by all the EU Member States analysed in this paper.

For more information see Council Regulation (EU) No 833/2014 of 31 July 2014 concerning restrictive measures in view of Russia's actions destabilising the situation in Ukraine.

4.1. Belgium

Innovation Procurement legal framework

The *Loi relative aux marchés publics*, in force since June 17th, 2016, regulates public procurement in Belgium. This law, which transposes into national legislation all the EU public procurement Directives[2], defines innovation in Art. 2(32), but does not define Innovation Procurement, PCP or PPI.[3] However, Article 32 of the *Loi relative aux marchés publics* (*services de recherche et de développement*) excludes the purchase of R&D services of its scope, giving a clear basis for PCP.[4]

[2] Directive 2014/24/EU, Directive 2014/25/EU, Directive 2014/23/EU and Directive 2009/81/EC.

[3] The Flemish Programme for Innovation Procurement (PIP), defines Innovation Procurement, R&D, PCP and PPI according to the official EU definition, but the definitions are applicable at regional level. See here for more information: https://www.innovatieveoverheidsopdrachten.be/en/about-pip/what-innovation-procurement

[4] «*Ne sont pas soumis à l'application de la présente loi, les marchés de services de recherche et de développement. La loi est par contre applicable aux marchés de services de recherche et de développement relevant des codes CPV 73000000-2 à 73120000-9, 73300000-5, 73420000-2 et 73430000-5, pour autant que les deux conditions suivantes soient réunies: 1° leurs fruits appartiennent exclusivement au pouvoir adjudicateur pour son usage dans l'exercice de sa propre activité; et 2° la prestation de services est entièrement rémunérée par le pouvoir adjudicateur*». For more information see here.

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Art 32 defines that the Act is only applicable to public service contracts for "*research and development services which are covered by CPV codes 73000000-2 to 73120000-9, 73300000-5, 73420000-2 and 73430000-5 provided that both of the following conditions are fulfilled: (a) the benefits accrue exclusively to the contracting authority for its use in the conduct of its own affairs, and (b) the service provided is wholly remunerated by the contracting authority*."

Art 108(4) of the Belgian Public Procurement Act states that the exclusion for public procurements of R&D services that do not meet the two conditions above, simultaneously applies to all types of public procurers in Belgium, thereby providing a clear legal basis for all types of public procurers in Belgium to implement PCP.[5]

The *Loi relative aux marchés publics* also regulates Preliminary Market Consultations, stating the necessity of assuring transparency and competion. It also states how a public procurer should act when an economic operator has taken part in the Preliminary Market Consultation and afterwards submits a tender.[6]

When it comes to subcontracting, the exclusion of subcontractors and the limitation of subcontracting in certain fields is only possible based on additional regulations issued by the king.[7]

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[5] ***Exclusions applicables à toutes les entités adjudicatrices. Art. 108 (4).*** *Sont applicables aux marchés publics visés par le présent titre, les exclusions suivantes: (…) 4° l'article 32 concernant les services de recherche et de développement.*

[6] ***Consultations préalables du marché. Art. 51****.*

Avant d'entamer une procédure de passation de marché, le pouvoir adjudicateur peut réaliser des consultations du marché en vue de préparer la passation du marché et d'informer les opérateurs économiques de ses projets et de ses exigences.

A cette fin, le pouvoir adjudicateur peut, par exemple, demander ou accepter l'avis d'experts indépendants, d'organismes publics ou privés ou d'acteurs du marché.

Les consultations préalables peuvent être utilisées pour la planification et le déroulement de la procédure de passation, à condition qu'elles n'aient pas pour effet de fausser la concurrence et d'entraîner une violation des principes de non-discrimination et de transparence.

Participation préalable de candidats ou de soumissionnaires. Art. 52.

§ 1er. Lorsqu'un candidat ou soumissionnaire, ou une entreprise liée à un candidat ou à un soumissionnaire, a donné son avis au pouvoir adjudicateur, que ce soit ou non dans le cadre de l'article 51, ou a participé d'une autre façon à la préparation de la procédure de passation, le pouvoir adjudicateur prend des mesures appropriées pour veiller à ce que la concurrence ne soit pas faussée par la participation de ce candidat ou soumissionnaire. Lesdites mesures doivent, pour les marchés dont le montant est égal ou supérieur aux seuils correspondants fixés pour la publicité européenne, être consignées dans les informations visées à l'article 164, §§ 1er ou 2.

Ces mesures consistent notamment à communiquer aux autres candidats et soumissionnaires des informations utiles échangées dans le contexte de la participation du candidat ou soumissionnaire susmentionné à la préparation de la procédure, ou résultant de cette participation et à fixer des délais adéquats pour la réception des offres. (…)

§ 2. Le candidat ou soumissionnaire concerné n'est exclu de la procédure que s'il n'existe pas d'autres moyens d'assurer le respect du principe de l'égalité de traitement. Toutefois, avant de pouvoir être exclu, le candidat ou soumissionnaire reçoit la possibilité de prouver au moyen d'une justification écrite, que sa participation préalable n'est pas susceptible de fausser la concurrence.

[7] ***Délégation au Roi relative à la fixation des règles générales d'exécution Art. 86.***

Le Roi fixe les règles générales d'exécution pour les marchés publics, en ce compris les règles relatives à la sous-traitance et au contrôle, pour les marchés à déterminer par Lui, de l'absence de motifs d'exclusion dans le chef des sous-traitants ainsi que les dispositions relatives à la fin du marché.

En matière de sous-traitance, le Roi peut, pour les marchés à déterminer par Lui, limiter la chaîne de sous-traitants, conformément aux règles à déterminer par Lui.

Le Roi peut également conformément aux règles à déterminer par Lui :

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The Belgian legislation defines a default regime for the allocation of Intellectual property Rights (IPRs): contractors must retain the ownership of the IPR associated to the solution they develop and in exchange of the price paid, the public authority, contracting authority/entity, receives a license to use the solution. This means that *ex lege,* the ownership of the IPRs is automatically allocated to the contractors, unless the tender documents say otherwise, which the law discourages.[8]

According to the Belgian copyright act[9], copyrights (moral rights) cannot be transferred to another party (the procurer), even when the creator is commissioned by the procurer (as contractor) or employed (e.g. by a subcontractor) to work on the procurement contract. To use the copyright protected work, the procurer must require in the tender specifications the transfer, assignment or a license of the economic rights (e.g. usage, licensing, publication, modification, reproduction rights) at equitable payment. Copyright protects also scientific work (product designs, product specifications, tests etc.), computer programmes and databases.

Belgium is a federal state with decentralised authority shared among the central government and the three regions: Wallonia, Flanders, and the Brussels-Capital Region. PP is regulated at the federal level by the procurement law, and each region has a certain level of flexibility for interpreting and implementing the legislation.

The Federal Public Service Chancellery of the Prime Minister is the entity responsible for the preparation, coordination, and monitoring of the public procurement legislation. The Chancellery acts as a secretariat of the Commission for PP which is a specialised advisory body composed of

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1° étendre la vérification de l'absence de motifs d'exclusion dans le chef des sous-traitants visée à l'alinéa 1er à la procédure de passation;

2° pour les marchés de travaux à déterminer par Lui, étendre l'agréation comme entrepreneur conformément à la loi du 20 mars 1991 organisant l'agréation d'entrepreneurs de travaux et ses arrêtés d'exécution à tous les sous-traitants de la chaîne."

[8] ***Spécifications techniques. Art. 53.***

§ 1er. (…) Les spécifications techniques peuvent préciser si le transfert des droits de propriété intellectuelle sera exigé.

This is a very vague disposition, but the *Arrêté royal du 14 janvier 2013 établissant les règles générales d'exécution des marchés publics* goes into detail in its ***Article 19. Utilisation des résultats***

*§ 1er. Sauf disposition contraire dans les documents du marché**, l'adjudicateur n'acquiert pas des droits de propriété intellectuelle nés, mis au point ou utilisés à l'occasion de l'exécution du marché**. (…)*

Lorsque l'adjudicateur n'acquiert pas les droits de propriété intellectuelle, il obtient une licence d'exploitation des résultats protégés par le droit de la propriété intellectuelle pour les modes d'exploitation mentionnés dans les documents du marché.

L'adjudicateur énumère dans les documents du marché les modes d'exploitation pour lesquels il entend obtenir

une licence.

*§ 2. Les droits de propriété intellectuelle nés, mis au point ou utilisés à l'occasion de l'exécution du marché ne peuvent être opposés à l'adjudicateur pour l'utilisation des résultats du marché**. Il appartient à l'adjudicataire d'entreprendre les démarches nécessaires auprès des tiers pour en obtenir les droits d'exploitation et autorisations nécessaires à la licence d'exploitation.** (…)*

§ 4. Les conditions d'une utilisation commerciale ou autre, par l'adjudicataire, des informations générales sur l'existence du marché et sur les résultats obtenus sont précisées dans les documents du marché.

§ 5. Si les documents du marché prévoient la participation de l'adjudicateur au financement de la recherche et du développement liés à l'objet du marché, ils peuvent préciser les modalités de la rémunération due à l'adjudicateur en cas d'utilisation des résultats par l'adjudicataire.

Find here the full document: https://europam.eu/data/mechanisms/PP/PP%20Laws/Belgium/10.%20Royal%20Decree%20of%2014%20January%202013_FRA,%20consolidated,%20last%20amended%202018.pdf

[9] Find here the full document: https://wipolex.wipo.int/en/text/125150

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representatives from the federal authority, federated entities, public corporations, supervision bodies, and representatives of businesses and trade unions.[10]

Although there is no national policy to stimulate PCP, nor a spending target for Innovation Procurement, at regional level, the Flemish region, has adopted a Programme for Innovation Procurement (PIO) to finance Innovation Procurement projects, support local authorities and rise competences. PIO clearly defines Innovation Procurement, PCP as well as PPI, and includes an action plan with expected results, spending target, clear timeline and budget. Since 2018, the Brussels region has also started to launch its first Innovation Procurements.

At local level, the cities of Ghent and Antwerp have set a spending target for Innovation Procurement.[11]

Joint Procurement legal framework

Joint procurement is expressly regulated in the Belgian legislation, not only at national level, but also at international level. Moreover, it can be institutionalized, as well as occasional joint cross border

[10] Find here more information: https://www.belgium.be/en/about_belgium/government/federal_authorities/federal_and_planning_public_services

[11] 10% of their ICT public procurement budget.

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procurement.[12] It is important to note that in Belgium there is a CPB: the Central Procurement Body for the Federal Services (CMS-FOR).[13]

Concluding remarks

The *Loi relative aux marchés publics* – even if it does not define Innovation procurement, nor its two modalities - clearly excludes R&D procurement from its scope of application. This would facilitate the uptake of a PCP project. Moreover, cross border joint procurement is expressly regulated which also gives a legal ground for an EU cross border PCP.

Belgium has certain inclination for Innovation Procurement. Nevertheless, the most active in this field is the Flemish region, followed by the Brussels region and the cities of Ghent and Antwerp.

The default IPR regime favors innovation on the supply side and the use of Preliminary Market Consultations is regulated in the national law transposing the Directives, and these are widely used.

[12] ***Marchés auxquels participent des pouvoirs adjudicateurs de différents Etats membres. Art. 49.***

§ 1er. Sans préjudice des articles 30 et 31, les pouvoirs adjudicateurs de différents Etats membres peuvent conjointement passer un marché public, recourir à des activités d'achats centralisées proposées par des centrales d'achat situées dans un autre Etat membre, conclure un accord-cadre, mettre en place un système d'acquisition dynamique ou établir une entité conjointe. Ils peuvent également, dans les limites fixées à l'article 43, § 1er, alinéa 2, passer des marchés sur la base d'un accord-cadre ou d'un système d'acquisition dynamique.

Les pouvoirs adjudicateurs ne recourent pas aux moyens prévus à l'alinéa 1er dans le but de se soustraire à l'application de dispositions obligatoires de droit public conformes au droit de l'Union auxquelles ils sont soumis.

§ 2. Les activités d'achat centralisées sont fournies par une centrale d'achat située dans un autre Etat membre conformément aux dispositions nationales de l'Etat membre dans lequel est située la centrale d'achat.

Les dispositions nationales de l'Etat membre dans lequel est située la centrale d'achat s'appliquent également :

1° à la passation d'un marché en vertu d'un système d'acquisition dynamique;

2° à la remise en concurrence en application d'un accord-cadre;

3° au choix, en vertu de l'article 43, § 5, 1° ou 2°, de l'opérateur économique partie à l'accord-cadre, qui exécutera une tâche donnée.

§ 3. Plusieurs pouvoirs adjudicateurs de différents Etats membres peuvent conjointement passer un marché public, conclure un accord-cadre ou mettre en place un système d'acquisition dynamique. Ils peuvent également, dans les limites fixées à l'article 43, § 1er, alinéa 2, passer des marchés sur la base d'un accord-cadre ou d'un système d'acquisition dynamique. A moins que les éléments nécessaires n'aient été prévus par un accord international conclu entre les Etats membres concernés, les pouvoirs adjudicateurs participants concluent un accord qui détermine ce qui suit :

1° les responsabilités des parties et les dispositions nationales applicables pertinentes;

2° l'organisation interne de la procédure de passation, y compris la gestion de la procédure, la répartition des travaux, des fournitures ou des services à acquérir, et la conclusion des marchés.

Un pouvoir adjudicateur participant remplit les obligations qui lui incombent en vertu de la présente loi lorsqu'il acquiert des travaux, des fournitures ou des services d'un pouvoir adjudicateur qui est responsable de la procédure de passation. Lorsqu'ils déterminent les responsabilités et le droit national applicable visés à l'alinéa 1er, 1°, les pouvoirs adjudicateurs participants peuvent se répartir des responsabilités spécifiques entre eux et déterminer les dispositions applicables du droit national de chacun des Etats membres respectifs. Pour les marchés publics passés conjointement, les documents du marché visent la répartition des responsabilités et le droit national applicable."

[13] Please note that CPBs in all countries tend to focus on final/existing products. E.g., Belgium´s CPB is specialised in insurance, fuel, hygiene, IT, furniture, office supplies, telecommunication, drinks and snacks, cars, and light commercial vehicles.

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Innovation Procurement legal framework

- Loi relative aux marchés publics, in force since June 17th, 2016 → Article 32 EXCLUDES the purchase of R&D services of its scope (PCP).
- Market Consultations → YES
- Subcontracting → YES
- IPR allocation to contractor by law → YES!
- National/regional Innovation structure → YES
- National policy to stimulate PCP → NO (regional)
- Spending target for IP → NO (regional and local)

Joint Procurement legal framework

- Joint procurement regulated at national and international level.
- Institutionalized and occasional joint cross border
- CPB: the Central Procurement Body for the Federal Services

Conclusions

- CLEAR EXCLUSION OF PCP of the scope of the Belgian law.
- Inclination for IP → Flemish region, Brussels region + Ghent and Antwerp
- Default IPR regime favours innovation

4.2. Finland

Innovation Procurement legal framework

In Finland, the EU Public Procurement Directives have been transposed into the national legal framework by the *Act on Public Contracts and Concessions (1397/2016)* and the *Act on Public Contracts and Concessions of Entities Operating in the water, energy, transport and postal services sectors (1398/2016)*.[14]

One of the objectives of the *Act on Public Contracts and Concessions* is to promote innovations. To this end, the Act defines what the word innovation means and includes provisions to implement innovation partnerships. Even though it does not define PCP, it provides a legal basis to implement it, by exempting from its scope of application the purchase of R&D services under certain conditions (where the benefits derived from them accrue solely to the contracting entity for use in its operations and the contracting entity pays in full for the service performed).[15]

The *Act on Public Contracts and Concessions* regulates Preliminary Market Consultations and clarifies that public authorities, contracting authorities/entities may consult with independent specialists, other public authorities or suppliers in order to plan and implement an award procedure, as long as this tool does not distort competition, or contradicts the principles of non-discrimination and transparency.[16] From

[14] See here for full text of the Act on Public Contracts and Concessions (in English): https://www.finlex.fi/en/laki/kaannokset/2016/en20161397.pdf and here for the Act on Public Contracts and Concessions of Entities Operating in the water, energy, transport and postal services sectors (in Finnish): https://www.finlex.fi/fi/laki/ajantasa/2016/20161398

[15] See Section 4(1.20) and Section 9 (1.13).

[16] See Section 65. *Market consultation*

(1) Before launching a procurement procedure, the contracting entity may conduct market consultations to prepare the procurement, and inform suppliers of their plans and requirements for the forthcoming procurement.

(2) The contracting entity may use independent specialists, other public authorities or suppliers in a market consultation. While the advice of these parties may serve as an aide to planning and implementing the procurement procedure, the use of advice may nevertheless not result in a distortion of competition, nor to conduct contrary to the principlesof non-discrimination and transparency referred to in section 3.

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a practical perspective, it can be stated that Preliminary Market Consultations are largely implemented in Finland.

On the other hand, subcontracting is also regulated in detail in the *Act on Public Contracts and Concessions*. Public authorities, contracting authorities/entities may require tenderers to indicate in their tenders any part of the contract that they intend to subcontract to third parties, and the proposed subcontractors. Nevertheless, the tender documents might also indicate that critical functions cannot be subcontracted. In the case of contracts to be implemented at facilities under the direct control of the public authorities, contracting authorities/entities, they shall require the contractor to notify the names, contact details and legal representatives of any subcontractors. Any changes in subcontractors shall also be notified.[17] Furthermore, subcontractors cannot be under any exclusion ground.[18] It is mandatory for the public authority, contracting authority/entity to require the supplier to change its subcontractors if they are under any of the mandatory exclusion criteria. They may ask for a change if the subcontractor is under any discretionary exclusion criteria, but in this case it is not mandatory.

The Act on Public Contracts and Concessions does not expressly allocate IPRs, but the Finnish legal framework, in particular the General Terms of Public Procurement in Service Contracts and General Terms of Public Procurement in Supply Contracts state that public authorities, contracting authorities/entities will have usage rights while all other IPR rights are left with the contractor.[19] Nevertheless, public authorities, contracting authorities/entities may change this provisions in their own contract terms that are annexed to the call for tenders, depending on their actual needs and the suppliers terms.[20] The actual IPR allocation is decided during the market consultation stage.

The Finnish copyright act determines that the moral rights can only be waived to a limited extent by the creator when the use of the work in question is limited in nature and extent. To use commissioned work, the procurer must require in the tender specifications the transfer, assignment or a license of the economic rights (e.g. usage, licensing, publication, modification, reproduction rights) at equitable payment. Copyright also protects scientific work (product designs, product specifications, tests etc.), computer programs and databases. The act foresees that whoever has legally acquired a computer program may make such copies of the program and make such alterations to the program as are necessary for the use of the program for the intended purpose.[21]

In Finland, the Ministry of Economic Affairs and Employment (MEAE) is responsible, among other tasks, for encouraging innovation procurement in the country.[22] The Ministry of Finance is responsible for providing general guidance and developing central government procurement activities and for deciding on centralised joint purchasing. The Ministry of the Environment provides information about integrating environmental considerations into public procurement.[23]

[17] See section 77.

[18] See section 78.

[19] See point 20 (https://vm.fi/documents/10623/307565/JYSE+2014+services/920004d3-fbfd-4e82-b4ce-fccdf6e9dbc5) and point 16 respectively (https://vm.fi/documents/10623/307565/JYSE+2014+supplies/0acd6bfd-1384-48f6-8e46-6c9c2ba172e3).

[20] Big companies have more power of bargain and may impose certain conditions.

[21] Find here the full document: https://wipolex.wipo.int/en/text/208099

[22] Finland Country Profile. The strategic use of Public Procurement for Innovation in the Digital Economy. Smart 2016/0040

[23] See here for more information: https://tem.fi/en/key-operators

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The Competence Centre for Sustainable and Innovative Public Procurement (KEINO) was founded in 2018.[24] The VTT Technical Research Centre of Finland Ltd, was one of the founders of KEINO and is a research institutions owned by the Finnish state, focussing on commercialisation of research and technology.[25] The Finnish Environment Institute (SYKE), also one of the founders of KEINO, is a research institute and a centre of expertise providing knowledge and solutions enabling sustainable development.[26]

From a policy perspective, the Finnish government has a spending target and an action plan for increasing the use of innovative PP, with two main objectives: promoting Innovation Procurement by developing cooperation, structures and operating models, and improving skills and management related to procurement and developing cooperation with companies (in which KEINO plays a major role).[27] This national strategy, called *Hankinta-Suomi* or Procurement Finland, was established in 2020 and is very detailed and applies across the country and to all public procurers, defines concrete actions, responsible actors and expected results.[28]

Joint Procurement legal framework

The Ministry of Finance is responsible for providing general guidance and developing central government procurement activities, as well as for deciding on centralised joint purchasing.[29]

Hansel Ltd, the Finnish government's central purchasing body, is a non-profit limited liability company operating under the guidance of the Ministry of Finance, whose purpose is to generate savings for public administrations through efficient procurement operations. It launches award procedures and establishes framework agreements on behalf of central government contracting authorities.[30] Since the Association of Finnish Local and Regional Authorities is a shareholder in Hansel Ltd with a 35% stake, the municipalities can also participate in these framework agreements.[31]

In its section 2, the *Act on Public Contracts and Concessions* allows the use of joint procurements or other opportunities for cooperation in tendering for public procurement. The usage of CPBs is regulated in detail under Finnish law.[32] The law also regulates other types of joint procurement, such as the use of CPBs from another Member State, the use of a Finnish CPB by another Member State, or occasional cross border joint procurement.[33]

[24] It also is responsible for monitoring innovation procurement. See here for more information: https://www.hankintakeino.fi/en/about-keino

[25] It also carries out monitoring activities. See here for more information: https://www.vttresearch.com/en

[26] See here for more information: https://www.syke.fi/en-US

[2727] The document, from 2020 is available here in English: https://tem.fi/documents/1410877/36553790/MEE_Action_Plan.pdf/eea428b3-a5c6-2207-5775-f595f0d5a404/MEE_Action_Plan.pdf?t=1600240171125

[28] See here: https://tem.fi/documents/1410877/110552150/Action_Plan_summary.pdf/525b4e4e-ef5e-a15b-b605-1a6fc4f05bb5/Action_Plan_summary.pdf?t=1645520032721 a summary. See here for more details on the program: https://vm.fi/hankinta-suomi and https://vm.fi/hankinnat-innovaatiot

[29] Nevertheless, it does not have influence on Finnish local and regional authorities.

[30] See here for more information: https://www.hansel.fi/en/about-us/hansel-brief/. Hansel Ltd focusses in 14 products and services categories: vehicle and logistics services, professional services, food and restaurant services, energy, personnel and healthcare, IT equipment, furniture and office services, data services and hardware, travel and meeting services, software, cleaning services and equipment, financial services, telecommunications and security systems and services.

[31] The state's ownership is 65%.

[32] See section 20.

[33] See section 21.

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Concluding remarks

Finland provides a definition of innovation and gives a legal basis to implement PCPs in the *Act on Public Contracts and Concessions*. It also regulates in detail Preliminary Market Consultations (whose use is widely implemented), subcontracting and joint cross border procurement.

Moreover, even though the Act does not provide a default scenario for the allocation of IPR, the General Terms of Public Procurement in Service Contracts and General Terms of Public Procurement in Supply Contracts state that public authorities, contracting authorities/entities will have usage rights while all other IPR rights are left with the contractor. Nevertheless, public authorities, contracting authorities/entities may change this provisions in their own contract terms that are annexed to the call for tenders, depending on their actual needs and the suppliers terms.

It can be concluded that the country shows a strong tendency towards innovation. This is well illustrated by the creation in the last few years of KEINO and the elaboration of an action plan for increasing the use of innovative PP.

Innovation Procurement legal framework

- Act on Public Contracts and Concessions and Act on Public Contracts and Concessions of Entities Operating in the water, energy, transport and postal services sectors→ EXCLUDES the purchase of R&D services of its scope (PCP).
- Market Consultations → YES!
- Subcontracting → YES
- IPR allocation to contractor by law → INDIRECTLY : General Terms of Public Procurement in Service Contracts and General Terms of Public Procurement in Supply Contracts
- National/regional Innovation structure → YES!
- National policy to stimulate PCP → YES!
- Spending target for IP → YES!

Joint Procurement legal framework

- Joint procurement regulated at national and international level
- Institutionalized and occasional joint cross border
- CPB: Hansel Ltd

Conclusions

- CLEAR EXCLUSION OF PCP of the scope of the Finnish law.
- Strong inclination for IP
- Default IPR regime INDIRECTLY favours innovation

4.3. France

Innovation Procurement legal framework

The *Code de la Commande Publique* in force since April the 1st 2019[34] defines what type of activities can be included under R&D following the definition of the Frascati Manual.[35] Those activities - under certain conditions (PCP) - are exempted from the code.[36]

[34] See here the full text: https://www.economie.gouv.fr/daj/code-commande-publique-et-autres-textes#:~:text=Le%20code%20de%20la%20commande%20publique%20est%20entr%C3%A9,%C2%BB%20pour%20les%20acteurs%20de%20la%20commande%20publique

[35] OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris.

[36] Article L2512-5 (2º) 2° *Sont soumis aux mêmes règles les marchés publics suivants : (..) 2° Les services relatifs à la recherche et développement pour lesquels l'acheteur n'acquiert pas la propriété exclusive des résultats ou ne finance pas entièrement la prestation.*

La recherche et développement regroupe l'ensemble des activités relevant de la recherche fondamentale, de la recherche appliquée et du développement expérimental, y compris la réalisation de démonstrateurs technologiques

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Although, the Code does not include an explicit definition of PCP, nor of Innovation Procurement, PCP and Public Procurement of Innovative solutions PPI are defined in the *Guide de l'achat public innovant*.[37]

The *Decree No. 2021-1634 of 13 December 2021 on innovative purchasing and various other provisions relating to public procurement* perpetuates the exemption for innovative contracts provided for a period of three years by *Decree No. 2018-1225 of 24 December 2018 on various measures relating to public procurement contracts*. The exemption implies that contracts for innovative works, supplies or services with an estimated value of less than €100,000 excluding tax can be awarded without prior advertising or competitive bidding.[38]

The *Code de la Commande Publique* regulates the deployment of Preliminary Market Consultations in a broad way in order to provide flexibility and adapt them to different contexts.[39] The public procurer is therefore free to establish his own way to conduct the Preliminary Market Consultations depending on the means and time available and in compliance with the fundamental principles of public procurement.[40] However, in practice the use of Preliminary Market Consultations is not widespread.[41]

Regarding subcontracting, the French legislation establishes that the providers are free to use one or more subcontractors to perform the services foreseen and the public authority, contracting authority/entity cannot force providers to carry out all the services of the contract by themselves. Nevertheless, the public authority, contracting authority/entity can make mandatory for the provider to perform certain essential tasks of the public contract.[42]

The Code de la Commande Publique states that the IPR allocation must be clarified in the tender documentation.[43] In this line, the *Cahiers des clauses administratives générales et techniques* (French

et à l'exception de la réalisation et de la qualification de prototypes de préproduction, de l'outillage et de l'ingénierie industrielle, de la conception industrielle et de la fabrication. Les démonstrateurs technologiques sont les dispositifs visant à démontrer les performances d'un nouveau concept ou d'une nouvelle technologie dans un environnement pertinent ou représentatif ;

[37] See here full text: https://www.economie.gouv.fr/files/files/directions_services/daj/marches_publics/conseil_acheteurs/guides/guide-pratique-achat-public-innovant.pdf

[38] See here for more information: https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000044487851

[39] Article R. 2111-1: "Afin de préparer la passation d'un marché, l'acheteur peut effectuer des consultations ou réaliser des études de marché, solliciter des avis ou informer les opérateurs économiques de son projet et de ses exigences.

Les résultats des études et échanges préalables peuvent être utilisés par l'acheteur, à condition que leur utilisation n'ait pas pour effet de fausser la concurrence ou de méconnaître les principes mentionnés à l'article L. 3."

[40] Proportionality, transparency, non discrimination and equal treatment.

[41] France Country Profile. The strategic use of Public Procurement for Innovation in the Digital Economy. Smart 2016/0040. P. 348.

[42] *Article L2193-3*

Le titulaire d'un marché peut, sous sa responsabilité, sous-traiter l'exécution d'une partie des prestations de son marché, dans les conditions fixées par le présent chapitre.

Toutefois, l'acheteur peut exiger que certaines tâches essentielles du marché soient effectuées directement par le titulaire.

Sont nuls et de nul effet, quelle qu'en soit la forme, les clauses, stipulations et arrangements qui auraient pour effet de faire échec aux dispositions du présent chapitre.

[43] Article R2111-5

Les spécifications techniques peuvent préciser si le transfert des droits de propriété intellectuelle sera exigé.

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national general terms and conditions for government contracts[44]) indicates that the public authority, contracting authority/entity will obtain license to use the results and the supplier keeps the ownership of the IPRs, except in certain situations, such as results intended to distinguish the specific identity of the public authority, contracting authority/entity (such as names, logos, slogans, graphic charters) and results qualified as confidential.[45] In other words, the supplier retains ownership of the know-how and

[44] See here all the available and in force *Cahiers des clauses administratives générales*: https://www.economie.gouv.fr/daj/cahiers-clauses-administratives-generales-et-techniques

[45] An example of this IPR allocation is *Arrêté du 30 mars 2021 portant approbation du cahier des clauses administratives générales des marchés publics de fournitures courantes et de services* that clarifies:

Article 37 Régime des résultats

37.1. Finalités et besoins d'utilisation des résultats :

37.1.1. Le titulaire accorde au titre du présent article à l'acheteur, les droits nécessaires pour utiliser ou faire utiliser les résultats, en l'état ou modifiés, de façon permanente ou temporaire, en tout ou partie, par tout moyen et sous toutes formes, pour les besoins et finalités d'utilisation exprimés dans les documents particuliers du marché et en toute hypothèse pour les besoins d'utilisation découlant de l'objet des prestations commandées dans le cadre du marché.

Les besoins d'utilisation de l'acheteur comprennent le droit de :

- publier et utiliser les résultats consistant en des documents préparatoires, tels que plans, études préalables ou spécifications, pour la mise en œuvre des besoins auxquels ils répondent ;

- évaluer ou faire évaluer par tout tiers à tout moment les résultats ;

- pouvoir procéder aux opérations d'archivage public ;

- permettre à tout service au sein de la même personne morale que l'acheteur de pouvoir utiliser les résultats dans les mêmes conditions et finalités d'utilisation ;

- assurer ou faire assurer par tout tiers l'évolution de tous résultats, en ce compris réaliser ou faire réaliser par tout tiers, la maintenance (corrective, préventive, adaptative et évolutive) des résultats consistant en des logiciels ;

- transférer les droits sur les résultats à tout tiers bénéficiaire d'un transfert de compétences de l'acheteur.

Pour les résultats qui sont des logiciels, les besoins d'utilisation comprennent en outre, la possibilité de rétrocéder tout droit à tout tiers à quelque titre que ce soit, et à quelques conditions que soit, ainsi que la possibilité de pouvoir les diffuser sous une licence libre / open source.

37.1.2. Le régime de confidentialité des résultats est défini le cas échéant dans les documents particuliers du marché.

Of particular relevance

37.2.2. Résultats protégés par un droit de propriété industrielle relatif à des inventions et connaissances techniques

Le titulaire informe l'acheteur de tout résultat qui aurait été identifié comme étant raisonnablement susceptible de faire l'objet d'une protection par un titre de propriété industrielle relatif à des inventions et connaissances techniques.

Le titulaire concède à l'acheteur une licence d'utilisation non exclusive des droits de propriété intellectuelle afférents à ces résultats, pour les finalités et besoins d'utilisation mentionnés au présent article tels qu'applicables au marché, comprenant le fait de pouvoir utiliser les résultats pour continuer les recherches.

Cette licence couvre les résultats à compter de leur livraison et sous condition résolutoire de la réception des prestations, pour le monde entier et pour la durée de validité de la protection.

Le prix de cette licence est compris dans le montant du marché.

Le titulaire accomplit toutes les formalités requises pour rendre la licence d'exploitation opposable aux tiers, dans tous les territoires où les droits sont concédés. Le coût de ces formalités est compris dans le montant du marché.

Dans l'hypothèse où le résultat consiste totalement ou partiellement en un nouveau savoir-faire, le titulaire concède une licence sur ce savoir-faire à l'acheteur, pour les finalités et besoins d'utilisation mentionnés au présent article, tels qu'applicables au marché, sous réserve d'en préserver la confidentialité. (…)

37.3.1. Le titulaire conserve la propriété de ses savoir-faire et méthodes utilisés pour réaliser les résultats.

L'acheteur autorise le titulaire à exploiter, y compris à titre commercial, les résultats créés dans le cadre du marché et non soumis à cession exclusive au profit de l'acheteur, pour les mêmes droits que ceux prévus à l'article 37.2.1, sous réserve de la confidentialité d'informations intégrées dans les résultats en vertu de l'article 5. Pour les

PROTECT

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methods used to achieve the results and obtains, consequently the right to exploit on a commercial basis these results. The general terms and conditions also include the payment of royalties to the public authority, contracting authority/entity by the contractor.

The French copyright law (the Intellectual property Code)[46] determines that copyrights belong in an inalienable way to the creator. The existence or conclusion of a contract (e.g. a public procurement contract) shall in no way derogate from the enjoyment of the right enjoyed by the creator. Only the economic rights can be assigned or licensed by the creator to another person/entity, on condition that the assignment is limited in scope, duration, place and destination. To use the copyright owned by the creator, the procurer must require in the tender specifications the assignment or a license of the economic rights (e.g. usage, licensing, publication, modification, reproduction rights) at equitable payment. Copyright law protects also scientific work, software and database rights.

The French Ministry of Economy and Finance, which has competences on public procurements, strongly encourages buyers to promote innovation in that field. In this line, the State Purchase Plan (Le Plan achat de l'Etat) aims for €1 billion in budget savings by the end of 2023. To achieve this savings, procurement must be done under the most economically advantageous conditions, which also include sustainable development and social development goals, easy access to public procurement for SMEs and support of innovation. This means that in an indirect way, France has set an innovation/sustainable procurement target although the MS does not have an structured action plan to foster innovation procurement at national level.[47]

Joint Procurement legal framework

French legislation encourages public authorities, contracting authorities/entities to consider whether their contract, even below the European thresholds, has "cross-border interest". Indeed, the *Code de la Commande Publique* expressly regulates joint procurement at national and European level.[48] The latter under the condition that it is not affecting the national public interest.

It is also important to note that in France, the *Union des groupements d'achats publics* (Union of Public Purchasing Groups or UGAP) acts as central purchasing body for central authorities and hospitals.[49]

connaissances antérieures mises à disposition du titulaire par l'acheteur pour l'exécution du marché, le titulaire sollicite l'accord de l'acheteur.

Le titulaire verse à l'acheteur, dans l'hypothèse de l'exploitation commerciale de tout ou partie des résultats, seuls ou incorporés dans des produits ou services, ou en cas de concession totale ou partielle de droits d'exploitation portant sur les résultats, une redevance.

Les documents particuliers du marché déterminent les modalités de calcul de la redevance.

[46] Find here the full document: https://wipolex.wipo.int/en/text/435178

[47] Also to bear in mind that the *Decree No. 2021-357 of 30 March 2021 on various provisions relating to public procurement* implementing la *loi de accélération et de simplification de l'action publique* in the context of the economic recovery plan, requires public authorities, contracting authorities/entities to reserve 10% of the estimated value of a global contract for SMEs or specialist workers, with the goal of facilitating small businesses´ access to public procurement. But only if the main contractor of a global contract is not an SME.

[48] See Articles L2113-6, L2113-7 and L2113-8.

[49] For more information see here: https://www.ugap.fr/ UGAP purchases and resells products to public authorities, contracting authorities/entities in the fields of office supplies, IT products, environmentally friendly printing paper, fuel, non-road diesel, lubricant and additives, cleaning and maintenance and scientific consumables.

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Concluding remarks

The *Code de la Commande Publique* does not define PCP, nor innovation procurement, nor PPI, but provides a basis for the implementation of PCP since the purchase of R&D services is excluded from its application under certain conditions. This would facilitate the implementation of a PCP project. Moreover, EU cross border joint procurement is expressly regulated which also gives a legal ground for an EU cross border PCP.

Additionally, the central government is interested in innovation procurement and has set (budget wise) targets for the upcoming years. However, this is an indirect way of fostering Innovation Procurement in an indirect way, since it there is not a structured action plan applicable to all type of procurers.[50]

Lastly, the IPR default regime set in the French national general terms and conditions for government contracts also fosters innovation and incentivizes the participation of suppliers.

Innovation Procurement legal framework

- Code de la Commande Publique in force since April the 1st 2019 → Article L2512-5 (2°) 2° EXCLUDES the purchase of R&D services of its scope (PCP).
- Market Consultations → YES
- Subcontracting → YES
- IPR allocation to contractor by law → INDIRECTLY : Cahiers des clauses administratives générales et techniques (general terms and conditions for government contracts)
- National/regional Innovation structure → YES
- National policy to stimulate PCP → INDIRECTLY
- Spending target for IP → INDIRECTLY (the State Purchase Plan)

Joint Procurement legal framework

- Joint procurement regulated at national and international level.
- Institutionalized and occasional joint cross border
- CPB: Union des groupements d'achats publics

Conclusions

- CLEAR EXCLUSION OF PCP of the scope of the French law.
- Inclination for IP
- Default IPR regime INDIRECTLY favours innovation

4.4. Germany

Innovation Procurement legal framework

Public procurement in Germany is mainly regulated under Articles 97 to 184 of the *Gesetz gegen Wettbewerbsbeschränkungen – GWB: Vergabe von öffentlichen Aufträgen und Konzessionen* (the German law against competition restrictions).[51] The law is complemented by six regulations:

- Regulation on the Award of Public Contracts (*Vergabeverordnung – VgV*)
- Regulation on the Award of Public Contracts in the Utilities Sectors (*Sektorenverordnung – SektVO*)
- Regulation in the Defense and Security Sector (*Vergabeverordnung Verteidigung und Sicherheit – VSVgV*)
- Regulation on the Award of Concessions (*Konzessionsvergabeverordnung – KonzVgV*)
- Statistical Regulation on the Award of Public Contracts and Concessions (*Vergabestatistikverordnung – VergStatVO*)
- Regulation on Prices in Public Contracts (*PreisVO*) .

[50] France Country Profile. The strategic use of Public Procurement for Innovation in the Digital Economy. Smart 2016/0040

[51] See full text here: https://www.gesetze-im-internet.de/gwb/BJNR252110998.html#BJNR252110998BJNG002404118

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Additionally, the General Conditions for works at national level *(Vergabe- und Vertragsordnung für Bauleistungen – VOB)* and General Conditions for services at national level *(Vergabe- und Vertragsordnung für Leistungen – VOL)* play a relevant role in PP above and below the European thresholds.[52]

The aforementioned laws and regulation transposed the EU Directives on Public Procurement (i.e. 2014/23/EU, 2014/24/EU and 2014/25/EU) in 2016.[53]

Nevertheless, this complex procurement legal framework does not include a definition of Innovation Procurement. It provides, however, a legal basis to implement PCP by excluding the purchase of R&D services under certain conditions.[54] The GWB also fosters innovation by requesting public authorities, contracting authorities/entities to consider quality and innovative aspects - in addition to social and environmental elements - when awarding a public contract. [55]

The General Conditions for works at national level (Vergabe- und Vertragsordnung für Bauleistungen – VOB) regulate Preliminary Market Consultation under Part 2.[56] However, even though Germany has implemented Preliminary Market Consultations, its use is not widespread.[57]

The German legal framework includes subcontracting in the different abovementioned regulations. For example, the regulation on the award of public contracts states that public authorities, contracting authorities/entities may request companies to clarify, when submitting the tender, those parts of the contract which they intend to subcontract to third parties and, if reasonable, to name the likely subcontractors. Before awarding the contract, the contracting authority may require the tenderers whose tenders are shortlisted to identify the subcontractors and to demonstrate that they have the necessary resources from these subcontractors at their disposal. Moreover, subcontractors under exclusion grounds must be replaced at the request of the public authority.[58]

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[52] *Both VOB and VOL are divided into two parts: Part A, which contains rules on the award and which in turn regulates, in a first part, contracts for non-harmonized amounts and in a second, contracts within the scope of application of the Directives. And part B that regulates the implementation conditions of the contracts. Although both regulations have part A and B, VOB also has a part C.* El sistema de reparto de riesgos en las concesiones: hacia una nueva gobernanza. Editorial: Aranzadi, Navarra, España, 2019. ISBN: 978-84-1309-991-0

[53] Bear in mind that public procurement below the EU thresholds is governed by national budgetary law at the federal level. In some federal states, below threshold public procurement is governed by a system of state level legislation, while others govern via decree or administrative rules. Some municipalities also have their own laws, rules and regulations. Public procurement – Study on administrative capacity in the EU Germany Country Profile: https://ec.europa.eu/regional_policy/sources/policy/how/improving-investment/public-procurement/study/country_profile/de.pdf

[54] See Article 116 (1.2) of the GWB: *"Besondere Ausnahmen (1) Dieser Teil ist nicht anzuwenden auf die Vergabe von öffentlichen Aufträgen durch öffentliche Auftraggeber, wenn diese Aufträge Folgendes zum Gegenstand haben: 2. Forschungs- und Entwicklungsdienstleistungen, es sei denn, es handelt sich um Forschungs- und Entwicklungsdienstleistungen, die unter die Referenznummern des Common Procurement Vocabulary 73000000-2 bis 73120000-9, 73300000-5, 73420000-2 und 73430000-5 fallen und bei denen a) die Ergebnisse ausschließlich Eigentum des Auftraggebers für seinen Gebrauch bei der Ausübung seiner eigenen Tätigkeit werden und b) die Dienstleistung vollständig durch den Auftraggeber vergütet wird,"*

[55] See article 97 (3) of the GWB.

[56] Abschnitt 2 - Vergabebestimmungen im Anwendungsbereich der Richtlinie 2014/24/EU3), Article 2 (7): *"Vor der Einleitung eines Vergabeverfahrens kann der öffentliche Auftraggeber Marktkonsultationen zur Vorbereitung der Auftragsvergabe und zur Unterrichtung der Unternehmer über seine Pläne zur Auftragsvergabe und die Anforderungen an den Auftrag durchführen. Die Durchführung von Vergabeverfahre zum Zwecke der Markterkundung ist unzulässig".*

[57] Germany Country Profile. The strategic use of Public Procurement for Innovation in the Digital Economy. Smart 2016/0040

[58] See Article 36 of the VgV. Similarly, Article 34 of the SektVO. The VSVgV which regulates the Defence and Security sector is more thorough due to the implications of the sector to the security interests of the states and includes subcontracting in Articles 38 to 41.

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The German legal framework does not define how to allocate the IPRs. Each German public authority, contracting authority/entity must specify this aspect in their tender specifications.

The German copyright act[59] assigns untransferable copyright (moral rights) to the creator. To use the copyright created by (sub)contractors, the procurer should require in the tender specifications the transfer, assignment, or license of the economic rights (e.g. usage, licensing, publication, modification, reproduction rights) at equitable payment. Copyright law protects also scientific work, software and database rights.

In Germany, the Federal Ministry for Economic Affairs and Climate Action (BMWK) defines the principles and the legal framework for public procurement.[60] The Kompetenzzentrum innovative Beschaffung (Competence Centre for Innovative Procurement or KOINNO) is the one in charge of implementation of Innovation Procurement policies on behalf of this Federal Ministry.[61] With this goal in mind, the competence centre fosters an innovative-oriented public procurement and the increase of Innovation Procurement in the total volume of public procurement in Germany.[62]

Another relevant actor on innovation procurement is ZENIT GmbH, a Public Private Partnership owned by the State of North Rhine-Westphalia[63], which implements part of the KOINNO competence centre mandate at regional level. Since January 2017, it also manages the EU Contact Point for Innovation Procurement in Germany.[64]

However, Germany does not have a stand-alone plan, nor a specific spending target for Innovation Procurement.

Joint Procurement legal framework

The regulation on the award of public contracts (*Vergabeverordnung – VgV*) describes occasional joint procurement and institutionalised central procurement, both at national and at European level. I.e., joint procurement among entities from different EU Members States is facilitated by the German legal framework.[65]

[59] Find here the full document: https://wipolex.wipo.int/en/text/474263

[60] For more information see here: https://www.bmwk.de/Redaktion/EN/Dossier/public-procurement.html

[61] For more information see here: https://www.koinno-bmwk.de/en/koinno

[62] In the performance of these tasks, KOINNO has published a Innovative Public Procurement Guide in 2018. See here the document: https://www.koinno-bmwk.de/fileadmin/user_upload/publikationen/KOINNO_Broschure_Innovation_Procurement_EN_print.pdf

[63] In this region, innovation procurement is envisaged in the context of Green Public Procurement.

[64] For more information see here: https://www.zenit.de/english/

[65] See § 4 VgV Gelegentliche gemeinsame Auftragsvergabe; zentrale Beschaffung

"(1) Mehrere öffentliche Auftraggeber können vereinbaren, bestimmte öffentliche Aufträge gemeinsam zu vergeben. Dies gilt auch für die Auftragsvergabe gemeinsam mit öffentlichen Auftraggebern aus anderen Mitgliedstaaten der Europäischen Union. Die Möglichkeiten zur Nutzung von zentralen Beschaffungsstellen bleiben unberührt.

(2) Soweit das Vergabeverfahren im Namen und im Auftrag aller öffentlichen Auftraggeber insgesamt gemeinsam durchgeführt wird, sind diese für die Einhaltung der Bestimmungen über das Vergabeverfahren gemeinsam verantwortlich. Das gilt auch, wenn ein öffentlicher Auftraggeber das Verfahren in seinem Namen und im Auftrag der anderen öffentlichen Auftraggeber allein ausführt. Bei nur teilweise gemeinsamer Durchführung sind die öffentlichen Auftraggeber nur für jene Teile gemeinsam verantwortlich, die gemeinsam durchgeführt wurden. Wird ein Auftrag durch öffentliche Auftraggeber aus verschiedenen Mitgliedstaaten der Europäischen Union gemeinsam vergeben, legen diese die Zuständigkeiten und die anwendbaren Bestimmungen des nationalen Rechts durch Vereinbarung fest und geben das in den Vergabeunterlagen an.

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It is worth noting that Germany has 4 Central Purchasing Bodies (CBP) at national level:

1. The Federal Procurement Office of the Ministry of Interior (BeschA) – It procures for all federal agencies and manages the main e-procurement platform.[66]
2. The Federal Office of Bundeswehr Equipment, Information, Technology and In-Service Support (BAAINB) – It provides the German army with defense equipment, including information technology.[67]
3. The Federal Institute for Materials Research and Testing (BAM) – It tests, researches and advises to protect people, the environment and material goods. To this end, BAM concludes framework agreements for specific technical product groups.
4. The Federal Financial Directorate Southwest (BFD Südwest) – It procures for the tax administration.

There are also CPS at regional level.

Concluding remarks

The German public procurement legal framework clearly excludes R&D procurement from its scope of application. This would facilitate the uptake of a PCP project. Moreover, cross border joint procurement is expressly regulated, both occasional or institutionalized at national or EU level, which gives a legal ground for a future European cross border PCP.

Even though the allocation of the IPRs is not expressly regulated in the German legislation and there is no dedicated action plan nor spending target for Innovation Procurement, the country fosters innovation and has a national and a regional innovation champion: KOINNO and ZENIT GmbH respectively.

Innovation Procurement legal framework

- Gesetz gegen Wettbewerbsbeschränkungen – GWB: Vergabe von öffentlichen Aufträgen und Konzessionen → Article 116 (1.2) EXCLUDES the purchase of R&D services of its scope (PCP).
- Market Consultations → YES
- Subcontracting → YES
- IPR allocation to contractor by law → NO (in tender documents)
- National /regional Innovation structure → YES!
- National policy to stimulate PCP → NO
- Spending target for IP → NO

Joint Procurement legal framework

- Joint procurement regulated at national and international level.
- Institutionalized and occasional joint cross border
- 4 CPB: BeschA, BAAINB, BAM, BFD Südwest

Conclusions

- CLEAR EXCLUSION OF PCP of the scope of the German law.
- Inclination for IP
- Default IPR regime DOES NOT favour innovation

(3) Die Bundesregierung kann für Dienststellen des Bundes in geeigneten Bereichen allgemeine Verwaltungsvorschriften über die Einrichtung und die Nutzung zentraler Beschaffungsstellen sowie die durch die zentralen Beschaffungsstellen bereitzustellenden Beschaffungsdienstleistungen erlassen."

[66] Please note that CPBs in all countries tend to focus on final/existing products. This is the case of BeschA. See here its product range: https://www.kdb.bund.de/KdB/SharedDocs/Downloads/Kategorien-Zustaendigkeiten.pdf?__blob=publicationFile&v=1

[67] It purchases in the field of military equipment, infrastructure, environmental protection and services.

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4.5. Greece

Innovation Procurement legal framework

Innovation Procurement in Greece is regulated by *Law 4412/2016 on public works, supplies, and service contracts* as amended transposing the Directives 2014/24 and 2014/25 EU and by *Law 4413/2016 on award and execution of concessions* as amended transposition of Directive 2014/23/EU. [68]

PCP is not under the scope of the Greek legislation. According to Article 14 of Law 4412/2016, research and development are excluded unless they are covered by codes 73000000-2 to 73120000-9, 73300000-5, 73420000-2 and 73430000-5 of the CPV, provided that both of the following conditions are fulfilled: (a) the benefits do not accrue exclusively to the contracting authority for its use in the conduct of its own affairs, and (b) the service provided is not wholly remunerated by the contracting authority. Law 4310/2014, article 2, paragraph 41 defines PCP. [69]

In particular PCP was added to the objectives of the Greek National Strategy for R&D&I in 2015, under article 4 of the *Law 4386/2016* that amended *Law 4310/2014 on Research, Technological Development, Innovation and other provisions*. This article states that *"the National Strategy on Research, Technological Development, Innovation aims at the development of […] every mean for funding Research, Technological Development, Innovation (such as […] pre-commercial public procurement […])"*.

The Greek public procurement legislation does not regulate the deployment of market consultations, not even in a facultative way; nor does it contain additional (to the Directives') exclusion grounds.

As far as subcontracting is concerned, the Greek regulations do not contain any mandatory provisions. However, according to article 58 of *Law 4412/2016*, the contracting authorities shall request the tenderer to indicate in his tender the part of the contract which he intends to award to third parties and the subcontractors he proposes.

In the field of IPRs, there is no default regime for the distribution of IPR rights between procurers and suppliers in Greece. Moreover, the Greek law, the general terms and conditions for government contracts and the guidelines on public procurement do not define how to allocate IPRs in contracts. Every Greek procurer is thus responsible to clearly specify in the tendering documents the IPR allocation in order to promote innovation while complying with applicable IPR/copyright law.

[68] In Greece the main actors in the field of public procurement are:

- The Government Council for Economic Policy which approves, monitors and evaluates the Action Plan for National Procurement Strategy and any possible revisions;
- The National Central Purchasing Bodies;
- The General Directorate of Public Procurements within the Ministry of Economy and Development owns and coordinates the national e-procurement system and is responsible for public supplies and services, including a specific focus on green and innovation procurement;
- The General Secretariat of Infrastructure (within the Ministry of Infrastructure and Transport), responsible for works procurement and public services contracts relating to public works;
- National Central Authority for Procurements in Health "EKAPI", responsible for procurements in the health sector;
- The Hellenic Single Public Procurement Authority (SPPA), established by the Government in 2011, is responsible for the development and promotion of the national strategy in the field of public procurements, provision of policy advice to the legislature, provision of guidance to awarding authorities on the application of procurement law and regulation, and authorisation of the use of special procedures, such as negotiated procedure without publication notice. The SPPA also plays a supervisory role by monitoring and evaluating awarding authorities' decisions.

[69] Law 4310/2014*, article 2, paragraph 41 defines PCP as: *"buying research services in case the contracting authority or entity does not assume all risks, the results and use benefits in the conduct of its activities, but shares them with the providers under market conditions. The object of the contract falls within one or more categories of research and development defined in the present context. The contract is of limited duration. With the exception of prototype or a limited set of first test/validation data, the purchase of goods or services, which are developed within the framework of a pre-commercial procurement, should not be subject of the same contract"*. (*) N. 4310/2014 (ΦΕΚ Α 258/8-12-2014) Έρευνα, Τεχνολογική Ανάπτυξη και Καινοτομία και άλλες διατάξεις. | Forin.gr

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Nevertheless, it is important to keep in mind that:

- The Greek public procurement law foresees that procurers can require in the tender specifications the transfer of IPR rights to the procurer.
- The Greek *copyright law 2121/1993* states that copyright (the moral rights) belong to the creator.[70] Only the economic rights can be transferred, assigned or licensed to another person/entity. If the procurer wants to use copyright produced by the contractor during his procurement, he must require in the tender specifications the transfer, assignment or a license of the economic rights (e.g. usage, licensing, publication, modification, reproduction rights) at equitable payment. That's why templates for public procurements in Greece refer to the abovementioned *Copyright law 2121/1993.*

Innovation Procurement is embedded in the regional policy, the public procurement policy, the innovation policy and the R&D policy. Actions to develop a framework for Innovation Procurement and PCP in the digital policy area are also envisaged in the National Digital Strategy 2016-2021. This strategy, elaborated by the General Secretariat for Digital Policy of the Ministry of Digital Policy, Telecommunications and Information, reports in in its Priority 4.1, *"Support for research and development Research and Technological Development (ETA) includes among its objectives: "a framework for the procurement of innovative services and pre-commercial procurement".* Greece has the innovation procurement competence center PROMITHEUS established under the Ministry of Economy (www.promitheus.gov.gr).

Joint Procurement legal framework

The Greek public procurement legislation does expressly allow joint cross border procurement. Indeed, according to article 43 paragraph 5 of *Law 4412/2016,* the participating contracting authorities shall agree on the applicable procurement rules of, either the Member State where the joint entity has its registered office, either the Member State where the joint entity is carrying out its activities. It is clear that institutionalized cross border joint procurement is allowed by Greek legislation. However, Greek legislation also allows *ad hoc* joint procurement[71].

Concluding remarks

The Greek public procurement legal framework clearly excludes R&D procurement from its scope of application. This would facilitate the uptake of a PCP project. Moreover, cross border joint procurement is expressly regulated, which gives a legal ground for a future European cross border PCP.

Even though the allocation of the IPRs is not expressly regulated in the Greek legislation and there is no spending target for Innovation Procurement, the country fosters innovation and has an innovation procurement competence center PROMITHEUS established under the Ministry of Economy www.promitheus.gov.gr).

There market consultations are not explicitly allowed in the national procurement law.

[70] Copyright law protects also scientific creations, software and database rights.

[71] See in this regard article 43 of L.4412/2016 that has transposed article 39 (*Procurement involving contracting authorities from different Member States*) of the Directive 2014/24/EU.

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Innovation Procurement legal framework

- Law 4412/2016 on public works, supplies, and service contracts transposes Directives 2014/24 and 2014/25 EU and Law 4413/2016 on award and execution of transposes Directive 2014/23/EU. → Art. 14 of Law 4412/2016 EXCLUDES the purchase of R&D services of its scope (PCP). Law 4310/2014, article 2, paragraph 41 defines PCP
- Market Consultations → YES (not regulated)
- Subcontracting → YES (article 58 of Law 4412/2016, the contracting authorities shall request the tenderer to indicate in his tender the part of the contract which he intends to award to third parties and the subcontractors he proposes).
- IPR allocation to contractor by law → NO (in tender documents)
- National/regional Innovation structure → YES!
- National policy to stimulate PCP → YES
- Spending target for IP → NO

Joint Procurement legal framework

- The Greek public procurement legislation does expressly allow joint cross border procurement. Indeed, according to article 43 paragraph 5 of Law 4412/2016, the participating contracting authorities shall agree on the applicable procurement rules.
- GC, GDP, National PB, SPPA

Conclusions

- CLEAR EXCLUSION OF PCP of the scope of the Greek law.
- Lack of IPR policy in public procurement that encourages innovation.

4.6. Italy

Innovation Procurement legal framework

In Italy, the procurement law was amended by *Decreto Legislativo 31 marzo 2023, n. 36 Codice dei contratti pubblici* in force since 1st April 2023.This legislation replaces the public procurement rules stated in *Decreto Legislativo 18 aprile 2016 n. 50. Attuazione delle direttive 2014/23/UE, 2014/24/UE e 2014/25/UE sull'aggiudicazione dei contratti di concessione, sugli appalti pubblici e sulle procedure d'appalto degli enti erogatori nei settori dell'acqua, dell'energia, dei trasporti e dei servizi postali, nonché per il riordino della disciplina vigente in materia di contratti pubblici relativi a lavori, servizi e forniture*.

The new Italian legal framework, such as the previous one, exempts of its scope of application the purchase of R&D services, as long as the benefits don't accrue exclusively to the contracting authority for its use in the conduct of its own affairs, and the service provided is not wholly remunerated by the contracting authority, i.e., PCP. Moreover, the Italian law, conversely to several other MS, expressly mentions and regulates PCP.[72] Article 135(2) of the new Code of Public Contracts establishes the

[72] See new Article 135 *(Servizi di ricerca e sviluppo).*

1. Relativamente ai servizi di ricerca e sviluppo, le disposizioni del codice si applicano esclusivamente ai contratti relativi ai servizi di cui all'allegato II.19, a condizione che: a) i risultati appartengano esclusivamente alla stazione appaltante, per essere destinati all'esercizio della propria attivita'; b) la prestazione del servizio sia interamente retribuita dalla stazione appaltante.

2. Le stazioni appaltanti possono ricorrere, in applicazione dei principi di cui agli articoli 1, 2 e 3, agli appalti pubblici pre-commerciali, che rispettino le condizioni delle lettere a) e b) del comma 1, quando: a) siano destinati al conseguimento di risultati non appartenenti in via esclusiva alla stazione appaltante, che li usi nell'esercizio della propria attivita'; b) la prestazione del servizio non sia interamente retribuita dalla stazione appaltante; c) l'esigenza non possa essere soddisfatta ricorrendo a soluzionigia' disponibili sul mercato.

3. In sede di prima applicazione del codice, l'allegato di cui al comma 1 e' abrogato a decorrere dalla data di entrata in vigore di un corrispondente regolamento adottato ai sensi dell'articolo 17, comma 3, della legge 23 agosto 1988, n. 400, con decreto del Ministro dell'universita' e della ricerca di concerto con il Ministro delle imprese e del made in Italy, che lo sostituisce integralmente anche in qualita' di allegato al codice.Article 135.

The replaced procurement law stated in Article 158 (Servizi di ricerca e sviluppo) the following:

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conditions for a PCP. The third condition in (c) indicates that the need cannot be satisfied by solutions available in the market.

The *Decreto Legislativo 31 marzo 2023, n. 36* that replaced *Decreto Legislativo 18 aprile 2016 n. 50,* regulates in detail Preliminary Market Consultations, which are regularly used by public authorities, contracting authorities/entities prior to launching an award procedure.[73]

Article 77 of the new Code states that:

1. The contracting authorities or entities may carry out market consultations to prepare the tender documents, including the choice of tender procedures, and to inform the economic operators of the contracts they have planned and of the related requisites.

2. For the purposes referred to in paragraph 1, the contracting authorities or entities may acquire information, advice, reports and any other suitable documentation, including of a technical nature, from experts, market operators, independent authorities or other suitable subjects. Such documentation may also be used in planning and carrying out the procurement procedure, provided that it does not have the effect of distorting competition and does not involve a violation of the principles of non-discrimination and transparency.

"1. Relativamente ai servizi di ricerca e sviluppo le disposizioni di cui al presente codice si applicano esclusivamente ai contratti per servizi di ricerca e sviluppo identificati con i codici CPV da 73000000-2 a 73120000-9, 73300000-5, 73420000-2 o 73430000-5, purche' siano soddisfatte entrambe le seguenti condizioni:

a) i risultati appartengono esclusivamente all'amministrazione aggiudicatrice e all'ente aggiudicatore, affinche' li usi ((nell'esercizio della sua attivita'));

b) la prestazione del servizio e' interamente retribuita dall'amministrazione aggiudicatrice e dall'ente aggiudicatore.

2. Le stazioni appaltanti possono ricorrere, nel rispetto dei principi di cui all'articolo 4 ((del presente codice)), agli appalti pubblici pre-commerciali, destinati al conseguimento di risultati non appartenenti in via esclusiva all'amministrazione aggiudicatrice e all'ente aggiudicatore perche' li usi nell'esercizio della sua attivita' e per i quali la prestazione del servizio non e' interamente retribuita dall'amministrazione aggiudicatrice e dall'ente aggiudicatore, cosi' come definiti nella comunicazione della Commissione europea COM 799 (2007) del 14 dicembre 2007, nelle ipotesi in cui l'esigenza non possa essere soddisfatta ricorrendo a soluzioni ((gia' disponibili sul mercato))."

[73] See Article 77 (*Consultazioni preliminari di mercato).*

1. Le stazioni appaltanti possono svolgere consultazioni di mercato per predisporre gli atti di gara, ivi compresa la scelta delle procedure di gara, e per informare gli operatori economici degli appalti da esse programmati e dei relativi requisiti richiesti.
2. Per le finalita' di cui al comma 1 le stazioni appaltanti possono acquisire informazioni, consulenze, relazioni e ogni altradocumentazione idonea, anche di natura tecnica, da parte di esperti, operatori di mercato, autorita' indipendenti o altri soggetti idonei. Tale documentazione puo' essere utilizzata anche nella pianificazione e nello svolgimento della procedura di appalto, a condizione che non abbia l'effetto di falsare la concorrenza e non comporti una violazione dei principi di non discriminazione e di trasparenza.

The replaced procurement law stated in Article Art. 66 (Consultazioni preliminari di mercato)

"*1. Prima dell'avvio di una procedura di appalto, le amministrazioni aggiudicatrici possono svolgere consultazioni di mercato per la preparazione dell'appalto e per lo svolgimento della relativa procedura e per informare gli operatori economici degli appalti ((da esse programmati)) e dei requisiti relativi a questi ultimi.*

2. Per le finalità di cui al comma 1, le amministrazioni aggiudicatrici possono acquisire consulenze, relazioni o altra documentazione tecnica da parte di esperti, di partecipanti al mercato nel rispetto delle disposizioni stabilite nel presente decreto, o da parte di autorità indipendenti. Tale documentazione può essere utilizzata nella pianificazione e nello svolgimento della procedura di appalto, a condizione che non abbia l'effetto di falsare la concorrenza e non comporti una violazione dei principi di non discriminazione e di trasparenza."

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Article 78 of the new Code refers to the participation in the preliminary consultations of candidates or bidders.[74] If a candidate or tenderer or a company related to a candidate or a tenderer has provided the documentation or information, data and news referred to in article 77, paragraph 2, or otherwise participated in the preparation of the procedure award of the contract, the contracting authority takes measures adequate to ensure transparency and that competition is not distorted by the participation of the candidate or tenderer himself. The communication to other candidates and offerors of information exchanged during the pre-consultations, as well as the setting of adequate deadlines for the receipt of offers constitute the minimum adequate measure.

Subcontracting in Italy was previously regulated in Article 105 (*Subappalto*) of *Decreto Legislativo 18 aprile 2016 n. 50 (replaced by Decreto Legislativo 36 of 2023).* In the new legislation, subcontracting is regulated in Article 119 of *Decreto Legislativo 36 of 2023.* While it is not possible to subcontract in full the activities under the scope of the contract, there is no subcontracting threshold, and subcontractors may in turn entrust other subcontractors with work ("subappalto a cascata"). It is specified that subcontracting has the characteristic that the work is carried out "with organization of means and risks borne by the subcontractor". The subcontractor must guarantee for the services entrusted to him the economic and regulatory treatment not lower than that which the contractor would have guaranteed

The contracting authority may limit this practice by stating the reasons in the tender documents. The public authority, contracting authority/entity can indicate in the tender documents which parts of the contracts cannot be subcontracted, duly justifying this decision. Before starting the implementation of the contract, the contractor must indicate the amount subcontracted, the identity of the subcontractors and the tasks they will execute. The selected subcontractors must comply with the selection criteria and not be under any exclusion grounds.

In Italy, there is no default scenario for the allocation of IPRs between the public authority, contracting authority/entity and the contractor. It is left to the individual responsibility of each Italian procurer to specify clearly the IPR allocation in its tender documents so that it stimulates innovation. It is important to note that in the new legislation refers to PCP defined in the *Communication from the Commission: Pre-commercial Procurement: Driving innovation to ensure sustainable high quality public services in Europe*, which explains that when procuring R&D services through this procedure, the IPR ownership remains with the contractor while the public authority, contracting authority/entity retains usage and rights to require the contractors to give licenses to third parties.[75]

However, the Guidelines on the acquisition and reuse of software for public administrations establish that *'Public administrations that are owners of solutions and computer programs made to the specifications of the public client, have the obligation to make the relevant source code available, complete with documentation and released in a public repository under an open licence, for use free of charge for other public administrations or for legal entities wishing to adapt them to their own*

[74]See new Article 78. (*Partecipazione alle consultazioni preliminari di candidati offerenti*).

1. *Qualora un candidato o un offerente o un'impresa collegata a un candidato o a un offerente abbia fornito la documentazione ovvero le informazioni, i dati e le notizie di cui all'articolo 77, comma 2, o abbia altrimenti partecipato alla preparazione della procedura di aggiudicazione dell'appalto, la stazione appaltante adotta misure adeguate per garantire la trasparenza e che la concorrenza non sia falsata dalla partecipazione del candidato o dell'offerente stesso. La comunicazione agli altri candidati e offerenti di informazioni pertinenti scambiate nel corso delle consultazioni preliminari, nonche' la fissazione di termini adeguati per la ricezione delle offerte costituiscono la minima misura adeguata.*
2. *Qualora non sia possibile garantire il rispetto del principio della parita' di trattamento, la stazione appaltante invita il candidato o l'offerente interessato a fornire, entro un termine comunque non superiore a dieci giorni, ogni elemento idoneo a provare che la sua partecipazione alla preparazione e alla scelta della procedura di aggiudicazione dell'appalto non costituisce causa di alterazione della concorrenza. Se la stazione appaltante non ritiene adeguate le giustificazioni fornite, il candidato o l'offerenteinteressato e' escluso dalla procedura.*
3. *Le misure adottate dalla stazione appaltante sono indicate nella relazione unica prevista dall'articolo 112.*

[75] COM(2007) 799 final. Brussels, 14.12.2007.

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requirements, except when there are 'justified reasons of public order and safety, national defence and electoral consultations'.[76]

The promotion of the use of innovative procurement is one of the priority objectives of the Italian Digital Agenda, which fosters the use of innovative public procurement and PCP in order to stimulate the demand for innovative goods and services.[77]

The Agency for Digital Italy (*Agenzia per l'Italia Digitale – AgID*) under the Presidency of the Cabinet has the task of ensuring that the objectives of the Italian Digital Agenda are achieved and contributing to the spread of the use of information and communication technologies, favoring innovation and economic growth.[78] In this regard, AgID has a strategic role in the promotion of Innovation Procurement:[79]

- It promotes the definition and development of large strategic research and innovation projects connected to the creation of the Italian Digital Agenda.
- It manages the center of territorial competence on innovation procurement in support of Italian public administrations. I.e., it acts as public innovation procurement broker.
- It can also play an auxiliary role as a commissioning station for the execution of innovation contracts, in favor of the Regions and other public administrations that request it.

On its side, the National Anti-Corruption Authority (*Autorità Nazionale Anticorruzione - ANAC*) exercises a supervisory role on public contracts at national level and implements soft regulations regarding PP, including innovation public procurement.[80]

Also at national level, the national purchasing body, CONSIP[81], participates in the EU-funded project Procure2Innovate, which aimed to set up a Competence Centre in Italy.[82]

At regional level, the Lombardy region has taken a leading role on innovation public procurement in the health sector. A good example is the PCP pilot in Niguarda Hospital that took place in 2012.

In the Puglia region the public authority launched a specific programme on the precommercial public procurement strategy and one of the addressed topics (e.g. water resources treatment) has also been promoted at European level within the "*Pilot Action on Strategic Public Procurement*" initiative founded

[76] See the Guidelines on the acquisition and reuse of software for public administrators.

[77] See more information here: https://www.funzionepubblica.gov.it/digitalizzazione/agenda-digitale

[78] See more information here: https://www.agid.gov.it/it. See also Trans-Regional Study On Institutional Frameworks. INTERREG, PPI2INNOVATE. 2017

[79] Moreover, AGID has created a website offering general information about innovation procurement: https://appaltinnovativi.gov.it/

[80] See here for more information: https://www.anticorruzione.it/contratti-pubblici

[81] See here for more information: https://www.consip.it/azienda/chi-siamo

[82] See here and here for more information about the project and its implementation in Italy: https://procure2innovate.eu/italy/ and https://www.consip.it/innovazione/esperienze-internazionali/procurement-dell-innovazione

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by DG-REGIO and Managed by the Organization for Security and Co-Operation in Europe (OCSE) Public Procurement Unit - Public Governance Directorate. [83] [84] [85]

However, there is no national action plan, nor specific spending target for innovation procurement at national level.

Joint Procurement legal framework

Article 62 of the new Code, enacted by *Decreto Legislativo n.36* of March 2023, regulates the aggregation and centralization of procurement. Similar to the replaced *Decreto Legislativo 18 aprile 2016 n. 50* the measures aim to rationalise and make public procurement more efficient and benefit from economies of scale. Only "authorised" public authorities can award contracts over certain

[83] ERDF Fund funded program "*OpenLabs* " within "*Programma regionale a sostegno della specializzazione intelligente e della sostenibilità sociale ed ambientale*". See here the Pin for the OMC: http://www.empulia.it/pcp/SitePages/openlabs.aspx

[84] See here more information about how DG REGIO is financing a pilot project to offer practical "hands-on" support to five contracting and/or managing authorities in the EU Member States for strategic procurement initiatives in order to promote the use of strategic procurement in the context of Cohesion policy: https://www.oecd.org/gov/public-procurement/country-projects/public-procurement-and-cohesion-policy-objectives/

[85] See here procuring innovation in water management in the context of the experience of the Region of Puglia, Italy: https://www.youtube.com/watch?v=5AGZuyaj7HI&t=140s

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thresholds.[86] The national CPB is CONSIP, as above mentioned, but at regional and local level there are currently 32 CPBs.[87]

[86] See new Article 62 (*Aggregazioni e centralizzazione delle committenzex*).

1. Tutte le stazioni appaltanti, fermi restando gli obblighi di utilizzo di strumenti di acquisto e di negoziazione previsti dale vigenti disposizioni in materia di contenimento della spesa, possono procedere direttamente e autonomamente all'acquisizione di furniture e servizi di importo non superiore alle soglie previste per gli affidamenti diretti, e all'affidamento di lavori d'importo pari o inferiore a 500.000 euro, nonche' attraverso l'effettuazione di ordini a valere su strumenti di acquisto messi a disposizione dale centrali di committenza qualificate e dai soggetti aggregatori.

2. Per effettuare le procedure di importo superiore alle soglie indicate dal comma 1, le stazioni appaltanti devono essere qualificate ai sensi dell'articolo 63 e dell'allegato II.4. Per le procedure di cui al primo periodo, l'ANAC non rilascia il codice identificativo di gara (CIG) alle stazioni appaltanti non qualificate.

3. L'allegato di cui al comma 2 indica i requisiti necessari per ottenere la qualificazione e disciplina i requisiti premianti. In sede di prima applicazione del codice, l'allegato II.4 e' abrogato a decorrere dalla data di entrata in vigore di un corrispondente regolamento adottato ai sensi dell'articolo 17, comma 3, della legge 23 agosto 1988, n. 400, con decreto del Presidente del Consiglio dei ministri, su proposta del Ministro delle infrastrutture e dei trasporti sentita l'ANAC, previa intesa in sede di Conferenza unificata, che lo sostituisce integralmente anche in qualita' di allegato al codice.

5. Le stazioni appaltanti qualificate, fatto salvo quanto previsto al comma 1 del presente articolo e al comma 8 dell'articolo 63,possono:
a) effettuare, in funzione dei livelli di qualificazione posseduti gare di importo superiore alle soglie indicate al comma 1 del presente articolo;
b) acquisire lavori, servizi e forniture avvalendosi di una centrale di committenza qualificata;
c) svolgere attivita' di committenza ausiliaria ai sensi del comma 11;
d) procedere mediante appalto congiunto ai sensi del comma 14;
e) procedere mediante utilizzo autonomo degli strumenti telematici di negoziazione messi a disposizione secondo la normativa vigente dalle centrali di committenza qualificate;
f) procedere all'effettuazione di ordini su strumenti di acquisto messi a disposizione dalle centrali di committenza anche per importi superiori ai livelli di qualificazione posseduti, con preliminare preferenza per il territorio regionale di riferimento. Se il bene o il servizio non e' disponibile o idoneo al soddisfacimento dello specifico fabbisogno della stazione appaltante, oppure per ragioni di convenienza economica, la stazione appaltante puo' agire, previa- motivazione, senza limiti territoriali;
g) eseguono i contratti per conto delle stazioni appaltanti non qualificate nelle ipotesi di cui al comma 6, lettera g).

6. Le stazioni appaltanti non qualificate ai sensi del comma 2 dell'articolo 63, fatto salvo quanto previsto dal comma 1 del presente articolo:
a) procedono all'acquisizione di forniture, servizi e lavori ricorrendo a una centrale di committenza qualificata;
b) ricorrono per attivita' di committenza ausiliaria di cui all'articolo 3, comma 1, lettera z), dell'allegato I.1 a centrali di committenza qualificate e a stazioni appaltanti qualificate;
c) procedono ad affidamenti per servizi e forniture di importo inferiore alla soglia europea di cui ai commi 1 e 2 dell'articolo 14 nonche' ad affidamenti di lavori di manutenzione ordinaria d'importo inferiore a 1 milione di euro mediante utilizzo autonomo degli strumenti telematici di negoziazione messi a disposizione dalle centrali di committenza qualificate secondo la normativa vigente;
d) effettuano ordini su strumenti di acquisto messi a disposizione dalle centrali di committenza qualificate e dai soggetti aggregatori, con preliminare preferenza per il territorio regionale di riferimento. Se il bene o il servizio non e' disponibile o idoneo al soddisfacimento dello specifico fabbisogno della stazione appaltante, oppure per ragioni di convenienza economica, la stazione appaltante puo' agire, previa motivazione, senza limiti territoriali;
e) eseguono i contratti per i quali sono qualificate per l'esecuzione;
f) eseguono i contratti affidati ai sensi delle lettere b) e c);
g) qualora non siano qualificate per l'esecuzione, ricorrono a una stazione appaltante qualificata, a una centrale di committenza qualificata o a soggetti aggregatori; in tal caso possono provvedere alla nomina di un supporto al RUP della centrale di committenza affidante.

7. Le centrali di committenza sono indicate nella specifica sezione di cui all'articolo 63, comma 1. In relazione ai requisiti di qualificazione posseduti esse:
a) progettano, aggiudicano e stipulano contratti o accordi quadro per conto delle stazioni appaltanti non qualificate;
b) progettano, aggiudicano e stipulano contratti o accordi quadro per conto delle stazioni appaltanti qualificate;
c) progettano, aggiudicano e stipulano convenzioni e accordi quadro ai quali le stazioni appaltanti qualificate e non qualificate possono aderire per l'aggiudicazione di propri appalti specifici;

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The Italian law expressly allows public authorities, contracting authorities/entities to resort to a Central Purchasing Body located in another Member State. Nevertheless, this recourse is limited to the acquisition of supplies and/or services and not for the award of public contracts or the conclusion of

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d) istituiscono e gestiscono sistemi dinamici di acquisizione e mercati elettronici di negoziazione;
e) eseguono i contratti per conto delle stazioni appaltanti non qualificate nelle ipotesi di cui al comma 6, lettera g).
1. L'allegato II.4 puo' essere integrato con una disciplina specifica sul funzionamento e sugli ambiti di riferimento delle centrali di committenza, in applicazione dei principi di sussidiarieta', differenziazione e adeguatezza.
2. Il ricorso alla stazione appaltante qualificata o alla centrale di committenza qualificata e' formalizzato mediante un accordo ai sensi dell'articolo 30 del testo unico delle leggi sull'ordinamento degli enti locali, di cui al decreto legislativo 18 agosto 2000, n. 267, o ai sensi dell'articolo 15 della legge 7 agosto 1990, n. 241, o mediante altra modalita' disciplinante i rapporti in funzione della natura giuridica della centrale di committenza. Fermi restando gli obblighi per le amministrazioni tenute all'utilizzo degli strumenti di acquisto e negoziazione messi a disposizione dai soggetti aggregatori, le stazioni appaltanti qualificate e le centrali di committenza qualificate possono attivare convenzioni cui possono aderire le restanti amministrazioni di cui all'articolo 1 del decreto legislativo 30 marzo 2001, n. 165, indipendentemente dall'ambito territoriale di collocazione della stazione appaltante o centrale di committenza qualificata.

(…)

The replaced procurement law stated in Article Art. 66 *(Consultazioni preliminari di mercato)*

Art. 37 (Aggregazioni e centralizzazione delle committenze)

"1. Le stazioni appaltanti, fermi restando gli obblighi di utilizzo di strumenti di acquisto e di negoziazione, anche telematici, previsti dalle vigenti disposizioni in materia di contenimento della spesa, possono procedere direttamente e autonomamente all'acquisizione di forniture e servizi di importo inferiore a 40.000 euro e di lavori di importo inferiore a 150.000 euro, nonchè attraverso l'effettuazione di ordini a valere su strumenti di acquisto messi a disposizione dalle centrali di committenza ((e dai soggetti aggregatori)). Per effettuare procedure di importo superiore alle soglie indicate al periodo precedente, le stazioni appaltanti devono essere in possesso della necessaria qualificazione ai sensi dell'articolo 38.

2. Salvo quanto previsto al comma 1, per gli acquisti di forniture e servizi di importo superiore a 40.000 euro e inferiore alla soglia di cui all'articolo 35, nonchè per gli acquisti di lavori di manutenzione ordinaria d'importo superiore a 150.000 euro e inferiore a 1 milione di euro, le stazioni appaltanti in possesso della necessaria qualificazione di cui all'articolo 38 ((nonchè gli altri soggetti e organismi di cui all'articolo 38, comma 1)) procedono mediante utilizzo autonomo degli strumenti telematici di negoziazione messi a disposizione dalle centrali di committenza qualificate secondo la normativa vigente. In caso di indisponibilità di tali strumenti anche in relazione alle singole categorie merceologiche, le stazioni appaltanti operano ai sensi del comma 3 o procedono mediante lo svolgimento di ((procedure di cui al)) presente codice.

3. Le stazioni appaltanti non in possesso della necessaria qualificazione di cui all'articolo 38 procedono all'acquisizione di forniture, servizi e lavori ricorrendo a una centrale di committenza ovvero mediante aggregazione con una o più stazioni appaltanti aventi la necessaria qualifica. (…)

7. Le centrali di committenza possono:

a) aggiudicare appalti, stipulare ed eseguire i contratti per conto delle amministrazioni aggiudicatrici e degli enti aggiudicatori;

b) stipulare accordi quadro ai quali le stazioni appaltanti qualificate possono ricorrere per l'aggiudicazione dei propri appalti;

c) gestire sistemi dinamici di acquisizione e mercati elettronici.

13. Le stazioni appaltanti possono ricorrere ad una centrale di committenza ubicata in altro Stato membro dell'Unione europea solo per le attività di centralizzazione delle committenze svolte nella forma di acquisizione centralizzata di forniture e/o servizi a stazioni appaltanti; la fornitura di attività di centralizzazione delle committenze da parte di una centrale di committenza ubicata in altro Stato membro è effettuata conformemente alle disposizioni nazionali dello Stato membro in cui è ubicata la centrale di committenza.(…)

[87] See here the 32 entities, including Consip, 19 regional CPBs, 2 Autonomous Provinces, 8 Metropolitan Cities and 2 Provinces: Microsoft Word - Delibera n. 643 del 22 settembre 2021.docx (acquistinretepa.it). CONSIP purchases in the fields of food and catering services, furnishing and accessories, events and communications, energy, management of building, IT and communications for offices, works, waste, healthcare and research, services for the Public Administration, GPP and management of the territory and vehicles and mobility.

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framework agreements for works, supplies or services (i.e., intermediary activity). This can constitute a barrier to cooperation and the opening of markets.

The new Code enacted by Decreto Legislativo n. 36 of March 2023, as well as the replaced *Decreto Legislativo 18 aprile 2016 n. 50,* defines cross border joint procurement in its two modalities: institutionalised (as above mentioned, resorting to CPBs from other MS under limited circumstances) and occasional.[88]

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[88] See new Article Art. 64. *(Appalti che coinvolgono stazioni appaltanti di Stati membri diversi)*

1. Le stazioni appaltanti possono rivolgersi a centrali di committenza ubicate in un altro Stato membro dell'Unione europea che svolgono la propria attività in conformità alle disposizioni nazionali dello Stato membro in cui sono ubicate.

2. Amministrazioni ed enti di diversi Stati membri possono congiuntamente aggiudicare un appalto pubblico, concludere un accordo quadro o gestire un sistema dinamico di acquisizione tramite accordi che determinino:

a) la disciplina nazionale applicabile;
b) le responsabilità delle parti;
c) le modalità di gestione della procedura e i termini di stipulazione dei contratti e di esecuzione dei lavori, delle forniture o dei servizi.

3. Se più amministrazioni di diversi Stati membri hanno istituito un soggetto congiunto comprendendo i gruppi europei di cooperazione territoriale di cui al regolamento (CE) n. 1082/2006 del Parlamento europeo e del Consiglio, del 5 luglio 2006 o altri soggetti istituiti in base al diritto dell'Unione europea, stabiliscono con apposito accordo che alle relative procedure di appalto si applichino, in alternativa:

a) le disposizioni nazionali dello Stato membro nel quale il soggetto congiunto ha la sua sede sociale;
b) le disposizioni nazionali dello Stato membro in cui il soggetto congiunto esercita le sue attività.

4. In base a quanto stabilito nell'atto costitutivo del soggetto congiunto, gli accordi del presente articolo possono applicarsi per un periodo indeterminato o a una generalità di appalti, oppure essere limitati a un periodo determinato, ad alcuni tipi di appalti o ad una o più aggiudicazioni di singoli appalti.

The replaced procurement law stated in Art. 43 (Appalti che coinvolgono amministrazioni aggiudicatrici e enti aggiudicatori di Stati membri diversi)

"1. Le amministrazioni aggiudicatrici o gli enti aggiudicatori possono ricorrere a centrali di committenza ubicate in un altro Stato membro dell'Unione europea che svolgono la propria attività in conformità alle disposizioni nazionali dello Stato membro in cui è ubicata, nei limiti previsti dall'articolo 37, comma 13.

2. Le amministrazioni aggiudicatrici o gli enti aggiudicatori possono aggiudicare un appalto pubblico, concludere un accordo quadro o gestire un sistema dinamico di acquisizione congiuntamente con le amministrazioni aggiudicatrici o gli enti aggiudicatori di diversi Stati membri concludendo un accordo che determina:

a) le responsabilità delle parti e le disposizioni nazionali applicabili;

b) la gestione della procedura di aggiudicazione, la distribuzione dei lavori, delle forniture e dei servizi oggetto dell'appalto e i termini di conclusione dei contratti. L'assegnazione delle responsabilità e il diritto nazionale applicabile sono indicati nei documenti di gara degli appalti pubblici aggiudicati congiuntamente.

3. Se una o più amministrazioni aggiudicatrici o uno o più enti aggiudicatori nazionali hanno costituito con amministrazioni aggiudicatrici o enti aggiudicatori di diversi Stati membri un soggetto congiunto con i gruppi europei di cooperazione territoriale di cui al regolamento (CE) n. 1082/2006 del Parlamento europeo e del Consiglio [1], o con altri soggetti istituiti in base al diritto dell'Unione europea, con apposito accordo stabiliscono le norme nazionali applicabili alle procedure d'appalto di uno dei seguenti Stati membri:

a) Stato membro nel quale il soggetto congiunto ha la sua sede sociale;

b) Stato membro in cui il soggetto congiunto esercita le sue attività.

4. L'accordo ai sensi del presente articolo è applicabile per un periodo indeterminato, quando è fissato nell'atto costitutivo del soggetto congiunto ovvero può essere limitato a un periodo determinato, ad alcuni tipi di appalti o a singoli appalti."

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Regarding joint cross-border procurement, the new Code refers to procurements involving contracting authorities from different Member States:

1. Contracting authorities or entities may turn to central purchasing bodies located in another Member State of the European Union which carry out their activities in compliance with the national provisions of the Member State in which they are located.

2. Administrations and entities from different Member States may jointly award a public contract, conclude a framework agreement or operate a dynamic purchasing system through agreements that determine: a) the applicable national legislation; b) the responsibilities of the parties; c) the procedures for managing the procedure and the terms for stipulating contracts and for executing works, supplies or services.

Concluding remarks

A new Code of public contracts enacted by *Decreto Legislativo n.36* of 31 March 2023, entered in force in Italy on 1st April 2023. One main strength of the Italian procurement legal framework is that it specifically defines PCP and exempts it from its scope of its application. Additionally, in Italy, Innovation Procurement is embedded at national and regional level.

The new Italian law defines Preliminary Market Consultations and public authorities, contracting authorities/entities have experience implementing this instrument. The Italian law includes provisions on cross border joint procurement in its two modalities: institutionalised and occasional. Nevertheless, there is a limitation to the recourse to the CPBs of other MS that should be considered.

The Italian legal framework does not define the allocation of IPRs. It is for the public authority, contracting authority/entity to specify clearly the IPR allocation in its tender documents so that it stimulates innovation. Since PCP is referred as such in the new Code, it can be understood that the guidelines on IPR of the Communication from the Commission: Pre-commercial Procurement: Driving innovation to ensure sustainable high quality public services in Europe, applies in the sense that the IPR ownership remains with the contractor while the contracting authority retains usage and rights to require the contractors to give licenses to third parties.

In addition, the Guidelines on the acquisition and reuse of software for public administrations establish that public administrations owner of software have the obligation to make the relevant source code available, complete with documentation and released in a public repository under an open licence, for use free of charge for other public administrations or for legal entities wishing to adapt them to their own requirements, except when there are 'justified reasons of public order and safety, national defence and electoral consultations'.

Innovation Procurement legal framework

- Decreto Legislativo 31 marzo 2023 n. 36. → **DEFINES PCP +** Article 135 EXCLUDES the purchase of R&D services of its scope (PCP).
- Market Consultations → YES!
- Subcontracting → YES!
- IPR allocation to contractor by law → INDIRECTLY (referal to 2007 PCP Communication)
- National/regional Innovation structure → YES!
- National policy to stimulate PCP → NO
- Spending target for IP → NO

Joint Procurement legal framework

- Joint procurement regulated at national and international level.
- Institutionalized and occasional joint cross border
- CPB: CONSIP + regional and local level 32 CPBs

Conclusions

- CLEAR EXCLUSION OF PCP of the scope of the Italian law + **Definition of PCP**
- Inclination for IP
- Default IPR regime INDIRECTLY favours innovation. There are Guidelines for the software owned by public administrations which needs to be shared under open licenses.

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4.7. Lithuania

Innovation Procurement legal framework

In Lithuania, public procurement is regulated in the Law on Public Procurement (*Lietuvos Respublikos viešųjų pirkimų įstatymo Nr. I-1491 pakeitimo įstatymas*).[89] This law defines innovation and gives a ground to implement PCP, by exempting from its application the purchase of R&D services under certain conditions.[90] Additionally, in the field of PCP, there are three important legal documents regulating the purchase of R&D services:

- Decree No 709 of the Government of the Republic of Lithuania of 1 July 2015 on the Approval of the Procedures for Pre-commercial Procurement.[91] This decree provides an official definition of Pre-commercial procurement.
- Resolution No VII-85 of the Research Council of Lithuania of 21 November 2011 on the Approval of the Procedures for the Evaluation of the Technical Part of the R&D Supplies, and the Selection of the R&D Services and the Suppliers of such Services.
- Decree No 772 of the Government of the Republic of Lithuania of 22 April 2011 on the Approval of the Procedures for Procurement of R&D Services other than those where the Benefits Accrue Exclusively to the Contracting Authority for its Use in the Conduct of its own Affairs, on Condition that the Services Provided are Wholly Remunerated by the Contracting Authority.

The Law on Public Procurement regulates Preliminary Market Consultations in its Article 27. Since January 2022, the implementation Of Preliminary Market Consultations is mandatory in certain cases.

The public authority, contracting authority/entity may request the advice of independent experts, institutions or market participants, as long as this advice does not distort competition. The invitation to the Preliminary Market Consultation must be published in the Lithuanian Central Public Procurement Information System. Additionally, the public authority, contracting authority/entity may publish in advance the draft technical specifications in this system. They can publish this information by other means, as long as the information provided is identical to the one provided mandatory publication in the Lithuanian Central Public Procurement Information System. Nevertheless, the use of this mechanism in practice is not widespread.

The Law on Public Procurement defines subcontracting and regulates it.[92] Public authorities, contracting authorities/entities must ask participants in their tender documentation to indicate which part of the contract they intend to subcontract and to which subcontractors, if possible.[93] This is an interesting point of the regulation, because usually public authorities, contracting authorities/entities can request this information, but are not mandated to do so. In addition, public authorities, contracting authorities/entities may decide to pay directly to these subcontractors.

[89] The literal translation is: Law on the Amendment of the Law of the Republic of Lithuania on Public Procurement No I-1491. Please find here the full text: https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/b63962122fcb11e79f4996496b137f39

[90] See Article 2(14) and 15. The latter is the basis for the legal text on PCP.

[91] This document collects the requirements included in the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Pre-commercial Procurement: Driving innovation to ensure sustainable high quality public services in Europe. Brussels, 14.12.2007. COM(2007) 799 final. See here the full text: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0799:FIN:EN:PDF. See here for an overview of innovation procurement and in particular PCP in Lithuania: https://ec.europa.eu/information_society/newsroom/image/document/2015-50/lithuania_12535.pdf

[92] See Article 2(45) and 88.

[93] In any case, the contractor will have to inform no later than the starting date of the execution of the contract about the names, contact details and representatives of the subcontractors, and inform about any changes during the execution of the contract.

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There is no default scenario for the distribution of IPR rights in Lithuania. Tender documents must define how IPRs will be allocated between the public authority, contracting authority/entity and the contractor.

According to the Lithuanian copyright law[94] copyrights belong in an inalienable way to the creator (cannot be waived, licensed or assigned to anyone else). Only the economic rights can be transferred, assigned or licensed by the creator to another person/entity. Latvian copyright law determines that for commissioned works the author retains copyright and the commissioning party obtains either a license to use the commissioned work or - if required in the contract – a transfer of economic rights at equitable payment. The tender documents need to clearly specify which economic rights (e.g. licensing, publication, modification, reproduction rights) owned by the creator (sub) contractor the procurer needs to obtain. Copyright law protects also scientific work, software and database rights.

The Ministry of Economy and Innovation is responsible for public procurement, and its main tasks are to:

1. Establish the state policy in the following areas: public procurement, procurement carried out by a procuring entity operating in the special sectors (water management, energy, transport or postal services) and procurement carried out in the field of defense and security.
2. Participate in the drafting and implementation of EU policy in the field of public procurement.
3. Prepare and/or participate in the preparation of drafts of legal acts regulating public procurement.
4. To implement the rights and duties of the owner of the public institution CPO LT, which manages centralized procurement.[95]

The Public Procurement Office (PPO) was established in 1996 and implements and supervises public procurement policy and supervises compliance with the Law on Public Procurement and related legal framework.

The Agency for Science, Innovation and Technology (MITA) was established in 2010 and is the national competence centre for Innovation Procurement.[96] It provides assistance to public authorities, contracting authorities/entities and contractors, gets financial support for research and innovation projects, coordinates national activities and international programmes in the fields of research, technological development and innovation, promotes the commercialisation of the results of research and the protection of Intellectual Property Rights (IPR), among other tasks related to the promotion of innovation in Lithuania.[97]

The Lithuanian Business Support Agency (LVPA) was Established by the Ministry of Economy and Innovation, and manages EU funds. Its goals are to promote sustainable economic development based on scientific knowledge, advanced technologies and innovation, and increase the country's international competitiveness.[98] To do so it aims at improving the management of projects, programs and project portfolios in Lithuanian business, the public sector and non-governmental organisations.

The Innovation Agency Lithuania is the official public agency responsible for the development of the innovation ecosystem and the promotion of innovation at all stages of business development.[99]

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[94] Find here the full document: https://wipolex.wipo.int/en/text/128571

[95] See here for more information: https://vpt.lrv.lt/en/about-ppo/public-procurement-office

[96] For more information about MITA in English, see here: https://mita.lrv.lt/en/

[97] See here for more information: https://mita.lrv.lt/en/about-mita/who-we-are

[98] See here for more information: https://lvpa.lt/en/veikla

[99] For more information in English see here: https://innovationagency.lt/

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Lithuania does not have an action plan specifically dedicated to Innovation Procurement, but it does have an innovation public procurement target: [100] set at 20% of the value of all PP in the country needs to go to Innovation Procurement by the year 2030.[101] It also proposes specific actions to reach that goal: the establishment of a national Lithuanian Innovation procurement competence centre, financial support for Innovation Procurement for contracting authorities, more staff working at the Innovation Agency (above mentioned) that works on Innovation Procurement and new guidelines and templates for Public Procurement.

Joint Procurement legal framework

The Law on Public Procurement regulates joint procurement at national and European level.[102] It allows public authorities, contracting authorities/entities to use the services of centralised procurement activities of a central procurement organisation operating in another MS, to participate in occasional cross border PP and to participate in institutionalised joint cross border procurement.

The law also regulates CPBs and makes its use mandatory for certain goods, services and works.[103] The Central Purchasing Organisation (CPO), created in 2013, is in charge of centralised purchases on behalf of contracting authorities at both national and local levels.[104]

Concluding remarks

Lithuania is clearly interested in implementing Innovation Procurement and in particular its PCP modality, as demonstrated by several policies and programs (e.g., the Lithuanian innovation development programme 2014–2020). Moreover, it has a national competence centre for innovation procurement and an innovation procurement spending target.

Additionally, the legal framework not only excludes the purchase of R&D from its scope, but expressly defines PCP. This makes it a good MS to implement a PCP.

It also regulates in detail Preliminary Market Consultation (although they are not widely used), subcontracting and joint cross border procurement.

Nevertheless, there is not a default scenario for the allocation of IPRs.

[100] Lithuania Country Profile. The strategic use of Public Procurement for Innovation in the Digital Economy. Smart 2016/0040

[101] See here: https://digital-strategy.ec.europa.eu/en/news/lithuania-sets-20-target-innovation-procurement

[102] See Article 84 and 85.

[103] The number of categories of goods, works or services available has increased from 14 to 71 in the period from 2013 to 2021.

[104] See here for more information: https://www.cpo.lt/en/eu-support/. Here you can find the CPO catalogue: https://katalogas.cpo.lt/katalogas/

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Innovation Procurement legal framework

- Law on Public Procurement + Decree No 709 → **DEFINES PCP +** Article 2(14) and 15 EXCLUDE the purchase of R&D services of its scope (PCP).
- Market Consultations → YES (mandatory in certain cases)
- Subcontracting → YES!
- IPR allocation to contractor by law → NO (in tender documents)
- National /regional Innovation structure → YES!
- National policy to stimulate PCP → NO
- Spending target for IP → YES!

Joint Procurement legal framework

- Joint procurement regulated at national and international level.
- Institutionalized and occasional joint cross border
- CPB: Central Purchasing Organisation

Conclusions

- CLEAR EXCLUSION OF PCP of the scope of the Lithuanian law + **Definition of PCP**
- Strong inclination for IP
- Default IPR regime DOES NOT favour innovation

4.8. Netherlands

Innovation Procurement legal framework

The *Aanbestedingswet 2012*, modified the 22nd of June 2016, transposes Directives 2014/23/EU, 2014/24/EU and 2014/25/EU to the Dutch national legislation.[105] This law does not explicitly mention PCP, PPI or Innovation Procurement, but the purchase of R&D services where the results and the costs are shared between the public authority, contracting authority/entity and the contractor, is exempted from its scope of application.[106] This would be the legal basis to implement a PCP under the Dutch legislation.

The *Aanbestedingswet 2012* expressly mentions the possibility to conduct a Preliminary Market Consultation prior to the launch of the procurement procedure.[107] It is important to highlight that, even though the regulation is relatively scarce in comparison to other national legislations, the Netherlands is the EU MS that uses this instrument the most and has, as a consequence, an extensive experience in the deployment of Preliminary Market Consultations.[108]

There are not any specific mandatory provisions according to the Dutch procurement law that could limit the subcontracting under a PCP procedure. However, the *Aanbestedingswet 2012* allows the public authority, contracting authority/entity to request the bidder an indication of which part of the contract will be performed by subcontractors and the identification of the proposed subcontractors, as well as their information (such as name, contact data, legal representative), information about changes in these subcontractors, a declaration that bidders will not engage subcontractors under exclusion grounds and/or a declaration signed by the selected subcontractors that they are not under any exclusion ground. The public authority, contracting authority/entity can also foresee in the contract an obligation for the supplier to replace those subcontractors on whom an exclusion ground has become applicable and/or

[105] See here the full text: https://wetten.overheid.nl/BWBR0032203/2022-03-02

[106] ***Artikel 2.24:*** *In afwijking van de artikelen 2.1 tot en met 2.6a is het bepaalde bij of krachtens deel 2 van deze wet niet van toepassing op overheidsopdrachten voor diensten: g. betreffende onderzoek en ontwikkeling, met uitzondering van opdrachten die vallen onder de CPV-codes, genoemd in artikel 14, aanhef, van richtlijn 2014/24/EU en waarvan de resultaten in hun geheel bestemd zijn voor de aanbestedende dienst voor gebruik ervan in de uitoefening van zijn eigen werkzaamheden, mits de dienstverlening volledig door de aanbestedende dienst wordt betaald.*

[107] ***Artikel 2.25****: De aanbestedende dienst past voor het plaatsen van een overheidsopdracht één van de procedures in deze afdeling, al dan niet na marktconsultatie toe.*

[108] The Netherlands Country Profile. The strategic use of Public Procurement for Innovation in the Digital Economy. Smart 2016/0040

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to deliver proof (certificates, declarations etc.) regarding the non-applicability of the exclusion grounds on the subcontractors.[109]

There are no mandatory IPR requirements stemming from the Dutch national legislation applicable to PCP in particular. Nevertheless, the General Government Terms and Conditions for Public Service Contracts (ARVODI-2018) state that all IPR rights belong to the contracting authority, unless otherwise specified in the procurement contract.[110] In other words, it is for the public authority, contracting authority/entity to decide in the tender documentation and on a case-by-case basis how to allocate the IPRs in a PCP. The Netherlands has a broad experience on Innovation Procurement.[111] Moreover, innovation is indirectly embedded in the *Aanbestedingswet* 2012.[112]

Currently, the Rijkswaterstaat - the executive agency of the Ministry of Infrastructure and Water Management - has developed the Innovation Agenda 2030, in which it distinguishes four aspects: (1) Replacement and Renovation, (2) Climate neutral and Circular, (3) Smart Mobility and Data and (4) Information Provision which must be tacked via innovative solutions and with the support of market parties.[113]

The Dutch national competence centre for public procurement, PIANOo, also focusses on Innovation Procurement and incentivises government bodies to aim at innovation in their procurement procedures.[114]

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[109] See Article 2.79 of the *Aanbestedingswet 2012.*

[110] Besluit vaststelling Algemene Rijksvoorwaarden voor inkoop (ARBIT-2018, ARIV-2018 en ARVODI-2018). See here the full text.

Artikel 24. Intellectuele eigendomsrechten

24.1.Tenzij anders overeengekomen komen alle auteursrechten die kunnen worden uitgeoefend – waar en wanneer dan ook – ten aanzien van de resultaten van de verrichte Diensten toe aan Opdrachtgever. Deze intellectuele eigendomsrechten worden op grond van de Overeenkomst door Opdrachtnemer op het moment van het ontstaan daarvan aan Opdrachtgever overgedragen, welke overdracht door Opdrachtgever reeds nu voor alsdan wordt aanvaard.

24.2.Alle databankenrechten die kunnen worden uitgeoefend – waar en wanneer dan ook – ten aanzien van de resultaten van de verrichte Diensten komen toe aan Opdrachtgever. Deze intellectuele eigendomsrechten worden op grond van de Overeenkomst door Opdrachtnemer op het moment van het ontstaan daarvan aan Opdrachtgever overgedragen, welke overdracht door Opdrachtgever reeds nu voor alsdan wordt aanvaard.

24.3.Voor zover de resultaten van de verrichte Diensten (mede) tot stand komen met gebruikmaking van reeds bestaande, niet aan Opdrachtgever toekomende intellectuele eigendomsrechten, verleent Opdrachtnemer aan Opdrachtgever een niet-exclusief en niet opzegbaar gebruiksrecht van onbepaalde duur. Opdrachtnemer garandeert in dat geval gerechtigd te zijn tot het verlenen van vorenbedoeld gebruiksrecht. (…)

24.6.Opdrachtnemer doet hierbij afstand jegens Opdrachtgever van alle eventueel aan hem, Opdrachtnemer, toekomende zogenoemde persoonlijkheidsrechten als bedoeld in de Auteurswet, in de mate als de toepasselijke regelgeving zodanige afstand toelaat. Opdrachtnemer doet, hiertoe gevolmachtigd, ook namens het Personeel van Opdrachtnemer, afstand jegens Opdrachtgever van alle eventueel aan deze personen toekomende persoonlijkheidsrechten, in de mate waarin de toepasselijke regelgeving zodanige afstand toelaat. (…)

[111] Netherlands Country Profile. The strategic use of Public Procurement for Innovation in the Digital Economy. Smart 2016/0040. P.580.

[112] ***Artikel 2.80***

1 Een aanbestedende dienst kan bijzondere voorwaarden verbinden aan de uitvoering van een overheidsopdracht, mits dergelijke voorwaarden verband houden met het voorwerp van de opdracht en in de aankondiging of de aanbestedingsstukken vermeld zijn. De voorwaarden waaronder de overheidsopdracht wordt uitgevoerd, kunnen verband houden met economische, innovatiegerelateerde, arbeidsgerelateerde, sociale of milieuoverwegingen.

[113] See here the full text: https://rwsinnoveert.nl/

[114] See here for more information: https://www.pianoo.nl/nl/themas/innovatie

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Finally, it is relevant to mention that the Netherlands has an action plan and spending target for Innovation Procurement. Moreover, there are several PCPs deployed by individual procuring authorities with their own funding.[115]

Joint Procurement legal framework

The *Aanbestedingswet 2012* explicitly allows contracting authorities to conduct ad-hoc joint procurement with procurement entities from other EU Member States.[116] The Law mandates the public authority, contracting authority/entity to conclude a joint procurement agreement with the other entities, which outlines the roles and responsibilities of each participant and the national legislation that will be applicable to the joint procurement. Moreover, the law explicitly states that the contracting authority will have to fulfil its obligations even if the joint procurement falls under the responsibility and jurisdiction of another EU Member State's contracting authority.

Concluding remarks

The Dutch public procurement legislation would be a good choice for the subsequent PCP, as it offers a very flexible framework. Not only R&D is excluded, but there is also existing case law on the matter. Moreover, the Netherlands has experience in PCP cases and Innovation Procurement is being

[115] Waterboards are innovation champions in the Netherlands. A good example is the full-blown integrated Big Data PCP & PPI procurement project launched by the Waterschapsbedrijf (Water Board) Limburg (WBL) , which won the EUIPA 2021 awards in the facing societal challenges category. For more information see here: https://eic.ec.europa.eu/dutch-waterschapsbedrijf-limburg-wbl-netherlands_en

[116] ***Artikel 2.11b***

1 Aanbestedende diensten in verschillende lidstaten van de Europese Unie kunnen gezamenlijk een overheidsopdracht plaatsen, een dynamisch aankoopsysteem exploiteren of, met inachtneming van artikel 2.140, eerste lid, een opdracht plaatsen in het kader van de raamovereenkomst of het dynamisch aankoopsysteem.

2 In een geval als bedoeld in het eerste lid, sluiten de deelnemende aanbestedende diensten een overeenkomst die het volgende bepaalt:

a.de verdeling van verantwoordelijkheden van de partijen en de relevante toepasselijke nationale bepalingen en

b.de interne organisatie van de aanbestedingsprocedure, met inbegrip van het beheer van de procedure, de verdeling van de aan te besteden werken, leveringen of diensten en de sluiting van overeenkomsten,

tenzij deze elementen reeds zijn geregeld door een tussen de betrokken lidstaten van de Europese Unie gesloten internationale overeenkomst.

3 De verdeling van verantwoordelijkheden en de toepasselijke nationale bepalingen, bedoeld in het tweede lid, onderdeel a, worden in de aanbestedingsstukken vermeld. (…)

6 Indien aanbestedende diensten uit verschillende lidstaten van de Europese Unie een gezamenlijke entiteit hebben opgericht, met inbegrip van een entiteit opgericht krachtens het recht van de Europese Unie, komen de deelnemende aanbestedende diensten bij besluit van het bevoegde orgaan van de gezamenlijke organisatie overeen welke nationale aanbestedingsregels van toepassing zijn:

a.de nationale bepalingen van de lidstaat waar de gezamenlijke entiteit zijn statutaire zetel heeft, of

b.de nationale bepalingen van de lidstaat waar de gezamenlijke entiteit zijn activiteiten uitoefent.

7 Een overeenkomst als bedoeld in het zesde lid kan:

a.voor onbepaalde tijd gelden indien de oprichtingsakte van de gezamenlijke entiteit daarin voorziet, of

b.beperkt zijn tot een bepaalde termijn, soorten opdrachten of tot een of meer individuele plaatsingen van opdrachten.

8 Aanbestedende diensten maken geen gebruik van een mogelijkheid als bedoeld in dit artikel met het oogmerk om zich te onttrekken aan voor hen dwingende publiekrechtelijke bepalingen overeenkomstig het recht van de Europese Unie.

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promoted through different initiatives. Another advantage is that cross border joint procurement is clearly regulated.

Nevertheless, the default IPR regime set in the General Government Terms and Conditions for Public Service Contracts (ARVODI)[117] - under which all IPR rights belong to the public authority, contracting authority/entity unless otherwise specified in the procurement contract - is not conducive to innovation and if selected, the tender documents should clearly outline the IPR allocation strategy.

On the other hand, Preliminary Market Consultations prior to launching a procurement procedure are clearly regulated in the Dutch procurement law and public authorities, contracting authorities/entities make extensive use of this tool, which leads to a solid experience in the deployment of Preliminary Market Consultations.

Innovation Procurement legal framework

- Aanbestedingswet 2012 → Article 2.24 EXCLUDES the purchase of R&D services of its scope (PCP).
- Market Consultations → YES!
- Subcontracting → YES
- IPR allocation to contractor by law → NO (in tender documents)
- National /regional Innovation structure → YES!
- National policy to stimulate PCP → YES!
- Spending target for IP → YES!

Joint Procurement legal framework

- Joint procurement regulated at national and international level.
- Institutionalized and occasional joint cross border
- NO CPB

Conclusions

- CLEAR EXCLUSION OF PCP of the scope of the Dutch law
- Strong inclination for IP
- Default IPR regime DOES NOT favour innovation

4.9. Poland

Innovation Procurement legal framework

On January 2021 an amended Public Procurement Law (PPL) came into force in Poland, transposing Directives 2014/24/EU, 2014/25/EU and 2009/81/EC.[118] The PPL defines innovation, but does not define R&D, nor PCP or PPI. However, it provides with a legal basis to implement PCPs, as it exempts from its scope the purchase of R&D services under certain conditions.[119]

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[117] Besluit vaststelling Algemene Rijksvoorwaarden voor inkoop (ARBIT-2018, ARIV-2018 en ARVODI-2018). See here the full text.

[118] See here and here for more information: https://iclg.com/practice-areas/public-procurement-laws-and-regulations/poland and https://www.garrigues.com/en_GB/new/poland-approves-changes-public-procurement-2021

See here the translated version of the PPL: https://www.uzp.gov.pl/__data/assets/pdf_file/0016/50353/PPL_of_2019_as_amended_consolidated_text_2022.pdf.

[119] See Article 7 (6) and 11 (3) respectively. Exactly what the Public procurement Directives state.

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The PPL regulates Preliminary Market Consultations in order to prepare award procedure and inform the economic operators of procurement plans and requirements.[120] Public authorities, contracting authorities/entities may recourse to the advice of experts, public authorities or economic operators. The advice can be used in an upcoming award procedure, as long as it does not distort competition or undermine the principles of equal treatment and transparency.[121] The use of the instrument as a tool to achieve efficiency is increasing since the entering into force of the PPL.

Bearing in mind that PCP is not regulated in the PPL, it is worth noting that it defines subcontracting and regulates it in detail.[122] Public authorities, contracting authorities/entities may ask tenderers in the contract notice to indicate which tasks will be entrusted to subcontractors, to inform immediately of any changes affecting subcontractors that occur during the performance of the contract. These requirements may be stricter in the case of contracts in the field of defence and security.

The PPL does not provide with a default scenario for the distribution of IPR rights between public authorities, contracting authorities/entities and suppliers. The public authority, contracting authority/entity decides in each award procedure and states the conditions in the tender documents.

Polish copyright law determines that copyright ownership belongs in an inalienable way to the creator (cannot be waived, licensed or assigned to anyone else).[123] Only the economic rights can be transferred, assigned or licensed by the creator to another person/entity. To obtain specific economic rights owned by the creator (sub)contractor, the procurer must require in the tender specifications the transfer, assignment or a license of those economic rights (e.g. licensing, publication, modification, reproduction) at equitable payment. Copyright law protects also scientific work, software and database rights.

In Poland, the Public Procurement Office (PPO), established in 1995 is in charge for the implementation of the Innovation Procurement policy.[124] It also raises awareness and enhances the capacity of public procurers in the field of innovation procurement. Other relevant actors in the Innovation Procurement ecosystem are the Ministry of Investment and Development, which is responsible for financing innovations, and the Polish Agency for Entrepreneurship Development (PARP), a government agency under the supervision of this Ministry, supporting innovative entrepreneurs and contractors.

The National Centre for Research and Development (NCBR), an executive agency under the Minister of Science and Higher Education, implements R&D projects (PCP) and manages innovation projects (PPI) with the involvement of public, private and academic partners to address public sector challenges.[125] I.e., NCBR aims to encourage the development of Polish research entities, universities and businesses in order to stimulate innovation.

In January 2022 the Polish government adopted the Purchasing Policy, which came into force in February, 2022.[126] This policy is a part of the Polish public procurement law reform and focuses on aspects connected with the support of the innovation in public procurement.

[120] Poland Country Profile. The strategic use of Public Procurement for Innovation in the Digital Economy. Smart 2016/0040

[121] See Article 84 of the PPL.

[122] See article 409 of the PPL.

[123] See here the full text: https://wipolex.wipo.int/en/text/129378

[124] See here for more information: https://www.uzp.gov.pl/en/role-and-functions

[125] Currently, NCBR is implementing two strategic research and development programmes (Advanced Technologies for Energy Generation and Interdisciplinary System for Interactive Scientific and Scientific Technical Information) and three strategic research projects (Integrated System for Reducing Energy Consumption in the Maintenance of Buildings, Work Safety Optimization in Mines and Safe Nuclear Power Engineering Development Technologies). A programme on "civilization diseases, new medicines and regenerative medicine" is being drafted. See here for more information: https://www.gov.pl/web/ncbr-en/ncbr

[126] The translation of the Purchasing Policy can be found here: https://www.uzp.gov.pl/__data/assets/pdf_file/0012/55110/State_Purchasing_Policy_ENG.pdf. See in particular pages 39 to 41 about Innovation Procurement.

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Joint Procurement legal framework

Joint procurement is regulated in the PPL. Public authorities, contracting authorities/entities can join forces in an institutional or in an occasional manner both at national and at European level. Central Purchasing Bodies are also regulated.[127] Currently, there is one main CPB at the national level (Government Administration Service Centre (COAR)), and there are multiple CPBs at the regional and local level.[128]

Concluding remarks

Poland does not expressly regulate PCP in its public procurement law, but it provides with the legal base to implement PCPs. It also regulates in detail Preliminary Market Consultations (although they are not widely implemented) and subcontracting. Moreover, the NCBR is known in Europe for the implementation of innovation procurement projects and the fact that they followed a well-established procedure/methodology to implement them.

Nevertheless, the country (and its legal framework) does not clearly allocate the IPRs in innovation procurement projects.

Innovation Procurement legal framework

- Public Procurement Law → Articles 7 (6) and 11 (3) EXCLUDE the purchase of R&D services of its scope (PCP).
- Market Consultations → YES!
- Subcontracting → YES
- IPR allocation to contractor by law → NO (in tender documents)
- National /regional Innovation structure → YES!
- National policy to stimulate PCP → INDIRECTLY (Purchasing Policy)
- Spending target for IP → NO

Joint Procurement legal framework

- Joint procurement regulated at national and international level.
- Institutionalized and occasional joint cross border
- CPB: Government Administration Service Centre + at regional and local level

Conclusions

- CLEAR EXCLUSION OF PCP of the scope of the Polish law
- Strong inclination for IP
- Default IPR regime DOES NOT favour innovation

4.10. Slovakia

Innovation Procurement legal framework

Slovakia regulates public procurement in zákon č. *343/2015 Z.z. o verejnom obstarávaní a o zmene a doplnení niektorých zákonov* (hereinafter as Public procurement Act 343/2015) which entered into force

[127] See Articles 43, 44, 45, 46 and 47, 48, 49, 50 and 51 of the PPL

[128] Paweł Nowicki. Chapter 16: Central purchasing bodies: the case of Poland. Centralising Public Procurement-Law 2021. 09 Dec 2021. Here you can find the list of services and supplies provided by COAR: https://centrum.gov.pl/usluga/centralny-zamawiajacy/

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on April 2016. The Act transposed Directives 2014/24/EU, 2014/25/EU and Security and Defence Directive 2009/81/EC.[129]

The law does not define nor PCP, nor PPI, but it does define R&D and provides the legal basis for implementing PCP by exempting from its scope the purchase of R&D services under certain conditions.[130]

The *Public Procurement Act 343/2015* regulates Preliminary Market Consultations in Article 25. Similarly to Directive 2014/24/EU, the exact procedural steps are not defined in the Article, which is basically the exact translation of the respective article of the Directive. The process of Preliminary Market Consultations is therefore governed by methodological acts of the Public Procurement Office (UVO) which are soft law. Nevertheless, public authorities, contracting authorities/entities have a broad margin of discretion when it comes to conducting Preliminary Market Consultations.

Based on the analysis of the Ministry of Interior of the Slovak Republic in the context of the project iProcureNet, Preliminary Market Consultations are used very often by different categories of public authorities, contracting authorities/entities. For example, in the case of Ministry of Interior, this instrument is used at least ten times a year in order to "*asks experts and market operators to offer their contributions in order to elaborate the object of the contract and to define the other features of the procedure*."[131] Public authorities, contracting authorities/entities in Slovakia already have a very good knowledge of different aspects related to engaging the market via Preliminary Market Consultations.

Preliminary Market Consultations are not a novelty in Slovakia. There was already market engagement before they were introduced by the Public Procurement Directives of 2014. But the explicit introduction in the legal framework has formalised and strengthen the use of this instrument, by tackling the concerns and doubts of public authorities, contracting authorities/entities regarding prior dialogue with the market.

The usual steps of Preliminary Market Consultations are illustrated in the following figure.

[129] See here full text: https://www.slov-lex.sk/static/pdf/2015/343/ZZ_2015_343_20200327.pdf

[130] See Article 2(5.l) and Article 1(2.d).

[131] A.M.Lopez, Preliminary market consultations in innovative procurement: A principled approach and incentives for anticompetetive behaviors, in G.M. Racca and Ch.R.Yukins, Joint public procurement and Innovation: Lessons across Borders, Bruylant, 2019, p. 390.

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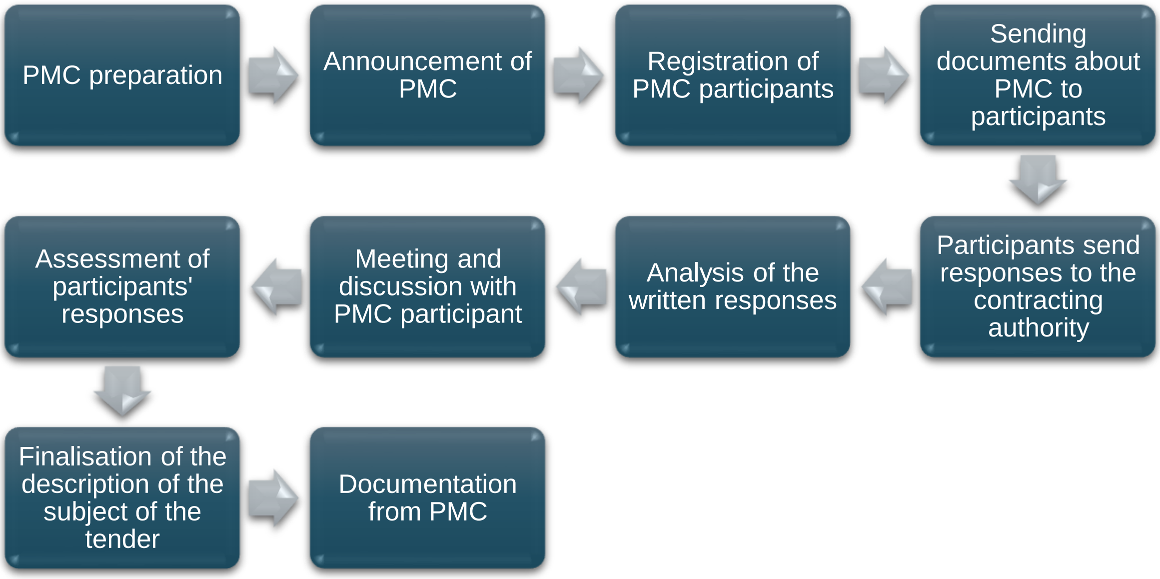

The *Public Procurement Act 343/2015* also regulates in detail the use of subcontractors. The public authorities, contracting authorities/entities may ask the tenderers in the tendering documents to indicate the share of the contract that he intends to award to subcontractors and the proposed subcontractors, who must comply with the selection criteria and not be under any exclusion grounds.[132]

[132] *(1) Verejný obstarávateľ a obstarávateľ môžu v súťažných podkladoch alebo v koncesnej dokumentácii vyžadovať, aby*

a) uchádzač v ponuke uviedol podiel zákazky, ktorý má v úmysle zadať subdodávateľom, navrhovaných subdodávateľov a predmety subdodávok,

b) navrhovaný subdodávateľ spĺňal podmienky účasti týkajúce sa osobného postavenia a neexistovali u neho dôvody na vylúčenie podľa § 40 ods. 6 písm. a) až g) a ods. 7 a 8; oprávnenie dodávať tovar, uskutočňovať stavebné práce alebo poskytovať službu sa preukazuje vo vzťahu k tej časti predmetu zákazky alebo koncesie, ktorý má subdodávateľ plniť.

(2) Ak navrhovaný subdodávateľ nespĺňa podmienky účasti podľa odseku 1 písm. b), verejný obstarávateľ alebo obstarávateľ písomne požiada uchádzača o jeho nahradenie. Verejný obstarávateľ alebo obstarávateľ môže písomne požiadať uchádzača o nahradenie subdodávateľa, ktorý má sídlo v treťom štáte, s ktorým nemá Slovenská republika alebo Európska únia uzavretú medzinárodnú zmluvu zaručujúcu rovnaký a účinný prístup k verejnému obstarávaniu v tomto treťom štáte pre hospodárske subjekty so sídlom v Slovenskej republike; verejný obstarávateľ alebo obstarávateľ musí písomne požiadať uchádzača, ak má subdodávateľ sídlo v treťom štáte, alebo ak ide o zákazku, o ktorých to ustanoví vláda nariadením. Uchádzač doručí návrh nového subdodávateľa do piatich pracovných dní odo dňa doručenia žiadosti podľa prvej vety alebo druhej vety, ak verejný obstarávateľ alebo obstarávateľ neurčil dlhšiu lehotu.

(3) Verejný obstarávateľ a obstarávateľ v súťažných podkladoch alebo v koncesnej dokumentácii vyžadujú, aby úspešný uchádzač v zmluve, rámcovej dohode alebo koncesnej zmluve najneskôr v čase jej uzavretia uviedol údaje o všetkých známych subdodávateľoch, údaje o osobe oprávnenej konať za subdodávateľa v rozsahu meno a priezvisko, adresa pobytu, dátum narodenia.

(4) Verejný obstarávateľ a obstarávateľ sú povinní v návrhu zmluvy, rámcovej dohody alebo koncesnej zmluvy určiť

a) povinnosť dodávateľa oznámiť akúkoľvek zmenu údajov o subdodávateľovi,

b) pravidlá zmeny subdodávateľa a povinnosť dodávateľa oznámiť zmenu subdodávateľa a údaje podľa odseku 3 o novom subdodávateľovi.

(5) Ak verejný obstarávateľ alebo obstarávateľ vyžadoval v súťažných podkladoch alebo v koncesnej dokumentácii, aby navrhovaný subdodávateľ spĺňal podmienky účasti podľa odseku 1 písm. b), vyžadované podmienky musí spĺňať aj nový subdodávateľ.

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If the nature of the contract allows it, the public authorities, contracting authorities/entities may specify that the due amounts will be paid directly to the subcontractor, if the subcontractor so requests.

The Slovakian law does not contemplate a default scenario for the distribution of IPR rights between the public authority, contracting authority/entity and the subcontractor. It is for the public authorities, contracting authorities/entities to clarify in their tender documents the IPR allocation of the contract.

The Slovakian copyright act[133] determines that the entire copyright (both moral and economic rights) belongs in an inalienable way to the creator (both moral and economic rights are non-transferable and may not be waived by the creator). In the case of commissioned work, like in a public tender, (1) the public procurer obtains automatically the right to use the commissioned work but no other rights from the creator and (2) as the creator maintains the entire copyright, he also maintains the right to use and further develop and commercialise the commissioned work. Copyright law protects also scientific work, software and database rights.

The UVO, established in 2000, ensures compliance with the *Public Procurement Act 343/2015*. It participates in EU expert working groups and actively cooperates with foreign partner institutions.[134] Within the UVO, the Working group in Innovation Procurement directly supports contracting authorities to engage in more innovation procurement procedures. However, Slovakia does not have a stand-alone action plan, nor a specific spending target for Innovation Procurement.

Joint Procurement legal framework

The *Public Procurement Act 343/2015* regulates centralised public procurement, occasional joint procurement and cross border joint procurement. The latter, both institutionalised and occasional and in a broad manner.[135]

(6) Ak ide o zákazku na uskutočnenie stavebných prác, zákazku na poskytnutie služby alebo koncesiu, verejný obstarávateľ a obstarávateľ nevyžadujú údaje podľa odsekov 3 a 4 o dodávateľovi tovaru.

(7) Ak to povaha zákazky umožňuje, verejný obstarávateľ alebo obstarávateľ môže v návrhu zmluvy alebo rámcovej dohody určiť, že náležité platby za tovar, stavebné práce alebo služby uhradí priamo subdodávateľovi, ktorý dodal tovar, uskutočnil stavebné práce alebo poskytol služby dodávateľovi, ak o to subdodávateľ požiada. Verejný obstarávateľ alebo obstarávateľ zároveň v návrhu zmluvy alebo rámcovej dohody určí podrobnosti týkajúce sa spôsobu platby subdodávateľovi a vhodný mechanizmus, ktorým umožní dodávateľovi namietať voči nenáležitej platbe subdodávateľovi.

(8) Ustanoveniami odsekov 1 až 7 nie je dotknutá zodpovednosť dodávateľa za plnenie zmluvy ani zodpovednosť koncesionára za plnenie koncesnej zmluvy.

[133] See here the full document: https://wipolex.wipo.int/en/text/451097

[134] See here for more information: https://www.uvo.gov.sk/introduction-of-the-office-for-public-procurement--456.html

[135] See Article 17 Cezhraničné obstarávanie

"(1) Cezhraničné obstarávaniesauskutočňujeprostredníctvom

a) centralizovanej činnostivoverejnomobstarávanípodľa § 15 ods. 1písm.b)poskytovaných centrálnou obstarávacouorganizáciouz členskéhoštátu,

b) spolupráce verejnýchobstarávateľovz rôznychčlenskýchštátovaleboobstarávateľovz rôznych členských štátovalebo

c) spoločného subjektu,ktorýzriadiliverejníobstarávateliaz rôznychčlenskýchštátovalebo obstarávatelia z rôznychčlenskýchštátovpodľaosobitnéhopredpisu.39)

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Centralised public procurement is defined in Slovak law in Article 15 of the *Public Procurement Act*. Currently, there are three major CPBs in Slovakia on the national level:

1. The Ministry of Health, acting as CPB primary for hospitals and medical institutions.
2. The Ministry of Interior, which is the CPB for different commodities for various contracting authorities on the national level.
3. The Ministry of Investments, Regional development and Informatisation of the Slovak republic which acts as CPB for software licences for various contracting authorities on the national level.

The new amendment to the *Public Procurement Act 343/2015*, which entered into force on 31 March 2022, introduced a new CPB under the Prime Minister's Office (new CPB). The law states that public authorities, contracting authorities/entities at national level will mandatorily procure specific goods, services, and works utilising this CPB. Such specific categories will be defined in a decree issued by the government. One of the downsides of such an arrangement is that the date when this decree will be issued is not yet known. Therefore, public authorities, contracting authorities/entities at national level are not yet obliged to procure through this newly created CPB.

Concluding remarks

Public procurement act 343/2015 defines R&D and provides the legal basis for implementing PCP by exempting from its scope the purchase of R&D services under certain conditions. Nevertheless, the law

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(2) Verejný obstarávateľaleboobstarávateľmôžezadávaťzákazkynazákladedynamického nákupného systémuprevádzkovanéhocentrálnouobstarávacouorganizáciouz inéhočlenského štátu alebozadávaťzákazkynazákladerámcovejdohodyuzavretejcentrálnouobstarávacou organizáciou z inéhočlenskéhoštátu.V týchtoprípadochsaverejnéobstarávanieuskutočňuje v súlade s právnymipredpismičlenskéhoštátu,v ktoromsacentrálnaobstarávaciaorganizácia nachádza.

(3) Verejný obstarávateľspoločnes verejnýmiobstarávateľmiz inýchčlenskýchštátovalebo obstarávateľ spoločnes obstarávateľmiz inýchčlenskýchštátovmôženazákladepísomnejdohody zadať zákazku,uzavrieťrámcovúdohodu,prevádzkovaťdynamickýnákupnýsystém,zadávať zákazky nazákladerámcovejdohodyalebonazákladedynamickéhonákupnéhosystému. Písomná dohodaokremprípadu,aktoupravujemedzinárodnázmluvauzavretámedzi zúčastnenými členskýmištátmi,musíobsahovať

a) určenie zodpovednostizmluvnýchstrána príslušnýchprávnychpredpisov,ktorésanatento účel uplatnia,

b) vnútornú organizáciuverejnéhoobstarávania,popisjehoriadenia,rozdelenieobstarávaných tovarov, stavebnýchprácaleboslužiebvrátaneuzavieraniazmluvyalebорámcovejdohody.

(4) Zodpovednosť zmluvnýchstrána príslušnéprávnepredpisypodľaodseku3písm.a)verejný obstarávateľ a obstarávateľuvedúv oznámenío vyhláseníverejnéhoobstarávania,oznámení použitom akovýzvanasúťažalebov súťažnýchpodkladoch.

(5) Ak ideo verejnéobstarávaniepodľaodseku1písm.c)verejníobstarávateliaalebo obstarávatelia sarozhodnutímpríslušnéhoorgánuspoločnéhosubjektudohodnúnaurčení právnych predpisov,podľaktorýchbudúpostupovaťvoverejnomobstarávaní.Môžeísťo právne predpisy členskéhoštátu,v ktorom

a) má spoločnýsubjektsvojesídloalebo

b) spoločný subjektvykonávasvoječinnosti.

(6) Dohoda uvedenáv odseku5môžebyťuzavretánadobuneurčitú,aksatakustanoví v zakladateľskom aktespoločnéhosubjektualebosamôžeuzavrieťnadobuurčitú,naurčité druhy zákaziekalebonaurčitéverejnéobstarávania.

(7) Verejný obstarávateľa obstarávateľmôžuvyužiťcezhraničnéobstarávaniepodľaodsekov1až 6, akuplatňovanéprávnepredpisysúv súlades právnezáväznýmiaktmiEurópskejúnie."

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does not include an IPR default scenario for Innovation procurement. It is for the public authorities, contracting authorities/entities to clarify in their tender documents the IPR allocation of the contract.

Preliminary Market Consultations are clearly explained in the Slovakian law and are used very often by different public authorities, contracting authorities/entities. The economic operators are willing to participate in them to share their views on the subject matter of the tender and to suggest solutions to procurers problems and concerns.

The MS is clearly interested in Innovation Procurement, since within the UVO, an expert group - the Working group in Innovation Procurement - directly supports contracting authorities to engage in more Innovation Procurement procedures. However, Slovakia does not have a stand-alone action plan, nor a specific spending target for Innovation Procurement.

Innovation Procurement legal framework

- Public procurement Act 343/2015 → Articles 2(5.l) and 1(2.d) EXCLUDE the purchase of R&D services of its scope (PCP).
- Market Consultations → YES!
- Subcontracting → YES
- IPR allocation to contractor by law → NO (in tender documents)
- National /regional Innovation structure → YES
- National policy to stimulate PCP → NO
- Spending target for IP → NO

Joint Procurement legal framework

- Joint procurement regulated at national and international level.
- Institutionalized and occasional joint cross border
- 3 CPB: Ministry of Health, Ministry of Interior, Ministry of Investments, Regional development and Informatisation

Conclusions

- CLEAR EXCLUSION OF PCP of the scope of the Slovak law
- Inclination for IP
- Default IPR regime DOES NOT favour innovation

4.11. Spain

Innovation Procurement legal framework

Ley 9/2017, de 8 de noviembre, de Contratos del Sector Público, por la que se transponen al ordenamiento jurídico español las Directivas del Parlamento Europeo y del Consejo 2014/23/UE y 2014/24/UE, de 26 de febrero de 2014 (hereafter LCSP) transposes the EU Directives 2014/23/UE, 2014/24/UE and 2014/25/UE to the Spanish national legal framework.[136]

The law does not provide a definition of Innovation Procurement, PCP, nor PPI. Nevertheless, according to its Article 8, R&D contracts are excluded from its application, as long as the benefits don't accrue exclusively to the contracting authority for its use in the conduct of its own affairs, and the service provided is not wholly remunerated by the contracting authority (basically what Directive 2014/24/EU covers in Article 14). Consequently, PCP does not fall under the scope of the LCSP.

Innovation Procurement is explained in a guide drafted by the Ministry of Economic Affairs and Digital Transformation.[137]

[136] See here full text in Spanish: https://www.boe.es/buscar/act.php?id=BOE-A-2017-12902

[137] See here the full document in Spanish: https://www.mineco.gob.es/stfls/MICINN/Innovacion/FICHEROS/Politicas_Fomento_Innv./Guia.CPI.pdf

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LCSP regulates the deployment of Preliminary Market Consultations on a voluntary basis.[138] For this, the contracting authorities may use the advice of third parties, who may be experts or independent authorities, professional associations, or exceptionally economic operators active in the market. It is important to highlight that consulting/resorting to advice to prepare the tender from economic operators is an exceptional measure in Spain (this is not applicable for other types of experts), that must be duly justified.

Bearing in mind that PCP is outside of the scope of the LCSP, it must be highlighted that the law gives some indications about subcontracting.[139] If the public authorities, contracting authorities/entities want

[138] ***Artículo 115. Consultas preliminares del mercado.***

1. Los órganos de contratación podrán realizar estudios de mercado y dirigir consultas a los operadores económicos que estuvieran activos en el mismo con la finalidad de preparar correctamente la licitación e informar a los citados operadores económicos acerca de sus planes y de los requisitos que exigirán para concurrir al procedimiento. Para ello los órganos de contratación podrán valerse del asesoramiento de terceros, que podrán ser expertos o autoridades independientes, colegios profesionales, o, incluso, con carácter excepcional operadores económicos activos en el mercado. Antes de iniciarse la consulta, el órgano de contratación publicará en el perfil de contratante ubicado en la Plataforma de contratación del Sector Público o servicio de información equivalente a nivel autonómico, el objeto de la misma, cuando se iniciara esta y las denominaciones de los terceros que vayan a participar en la consulta, a efectos de que puedan tener acceso y posibilidad de realizar aportaciones todos los posibles interesados. Asimismo en el perfil del contratante se publicarán las razones que motiven la elección de los asesores externos que resulten seleccionados.

2. El asesoramiento a que se refiere el apartado anterior será utilizado por el órgano de contratación para planificar el procedimiento de licitación y, también, durante la sustanciación del mismo, siempre y cuando ello no tenga el efecto de falsear la competencia o de vulnerar los principios de no discriminación y transparencia.

De las consultas realizadas no podrá resultar un objeto contractual tan concreto y delimitado que únicamente se ajuste a las características técnicas de uno de los consultados. El resultado de los estudios y consultas debe, en su caso, concretarse en la introducción de características genéricas, exigencias generales o fórmulas abstractas que aseguren una mejor satisfacción de los intereses públicos, sin que en ningún caso, puedan las consultas realizadas comportar ventajas respecto de la adjudicación del contrato para las empresas participantes en aquellas.

3. Cuando el órgano de contratación haya realizado las consultas a que se refiere el presente artículo, hará constar en un informe las actuaciones realizadas. En el informe se relacionarán los estudios realizados y sus autores, las entidades consultadas, las cuestiones que se les han formulado y las respuestas a las mismas. Este informe estará motivado, formará parte del expediente de contratación, y estará sujeto a las mismas obligaciones de publicidad que los pliegos de condiciones, publicándose en todo caso en el perfil del contratante del órgano de contratación.

En ningún caso durante el proceso de consultas al que se refiere el presente artículo, el órgano de contratación podrá revelar a los participantes en el mismo las soluciones propuestas por los otros participantes, siendo las mismas solo conocidas íntegramente por aquel.

Con carácter general, el órgano de contratación al elaborar los pliegos deberá tener en cuenta los resultados de las consultas realizadas; de no ser así deberá dejar constancia de los motivos en el informe a que se refiere el párrafo anterior.

La participación en la consulta no impide la posterior intervención en el procedimiento de contratación que en su caso se tramite.

[139] ***Artículo 215. Subcontratación****.*

1. El contratista podrá concertar con terceros la realización parcial de la prestación con sujeción a lo que dispongan los pliegos, salvo que conforme a lo establecido en las letras d) y e) del apartado 2.º de este artículo, la prestación o parte de la misma haya de ser ejecutada directamente por el primero.

En ningún caso la limitación de la subcontratación podrá suponer que se produzca una restricción efectiva de la competencia, sin perjuicio de lo establecido en la presente Ley respecto a los contratos de carácter secreto o reservado, o aquellos cuya ejecución deba ir acompañada de medidas de seguridad especiales de acuerdo con disposiciones legales o reglamentarias o cuando lo exija la protección de los intereses esenciales de la seguridad del Estado.

2. La celebración de los subcontratos estará sometida al cumplimiento de los siguientes requisitos:

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to limit subcontracting, this limitation cannot distort or limit competition. Nevertheless, a limitation of subcontracting (even if it distorts competition) might be allowed in the case of contracts of a secret or reserved nature, or those whose execution must be accompanied by special security measures in accordance with legal or regulatory provisions or when national security requires it. In this case, subcontracting must be previously authorised by the contracting entity.

The tender documents can ask bidders to indicate which part of the contract they intend to subcontract and the (already known) details of the subcontractors. In any case, the selected contractor will have to indicate these aspects once the contract is awarded and will have to inform the public authority, contracting authority/entity of any modification during the execution of the contract.

Regarding IPR, in principle LCSP assigns usage rights to the public procurer.[140] However, this is not the default regime for all types of public procurements.[141] Moreover, there are no mandatory requirements stemming from Spanish legislation when it comes to PCP. However, for a PCP to be outside the scope of LCSP, risks and benefits are to be shared between the contracting authority and the selected candidates. This can be done in multiple ways. For example, the successful tenderer may retain ownership of IPR, while the contracting authority keeps a user license on the results obtained. The Spanish public procurement legislation does not pose any restrictions. Consequently, there is room to define the IPR sharing arrangements in the PCP tender documentation.

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a) Si así se prevé en los pliegos, los licitadores deberán indicar en la oferta la parte del contrato que tengan previsto subcontratar, señalando su importe, y el nombre o el perfil empresarial, definido por referencia a las condiciones de solvencia profesional o técnica, de los subcontratistas a los que se vaya a encomendar su realización.

b) En todo caso, el contratista deberá comunicar por escrito, tras la adjudicación del contrato y, a más tardar, cuando inicie la ejecución de este, al órgano de contratación la intención de celebrar los subcontratos, señalando la parte de la prestación que se pretende subcontratar y la identidad, datos de contacto y representante o representantes legales del subcontratista, y justificando suficientemente la aptitud de este para ejecutarla por referencia a los elementos técnicos y humanos de que dispone y a su experiencia, y acreditando que el mismo no se encuentra incurso en prohibición de contratar de acuerdo con el artículo 71.

El contratista principal deberá notificar por escrito al órgano de contratación cualquier modificación que sufra esta información durante la ejecución del contrato principal, y toda la información necesaria sobre los nuevos subcontratistas.

En el caso que el subcontratista tuviera la clasificación adecuada para realizar la parte del contrato objeto de la subcontratación, la comunicación de esta circunstancia será suficiente para acreditar la aptitud del mismo.

La acreditación de la aptitud del subcontratista podrá realizarse inmediatamente después de la celebración del subcontrato si esta es necesaria para atender a una situación de emergencia o que exija la adopción de medidas urgentes y así se justifica suficientemente. (…)

d) En los contratos de carácter secreto o reservado, o en aquellos cuya ejecución deba ir acompañada de medidas de seguridad especiales de acuerdo con disposiciones legales o reglamentarias o cuando lo exija la protección de los intereses esenciales de la seguridad del Estado, la subcontratación requerirá siempre autorización expresa del órgano de contratación. (…)

[140] **Artículo 122. Pliegos de cláusulas administrativas particulares.**

2. (…) Los pliegos podrán también especificar si va a exigirse la transferencia de derechos de propiedad intelectual o industrial, sin perjuicio de lo establecido en el artículo 308 respecto de los contratos de servicios

[141] For example, service contracts whose purpose is the development and provision of products protected by an intellectual or industrial property right will entail the transfer of the IPRs to the public authority, contracting authority/entity.

***Artículo 308. Contenido y límites*.**

1. Salvo que se disponga otra cosa en los pliegos de cláusulas administrativas o en el documento contractual, los contratos de servicios que tengan por objeto el desarrollo y la puesta a disposición de productos protegidos por un derecho de propiedad intelectual o industrial llevarán aparejada la cesión de este a la Administración contratante. En todo caso, y aun cuando se excluya la cesión de los derechos de propiedad intelectual, el órgano de contratación podrá siempre autorizar el uso del correspondiente producto a los entes, organismos y entidades pertenecientes al sector público.

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The Spanish intellectual property rights act[142] determines that copyright belongs in any case inalienably to the creator (moral rights cannot be waived or transferred, only economic rights may be transferred). In work that has been commissioned (e.g. in a public procurement) the creator's rights remain. Copyright law protects also scientific work, software and database rights.

In Spain, the Center for Industrial Technological Development (*Centro para el Desarrollo Tecnologico e Industrial* - CDTI) is a public undertaking under the Ministry of Science and Innovation which promotes innovation and technological development among Spanish companies by managing national and European funds. It channels requests for support for R&D&I projects by Spanish companies. CDTI is also a national competence center on innovation procurement in the Procure2Innovate project, which aims to improve institutional support for public procurers purchasing Information and Communication Technologies (ICT), as well as acquiring products and services from a range of sectors that implement innovation procurement.

In November 2018, CDTI created the Innovative Public Procurement Office (*Oficina de Compra Pública Innovadora* - OCPI) with the objective of promoting PCP. The initiative – which is co-financed with European funds – has two tracks:[143]

1. On the demand side, CDTI acquires R&D services that may result in prototypes of first products or services, that are technologically innovative and that meet public needs. Where appropriate, the results are transferred to the particular Spanish Public Administration with that need, so that it can test it. However, it is important to note that this testing does not imply commercial deployment.

2. On the supply side, CDTI leads *Innodemanda*, a program to fund companies that provide the R&D services above mentioned.[144]

The Regional Governments have competencies in the field of public procurement and are progressively allocating a greater budget to promote innovation. Certain regions are more advance in this field than others. Good examples are the Galician Innovation Agency (Agencia Gallega de Innovación or GAIN)[145], the Catalonian Agency for Health Quality and Evaluation (Agencia de Calidad y Evaluación Sanitarias de Cataluña or AQuAS)[146], the Aragonese Institute for Health Sciences (Instituto Aragonés de Ciencias de la Salud or IACS)[147], the Andalusian Knowledge Agency (Agencia Andaluza del Conocimiento)[148] and the Valencian Agency for Innovation (Agència Valenciana de la Innovació or AVI)[149]. Nevertheless, there is no national policy in place to foster PCP.

[142] See here the full document: https://wipolex.wipo.int/en/text/469891

[143] See here for more information: https://www.cdti.es/index.asp?MP=100&MS=882&MN=2

[144] See here for more information: https://www.cdti.es/index.asp?MP=100&MS=883&MN=3

[145] See here for more information about GAIN and Innovation Procurement: http://gain.xunta.gal/artigos/61/contratacion+publica+innovacion+cpi

[146] See here the European Innovation Procurement projects in which AQUAS participates: https://aquas.gencat.cat/es/ambits/innovacio-salut/compra-publica-innovacio/

[147] In 2020, the region set a target to ensure that in 2020, 3% of the public tenders launched in Aragon would be Innovation Procurement. See here Innovation Procurement projects in the health sector in Aragon: https://cpi.aragon.es/

[148] The agency has its own Innovation Procurement strategy and is involved in several projects: https://www.juntadeandalucia.es/organismos/aac/areas/compra-publica-innovacion/estrategia-cpi.html. See here for more information: https://www.juntadeandalucia.es/organismos/aac/areas/compra-publica-innovacion.html

[149] See here for more information: https://innoavi.es/es/compra-publica-de-innovacion/. The has drafted its own Innovation procurement guide for public entities in Valencia: https://innoavi.es/wp-content/uploads/2019/04/GuiaCPI_AVI.pdf

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Joint Procurement legal framework

The LCSP does not regulate joint cross border procurement. In fact, there is not a specific regulation on the matter.[150] I.e., it is not the ideal situation if a public authority, contracting authority/entity located in Spain wants to lead a cross border PCP. Nevertheless, they do participate as procurers in these kind of projects.

INGESA, under the Health Ministry acts as a CPB for certain drugs and treatments.[151]

Concluding remarks

Spain, as many other Member States, does not regulate in its public procurement law PCP, PPI, nor Innovation Procurement. Nevertheless, it does give the legal basis to implement PCPs, understood as the purchase of R&D services under certain conditions. I.e., Spain has the legal basis to implement a PCP. The law also regulates Preliminary Market Consultations in detail, but its use is not widely widespread.

In principle the Spanish public procurement law assigns the ownership of the IPRs to the contractors and gives the public authority, contracting authority/entity usage rights (a license to use the results). However, this is not the default regime for all types of public procurements and there are no mandatory requirements stemming from Spanish legislation when it comes to PCP.

The country has some experience in Innovation Procurement and all its regions are fostering the uptake of this strategic tool with varying degrees of implementation. On its side, CDTI is mobilizing Innovation Procurement from the demand and the supply side at national level. Nevertheless, there is no national policy in place to foster PCP and the LCSP does not regulate joint cross border procurement.

Innovation Procurement legal framework

- Ley 9/2017 de Contratos del Sector Público→ Article 8 EXCLUDES the purchase of R&D services of its scope (PCP).
- Market Consultations → YES (exceptionally economic operators active in the market)
- Subcontracting → YES
- IPR allocation to contractor by law → NO (in tender documents)
- National/regional Innovation structure → YES
- National policy to stimulate PCP → NO
- Spending target for IP → NO

Joint Procurement legal framework

- NO clear joint procurement legal framework at national and international level.
- CPB: INGESA

Conclusions

- CLEAR EXCLUSION OF PCP of the scope of the Spanish law
- Inclination for IP
- Default IPR regime DOES NOT favour innovation

[150] Articles 227-230 of the LCSP only refer to national Centralized Purchasing Bodies.

[151] See here: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2021-10826 and here: https://comprassns.ingesa.sanidad.gob.es/informacion_general

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5. Conclusions

In conclusion, and as far as the legal framework on innovation in public procurement is concerned, it is possible to say that PCP is exempted from all the assessed legal frameworks, whereas explicitly, such as in Italy and in Lithuania, whereas in an indirect manner by excluding the purchase of R&D services under certain conditions. In Greece, the law of Law 4310/2014, article 2, paragraph 41 defines PCP.

All the analysed countries expressly regulate Preliminary Market Consultations in a non-compulsory way. In Spain, however, consulting - for advice to prepare the tender documents - the economic operators of the market (not the rest of the experts) is an exceptional measure and must be duly justified by the public authority, contracting authority/entity. The use of this powerful tool to refine the needs of the public authorities, contracting authorities/entities and determine what the market has to offer, is implemented in varying degrees in the different analysed countries.

Subcontracting is regulated in detail in all of the assessed national legal frameworks. Some provisions, are stricter than others, for example in Lithuania, public authorities, contracting authorities/entities must ask participants in their tender documentation to indicate which part of the contract they intend to subcontract. In the other legislations, this is a possibility, not an obligation. Some laws give the public authorities, contracting authorities/entities a margin of discretion in certain aspects. E.g., the Italian, the Lithuanian and the Slovakian law, expressly regulate the possibility that the public authority, contracting authority/entity directly pays to the subcontractor for their activities. In Greece, according to article 58 of Law 4412/2016, the contracting authorities shall request the tenderer to indicate in his tender the part of the contract which he intends to award to third parties and the subcontractors he proposes.

Only Belgium, France and Finland allocate the IPR to the contractors *ex lege*. Italy does so in an indirect way. The rest of the assessed countries do not have provisions on the allocation of IPRs between public authorities, contracting authorities/entities and contractors. It is for the public authorities, contracting authorities/entities to clarify in their tender documents the IPR allocation of the contract.

The different countries foster innovation procurement in varying degrees. Many of them, have national competence centres for innovation procurement or similar institutions. E.g., CDTI in Spain, NCBR in Poland, the Slovak Public Procurement Office (UVO) and KOINNO and KEINO (in Germany and Finland respectively). Greece has an innovation procurement competence center PROMITHEUS established under the Ministry of Economy (www.promitheus.gov.gr). Some of them have a dedicated action plan for innovation procurement and/or a spending target, such as France, Finland, Lithuania and the Netherlands, also in Greece the Greek National Strategy for R&D&I and the Greek Smart Specialization Strategy. Some of them have a dedicated action plan for innovation procurement and/or a spending target, such as France, Finland, Lithuania and the Netherlands. Greece has the Greek National Strategy for R&D&I and the Greek Smart Specialization Strategy.

Concerning joint procurement, all participating countries - except Spain - allow contracting authorities to aggregate their demands with those of other contracting authorities, either from the same country or from other Member States.[152] Some national legislations also envisage requests to contracting authorities to conclude ad hoc agreements on applicable law, division of tasks and responsibilities, and organisational issues (Poland and Lithuania among others). The Italian law expressly allows public authorities, contracting authorities/entities to resort to a central purchasing body located in another Member State, but only to acquire supplies and/or services and not for the award of public contracts or the conclusion of framework agreements for works, supplies or services. Greek law expressly allows joint cross border procurement.

The table below gives an overview of the countries and the positive features of their legal framework in relation to innovation friendliness. The colouring and the numbering works as follows:

- -1 indicates that the particular feature is not present in the legal framework.

[152] That poses the problem of legal uncertainty: the EU legislator encourages cross-border initiatives, which means that a national legislator is not entitled to limit this possibility. But the fact that it is not regulated in the law still remains.

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- 0 indicates that the feature is present in the legal framework but not favourable to innovation procurement.
- 1 indicates that the feature is present in the legal framework and favourable to innovation procurement.
- Green indicates that the feature is present in the legal framework and extremely favourable to innovation procurement.

Country	Exclusion of PCP	Definition of OMC	Clear allocation of IPRs	Policies and initiatives regarding innovation procurement	Clear joint procurement legal framework
Belgium	1	1	1	1	1
Finland	1	1	1	1	1
France	1	1	1	1	1
Germany	1	1	0	1	1
Greece	1	0	0	1	1
Italy	1	1	1	1	0
Lithuania	1	1	1	1	1
Netherlands	1	1	0	1	1
Poland	1	1	0	1	1
Slovakia	1	1	0	1	1
Spain	1	1	0	1	-1

From the analysis above, the countries with innovation procurement more friendly legal frameworks are: Finland, Lithuania, The Netherlands, Belgium and France.

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ANNEX VIII Common needs in five domains using value methodologies (T1.5)

Task 1.5: Common needs in five domains using value methodologies

CORVERS PROCUREMENT
SERVICES B.V.

August 2023

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Task 1.5: Preliminary identification of procurers needs in the five selected application domains

(M1-M10)

Lead: CPS - Participants: AV, CKIC, HAA, CA, EURADA, ISEMI, GAC

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1. Introduction

One of the objectives of PROTECT is to identify procurement challenges/needs that could be tackled via Pre-Commercial Procurement (PCP). With this purpose, a comprehensive needs analysis on main climate challenges in five application domains[1] is conducted in WP1 and fine-tuned in T3.1, resulting in four procurement challenges that will be prioritized for a potential follow up PCP (based on their impact and the interest of the participating procurers).

Once the four procurement challenges/needs have been preliminarily defined, PROTECT will follow the EAFIP methodology for an in-depth analysis of the challenges eligible for a future PCP throughout five preparatory steps: (i) Needs Identification and Assessment; (ii) Prior State-of-the-Art Analysis; (iii) Analysis of the Standards Landscape; (iv) Open Market Consultation (OMC); and (v) Business Case and Value Calculations.

To identify, assess and select the needs to be tackled, PROTECT combines several methodologies that build upon each other: questionnaires, interviews, round-table discussions and focused workshops.

In this context, this report provides: (i) the general methodology for the preliminary identification of procurement needs; (ii) an overview of environmental sustainable activities and risks; (iii) an earth observation taxonomy and service examples per domain; (iv) the results of the EU Survey questionnaire relevant to the overview of main climate challenges and unmet needs; and (iii) the value methodologies to be used in the dynamic of workshops to obtain:

a) *The description of challenges/needs per domain;*
b) *Use cases per domain; and*
c) *Value in each use case.*

2. Methodology

To define the needs of climate change services of procurers in five domains the Value (engineering) based methodology is applied. It consists of a 3-stage approach:

(1) Pre-study consisting of desk research, an EU Survey questionnaire, the identification of potential participants and the preparation of the workshops;
(2) Workshops using value methodologies and tools based on the Value Management standard[2] and the Lean principles; and
(3) Post-study defining common challenges/needs expressed as functional requirements and preliminary use cases for each domain with the identification of value creation activities.

[1] The five domains are: Marine and coastal environment, Energy and Utilities, Sustainable urban communities, Agriculture, Forestry and other Land use, Civil security and protection.
[2] Value Management standard NEN-EN 12973 - Value Management | Engineering360 (globalspec.com)

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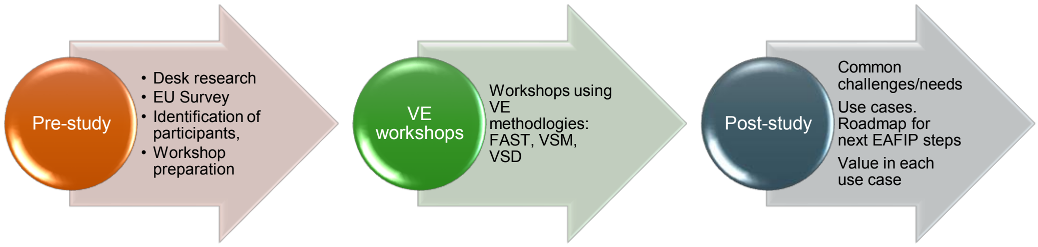

Figure 1. The 3 stages of the Value (engineering) methodology

The results of the pre-study stage have provided a baseline to define the challenges/needs as a result of information obtained from the activities mentioned above.

During the workshops (in T1.5 and T3.1), three main value (engineering) techniques will be used to focus on what creates "value" for the public and private buyers:

(i) Functional Analysis System Technique (FAST) will help thinking about the problem objectively and identifying the scope of the project by showing the logical relationships between functions;
(ii) Value Stream Mapping[3] (VSM) will be used to display critical steps in a specific process and quantify the time taken at each stage;
(iii) Value Stream Design[4] (VSD) or "value chain design" will help represent the process according to its ideal conditions based on the 5 principles of Lean Manufacturing. .

These techniques are based on the Value Management standard tools and the 5 Lean principles.

1. **Identifying value**: Assess the product and service from the (customer) user's point of view. How does the product help to do the job, accomplish a mission or improve a position? This helps to determine the unique value of their product or service. Leading questions are, for example: What does the user need? Why and when do they need it? What can be produced to meet that need? How and when can it be achieved?
2. **Mapping the value stream:** Once you determine the unique value (what to create, why, and for whom), the team can evaluate each process that leads to that end goal. Value stream mapping enables teams to understand how value flows through the organization – and more importantly, where it gets stuck. The product of a value stream mapping exercise is a physical 'map' of the organization, which maps every step of the process for every part of the business: production, R&D, marketing, HR, etc.
3. **Creating flow:** With the value stream map in hand, it is possible to move to the third principle: creating flow by analyzing each step in the process and finding ways to maximize efficiency and

[3] For more information see: ISO - ISO 22468:2020 - Value stream management (VSM)
[4] For more information see: Value Stream Design

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reduce waste. Here you can think of the following issues: Which tools do we need for each step and are these tools needed every day to make production/work run smoothly?

4. **Establishing the pull:** The teams take into account the (customer) user's perspective on the end product and look effectively at the activities of the organization. When does the (customer) user need the product in hand? The idea is that the (customer) user is able to pull value. Instead of investing in materials, it is possible to use the (customer) user's real needs to manage a more sensible model that saves costs, space, time and resources
5. **Searching for perfection:** Finally, the teams identify areas for improvement and implements meaningful changes.

In practice, these 5 Lean principles are cyclical. While the Lean teams strive for perfection, they continuously analyze each process for the increase in value (lower costs, time, resources used, space, etc.). The entire process is therefore completed as often as possible.

These techniques adapted to the context of PROTECT will help to prioritize and fine-tune the procurement challenges during task 3.1. The results will be **used to define keywords on functions and performance** to conduct a prior State-Of-The-Art analysis using the online-based IPlytics tool that helps identify technology and market landscapes.

Subsequently, the Open Market Consultation – in the form of events and questionnaires to the market providers to gather more granular information - will be implemented. The SOTA analysis will already give information about suppliers/technology vendors that can come up with solutions for the procurement challenges. These suppliers will be contacted and informed about the upcoming OMC, to ensure their participation. The OMC described in T3.3 will be widely announced in Tenders Electronic Daily via a Prior Information Notice (to ensure European coverage), as well as via other communication channels.

3. Pre-study results

The Pre-Study aims to provide information on: (i) the context of environmental sustainable activities and risks; (ii) an overview of existing Earth Observation (EO) taxonomies and examples in the five application domains of PROTECT; (iii) the feedback from interested stakeholders on common needs regarding Climate Services based on EO; and (iv) potential participants to join the Pain Point Workshops.

3.1. Environmental sustainable activities and risks

The methodology used in the EU Taxonomy Regulation[5], based on the work by the Technical Expert Group (TEG), considers that environmental sustainable activities can make a substantial contribution[6] when:

[5] The EU Taxonomy Regulation establishes the criteria for determining whether an economic activity qualifies as environmentally sustainable for the purposes of establishing the degree to which an investment is environmentally sustainable.

[6] These are not types of activities explicitly listed in the Taxonomy Regulation. Instead, they are ways to understand and frame the concept of 'substantial contribution', based on Articles 10 to 15 of the Taxonomy Regulation. An economic activity can contribute substantially to the environmental objective of transitioning to a circular economy in several ways. It can, for example, increase the durability, reparability, upgradability and reusability of products, or can reduce the use of resources through the design and choice of materials, facilitating repurposing, disassembly and deconstruction in the buildings and construction sector, in particular to reduce the use of building materials and promote the reuse of building materials. It can also contribute substantially to the environmental objective of transitioning to a circular economy by developing 'product-as-a-service' business models and circular value chains,

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- *they have a low impact on the environment and have the potential to replace high impact activities (e.g. renewable energy);*
- *they reduce impact from other activities (e.g. wastewater treatment); or*
- *they make a positive environmental contribution (e.g. restoration of wetlands).*

Substantial contribution to climate change mitigation, for example, means levels of performance that are aligned with climate neutrality and limiting the increase in temperature to 1.5 degrees Celsius globally. **For climate change adaptation** this means the implementation of solutions to substantially reduce the most significant identified climate risks to a particular activity such as wildfires, storms or droughts.[7]

For the purposes of PROTECT, the substantial contribution and risks focus on five encompassing application domains (described in more detail in 3.2):

Figure 2. Five application domains of PROTECT

One way to approach a substantial contribution could be to identify how to tackle the main related risks in an application domain.[8]

Domain	Risk[9]
1. Marine and coastal environments	Sea contamination, pollution[10], rising levels, coastal erosion
2. Energy & utilities	Interruption/disruption of services
3. Sustainable urban communities	Waste management problems, contamination, heat waves, water scarcity
4. Agriculture, forestry and other land use	Food shortage, deforestation, drought
5. Civil security protection	Fire, flood, loss of inhabitability

with the aim of keeping products, components and materials at their highest utility and value for as long as possible. Any reduction in the content of hazardous substances in materials and products throughout the life cycle, including by replacing them with safer alternatives, should, as a minimum, be in accordance with Union law. An economic activity can also contribute substantially to the environmental objective of transitioning to a circular economy by reducing food waste in the production, processing, manufacturing or distribution of food. See Recital 28 of EU Taxonomy Regulation.

[7] See EU Taxonomy Regulation FAQ https://finance.ec.europa.eu/publications/sustainable-finance-package_en

[8] For a climate risk analysis see: Larsen, et al. (2021) Advancing future climate services: Multi-sectorial mapping of the current usage and demand in Denmark, in Climate Risk Management, Elsevier. Available at: https://doi.org/10.1016/j.crm.2021.100335

[9] An economic activity that pursues the environmental objective of climate **change adaptation** should contribute substantially to **reducing or preventing the adverse impact of the current or expected future** climate, or the risks of such adverse impact, whether on that activity itself or on people, nature or assets. That environmental objective should be interpreted in accordance with relevant Union law and the Sendai Framework for Disaster Risk Reduction 2015–2030. See Recital 25 of the EU Taxonomy Regulation.

[10] The environmental objective of pollution prevention and control should be interpreted in accordance with relevant Union law, including Directives 2000/60/EC, 2004/35/EC, 2004/107/EC, 2006/118/EC, 2008/50/EC, 2008/105/EC, 2010/75/EU, (EU) 2016/802 and (EU) 2016/2284 of the European Parliament and of the Council. See Recital 29 of EU Taxonomy Regulation.

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In this context, technologies and applications can serve general objectives of e.g. monitoring, measurement, comparison, data analytics to enable, for example, the following functions in relation to climate change key topics:[11]

- ***Renewable Energy:*** Supporting the transition to renewable energy and improving energy efficiency[12] to reduce emissions and improve energy access.
- ***Forests and landscapes:***[13] Reducing emissions by combating deforestation and improving conservation and management of carbon-rich forests and landscapes. Restoring forests and other land, tackling unsustainable land use from agricultural expansion and poor agricultural management, illegal logging, damaging charcoal and timber production. Measurement of greenhouse gas emissions.
- ***Prepare for, respond to, and recover from climate-related disasters:*** Helping communities and countries better prepare for, respond to, and recover from climate-related disasters.
- ***Food and nutrition security:*** Strengthening global food and nutrition security by advancing climate-smart agriculture and increased resilience to droughts, rising temperatures, and changing rainfall patterns.
- ***Climate-resilient drinking water and sanitation, and manage water resources:*** Helping people and economies deliver climate-resilient drinking water and sanitation, and manage water resources(link is external) to cope with growing scarcity. And protecting our oceans by limiting climate impacts and addressing other critical threats, like ocean plastic pollution.
- ***Reducing greenhouse gas emissions and air pollutants:*** Reducing greenhouse gas emissions and air pollutants(link is external) which in turn improves public health, reduces poverty and inequality, and lessens climate change impacts.

3.2. Earth observation taxonomy and service examples in five domains[14]

The Earth observation taxonomy[15] includes a generic and comprehensive definition of available products and how these form the basis for the delivery of the EO services (the combination of – for

[11] See the related literature in https://doi.org/10.1016/j.crm.2021.100335
[12] ‘Energy efficiency’ in a broad sense should be construed by taking into account relevant Union law, including Regulation (EU) 2017/1369 of the European Parliament and of the Council and Directives 2012/27/EU and (EU) 2018/844 of the European Parliament and of the Council, as well as the implementing measures adopted pursuant to Directive 2009/125/EC of the European Parliament and of the Council. See Recital 33 of EU Taxonomy Regulation.
[13] The environmental objective of the protection and restoration of biodiversity and ecosystems should be interpreted in accordance with relevant Union law, including Regulations (EU) No 995/2010, (EU) No 511/2014 and (EU) No 1143/2014 of the European Parliament and of the Council, Directive 2009/147/EC of the European Parliament and of the Council, Council Regulation (EC) No 338/97, Council Directives 91/676/EEC and 92/43/EEC, and with the communications of the Commission of 21 May 2003 on ‘Forest Law Enforcement, Governance and Trade (FLEGT)’, of 3 May 2011 on ‘Our life insurance, our natural capital: an EU biodiversity strategy to 2020’, of 6 May 2013 on ‘Green Infrastructure (GI) – Enhancing Europe’s natural Capital’, of 26 February 2016 on ‘EU Action Plan against Wildlife Trafficking’ and of 23 July 2019 on ‘Stepping up EU Action to Protect and Restore the World’s Forests’. See Recital 30 of EU Taxonomy Regulation.
[14] The description of each domain and the related EO services have been provided by AV.
[15] See EARSC https://earsc.org/2020/09/03/eotaxonomy/

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example – EO products, in-situ data, modelling, etc.) to provide contextualized knowledge to citizens, business, government and other organizations.

The taxonomy takes a two-sided approach, describing this common list of services from both the suppliers' and users' points of view as described in the following images.

Figure 3. EARSC Taxonomy (Market/User) perspective (2020)

Figure 4. EARSC Taxonomy (Thematic/Provider) perspective (2020)

Other relevant sources are the EUSPA EO and GNSS report[16] which identifies 17 market segments: Agriculture / Aviation and Drones / Biodiversity, Ecosystems and Natural Capital / Climate Services / Consumer Solutions, Tourism and Health / Emergency Management and Humanitarian Aid / Energy and Raw Materials / Environmental Monitoring / Fisheries and Aquaculture / Forestry / Infrastructure / Insurance and Finance / Maritime and Inland Waterways / Rail / Road and Automotive / Space / Urban Development and Cultural Heritage.

[16] Source: EUSPA EO and GNSS Market Report, Issues 1, 2022. https://www.euspa.europa.eu/european-space/euspace-market/gnss-market/eo-gnss-market-report

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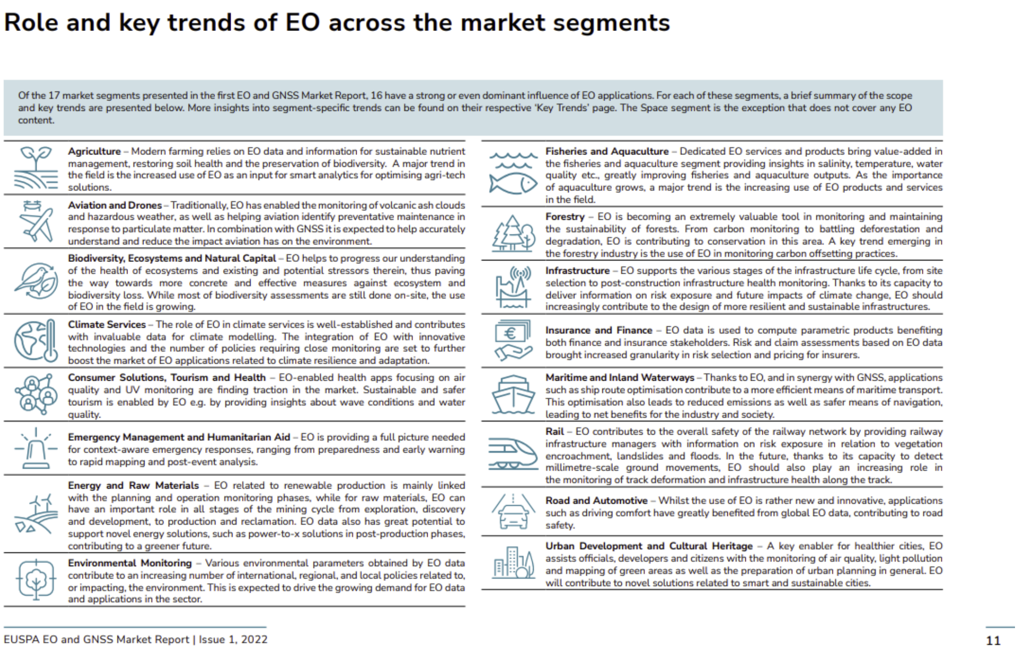

Role and key trends of EO across the market segments

Of the 17 market segments presented in the first EO and GNSS Market Report, 16 have a strong or even dominant influence of EO applications. For each of these segments, a brief summary of the scope and key trends are presented below. More insights into segment-specific trends can be found on their respective 'Key Trends' page. The Space segment is the exception that does not cover any EO content.

Agriculture – Modern farming relies on EO data and information for sustainable nutrient management, restoring soil health and the preservation of biodiversity. A major trend in the field is the increased use of EO as an input for smart analytics for optimising agri-tech solutions.

Aviation and Drones – Traditionally, EO has enabled the monitoring of volcanic ash clouds and hazardous weather, as well as helping aviation identify preventative maintenance in response to particulate matter. In combination with GNSS it is expected to help accurately understand and reduce the impact aviation has on the environment.

Biodiversity, Ecosystems and Natural Capital – EO helps to progress our understanding of the health of ecosystems and existing and potential stressors therein, thus paving the way towards more concrete and effective measures against ecosystem and biodiversity loss. While most of biodiversity assessments are still done on-site, the use of EO in the field is growing.

Climate Services – The role of EO in climate services is well-established and contributes with invaluable data for climate modelling. The integration of EO with innovative technologies and the number of policies requiring close monitoring are set to further boost the market of EO applications related to climate resilience and adaptation.

Consumer Solutions, Tourism and Health – EO-enabled health apps focusing on air quality and UV monitoring are finding traction in the market. Sustainable and safer tourism is enabled by EO e.g. by providing insights about wave conditions and water quality.

Emergency Management and Humanitarian Aid – EO is providing a full picture needed for context-aware emergency responses, ranging from preparedness and early warning to rapid mapping and post-event analysis.

Energy and Raw Materials – EO related to renewable production is mainly linked with the planning and operation monitoring phases, while for raw materials, EO can have an important role in all stages of the mining cycle from exploration, discovery and development, to production and reclamation. EO data also has great potential to support novel energy solutions, such as power-to-x solutions in post-production phases, contributing to a greener future.

Environmental Monitoring – Various environmental parameters obtained by EO data contribute to an increasing number of international, regional, and local policies related to, or impacting, the environment. This is expected to drive the growing demand for EO data and applications in the sector.

Fisheries and Aquaculture – Dedicated EO services and products bring value-added in the fisheries and aquaculture segment providing insights in salinity, temperature, water quality etc., greatly improving fisheries and aquaculture outputs. As the importance of aquaculture grows, a major trend is the increasing use of EO products and services in the field.

Forestry – EO is becoming an extremely valuable tool in monitoring and maintaining the sustainability of forests. From carbon monitoring to battling deforestation and degradation, EO is contributing to conservation in this area. A key trend emerging in the forestry industry is the use of EO in monitoring carbon offsetting practices.

Infrastructure – EO supports the various stages of the infrastructure life cycle, from site selection to post-construction infrastructure health monitoring. Thanks to its capacity to deliver information on risk exposure and future impacts of climate change, EO should increasingly contribute to the design of more resilient and sustainable infrastructures.

Insurance and Finance – EO data is used to compute parametric products benefiting both finance and insurance stakeholders. Risk and claim assessments based on EO data brought increased granularity in risk selection and pricing for insurers.

Maritime and Inland Waterways – Thanks to EO, and in synergy with GNSS, applications such as ship route optimisation contribute to a more efficient means of maritime transport. This optimisation also leads to reduced emissions as well as safer means of navigation, leading to net benefits for the industry and society.

Rail – EO contributes to the overall safety of the railway network by providing railway infrastructure managers with information on risk exposure in relation to vegetation encroachment, landslides and floods. In the future, thanks to its capacity to detect millimetre-scale ground movements, EO should also play an increasing role in the monitoring of track deformation and infrastructure health along the track.

Road and Automotive – Whilst the use of EO is rather new and innovative, applications such as driving comfort have greatly benefited from global EO data, contributing to road safety.

Urban Development and Cultural Heritage – A key enabler for healthier cities, EO assists officials, developers and citizens with the monitoring of air quality, light pollution and mapping of green areas as well as the preparation of urban planning in general. EO will contribute to novel solutions related to smart and sustainable cities.

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Figure 5. Role and Key trends of EO across the market segments, EUSPA EO and GNSS Market Report, 2022

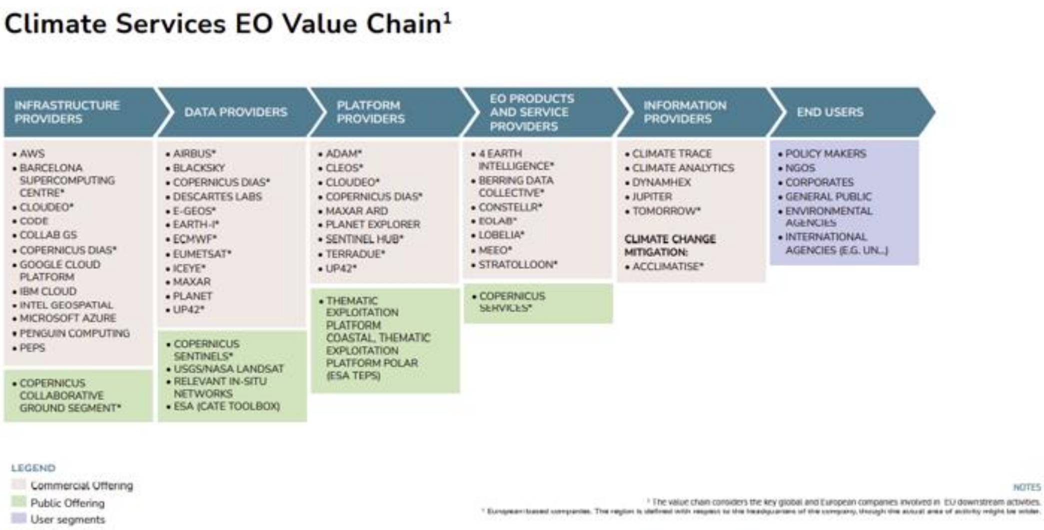

Figure 6. Climate Services EO Value Chain, EUSPA EO and GNSS Market Report, 2022

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3.2.1. Five domains description and EO service examples[17]

Marine and coastal environment[18]

Marine environments are aquatic environments with high levels of dissolved salt. These include the open ocean, the deep-sea ocean, and coastal marine ecosystems, each of which have different physical and biological characteristics, and thus representing different ecosystems. Marine and coastal environments can host complex ecosystems whose fragile equilibrium and prosperity depends on numerous environmental factors influencing each other, and are thus a prime example of systematic approach to tackling climate needs (and providing corresponding services), making sure that addressing a single ecosystem indicator impacts other indicators in a foreseeable and favourable manner.

The climate services in the marine and coastal domain rely on Earth observation data for precise nowcasting and forecasting, informing ocean weather algorithms, and monitoring parameters influencing water quality (for health, tourism, reporting purposes), such as turbidity, (potentially harmful) algae blooms and others.

Potential of Earth Observation:[19]

[17] Reference for infographics: https://www.eurisy.eu/wp-content/uploads/2021/11/Space-Opportunities-for-Climate-Challenges_Eurisy-Report.pdf

[18] The environmental objective of the sustainable use and protection of water and marine resources should be interpreted in accordance with relevant Union law, including Regulation (EU) No 1380/2013 of the European Parliament and of the Council and Directives 2000/60/EC, 2006/7/EC, 2006/118/EC, 2008/56/EC and 2008/105/EC of the European Parliament and of the Council, Council Directives 91/271/EEC, 91/676/EEC and 98/83/EC and Commission Decision (EU) 2017/848, and with the communications of the Commission of 18 July 2007 on 'Addressing the challenge of water scarcity and droughts in the European Union', of 14 November 2012 on 'A Blueprint to Safeguard Europe's Water Resources' and of 11 March 2019 on 'European Union Strategic Approach to Pharmaceuticals in the Environment. See Recital 26 in the EU Taxonomy Regulation.

[19] Examples of services: High resolution wind forecast to assess environmental risks; Tracking effect of climate change in the Mediterranean; Landcover overview at regional scale; Algae blooms

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Figure 7. Example of the potential of EO in the Marine and Coastal Environment domain

Energy and Utilities

The Utilities sector includes all activities related to water supply, sewage services, electricity, dams, and natural gas. Climate-change-related risks affect water supply and utility infrastructures, as damages will have great impacts on operations and costs.
The use of climate services can contribute to a better management of water flow, more resilient and independent energy systems, informed purchasing decisions based on accurate predictions, and others.

Earth observation-based data, in particular, can be used into climate services aimed and forecasting and nowcasting, planning and optimization of renewable energy (onshore and offshore wind, solar, tidal and wave), and monitoring of strategic for the utilities sector infrastructure (e.g. dams, pipelines).

The potential of Earth Observation:[20]

[20] Examples of services: Water leak detection; Forecasting system for solar energy; Forecasting for wind onshore/offshore wind energy; Applications for tidal and wave energy forecast; Methane watch

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Figure 8. Example of the potential of EO in powering renewable energy sources

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Figure 9. Example of satellite data streams for Europe's freshwater

Sustainable urban communities

Green and sustainable urban communities operate their human, natural, and financial capital with the goal to meet current and future needs in a sustainable manner, while prioritising a long-term perspective. This is particularly important against the backdrop of the ongoing climate crisis, due to the sustainable communities' focus on anticipating and adapting to change in both the present and future. Moreover, the current reality of an increasing majority of the world's population living in cities which in turn grow rapidly and not always sustainably, puts urban communities at the forefront for climate services related to resilience and adaptation.

Those using Earth observation data have prominent application when it comes to assessing and forecasting air quality and pollen concentration and assisting urban planning and operations (monitoring

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and preventing heat islands, building greener cities) and optimizing green cities, in particular when these are implementing elements of a smart (e.g., IoT) infrastructure.

Potential of Earth Observation:[21]

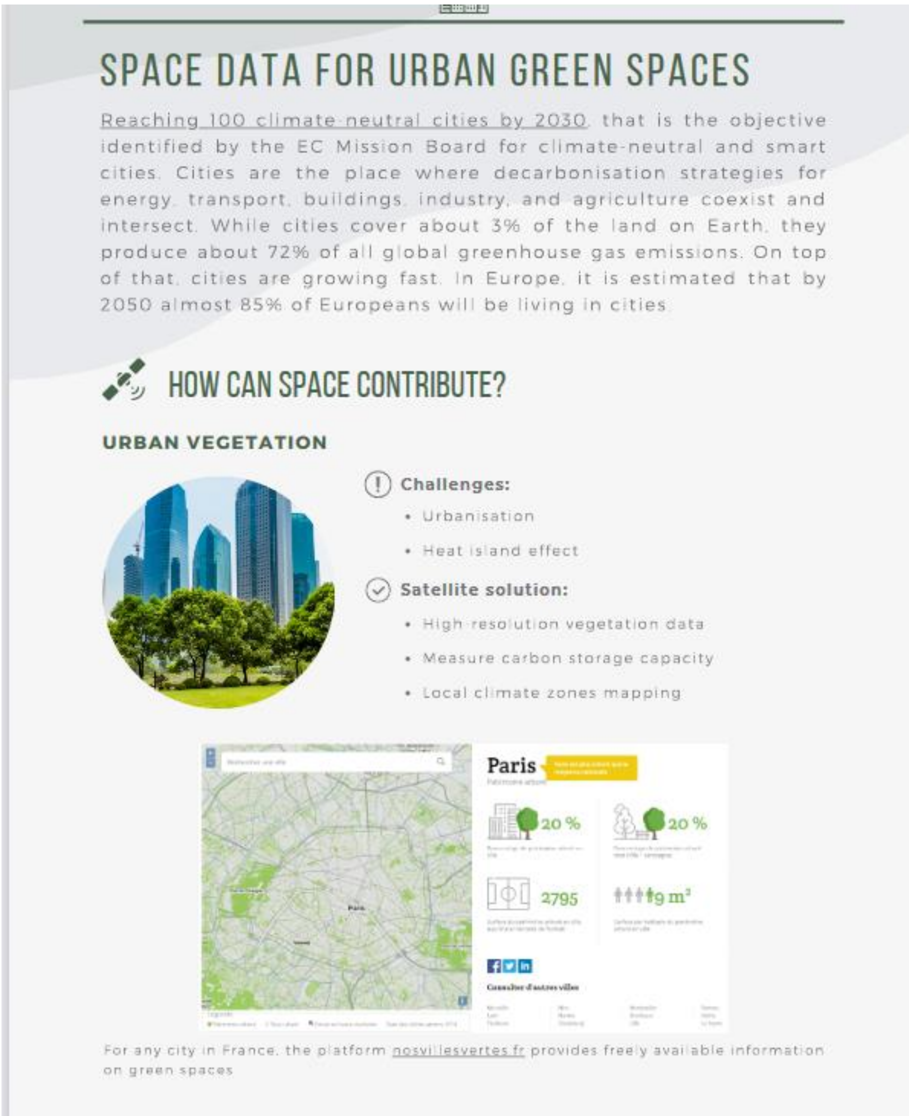

Figure 10. Example of EO potential for Urban Green Spaces

[21] Examples of services: Heat island effect detection; Urban planning (e.g. greening)/modelling/digital twins; Health – pollen, air pollution; Solar cadasters for urban environments.

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Figure 11. Example of EO potential for Air quality and Smart Infrastructure

Agriculture, Forestry and other Land use[22]

Agriculture, forestry, and other land uses (AFOLU) covers an array of environments and encompasses great potential and need for climate services. Unsustainable use of agricultural and forest practices (e.g. overexploiting the soil, converting forests into agricultural land) create huge amounts of greenhouse gases and disrupt the already fragile equilibrium in the local ecosystems.[23]

[22] https://www.thegef.org/what-we-do/topics/agriculture-forestry-and-other-land-uses
[23] Green European Foundation – GEF https://gef.eu/about-gef/who-we-are/what-is-gef/

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Using sustainable forest and land management practices with a view on long term and systemic impact can instead help those ecosystems retain and store significant amounts of carbon and preserve their fragile equilibrium.

The products of these sustainable practices could then fuel bioeconomy - a corollary of circular[24] economy, where renewable biological resources from land and sea (such as crops, forests, fish, animals, micro-organisms etc.) are used to derive products, processes and services in all economic sectors within the frame of a sustainable economic system.[25]

Climate services using Earth observation in the domain of AFOLU can contribute to a more optimised and sustainable exploitation of the land (based on precision agriculture, natural resources management) as well as counter the growing challenges related to the climate crises (i.e., providing forecasting and alerts on extreme weather events).

Potential of Earth Observation:[26]

[24] The environmental objective of the transition to a circular economy should be interpreted in accordance with relevant Union law in the areas of the circular economy, waste and chemicals, including Regulations (EC) No 1013/2006 (19), (EC) No 1907/2006 (20) and (EU) 2019/1021 (21) of the European Parliament and of the Council and Directives 94/62/EC (22), 2000/53/EC (23), 2006/66/EC (24), 2008/98/EC (25), 2010/75/EU (26), 2011/65/EU (27), 2012/19/EU (28), (EU) 2019/883 (29) and (EU) 2019/904 (30) of the European Parliament and of the Council, Council. See Recital 27 of EU Taxonomy Regulation.
[25] https://www.biooekonomierat.de/en/

[26] Examples of services : Food security monitoring and assessment; Carbon sequestration monitoring

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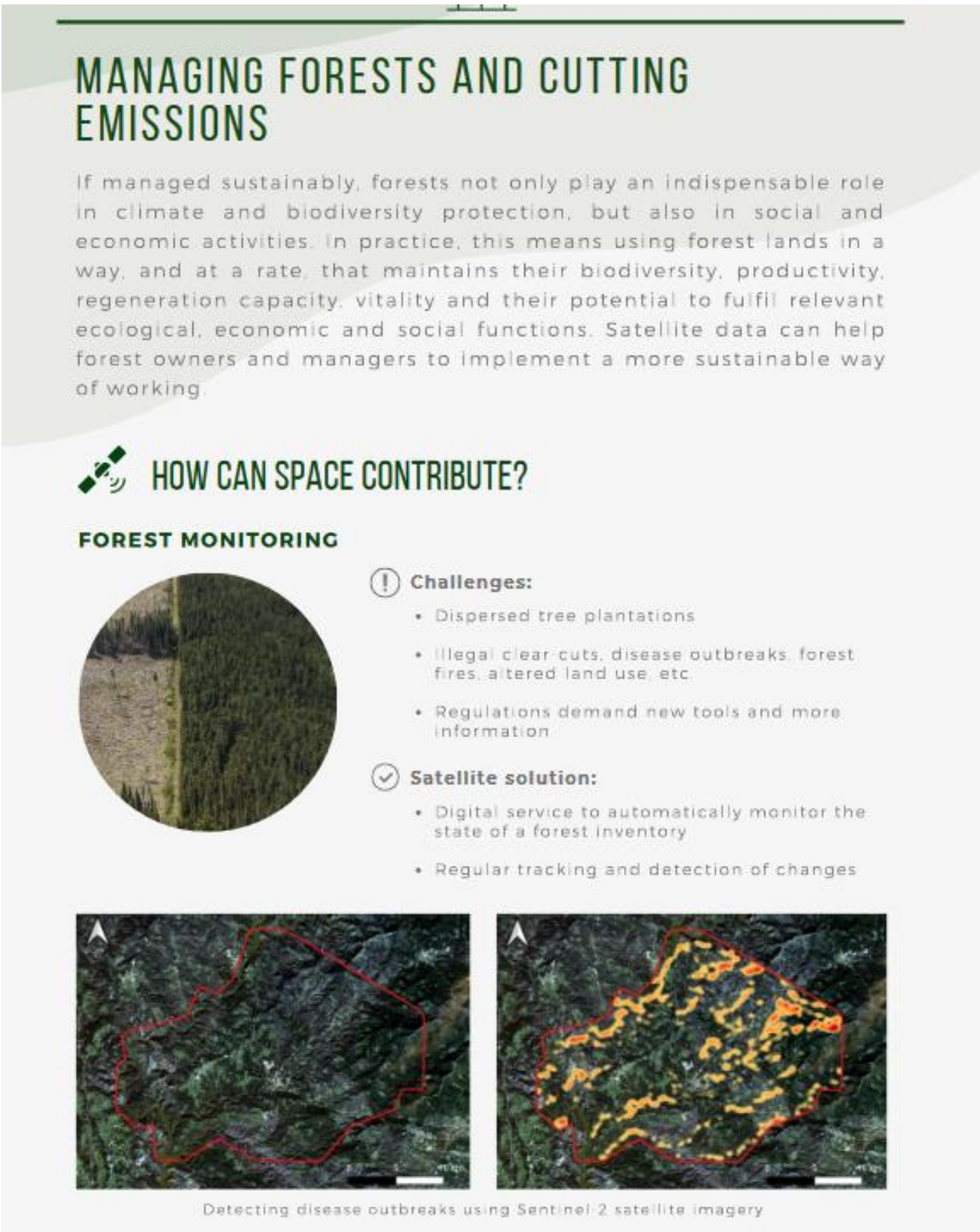

Figure 12. Example of EO potential for managing forests and cutting emissions

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Figure 13. Example of EO potential for Biodiversity

Civil Security and Protection [27]

Civil security and protection include the policies, bodies and mechanisms that a country or region has in place to protect it against new and urgent threats to the security of people and/or the functioning of critical infrastructures. Each government in Europe has such a system in place to provide 'societal

[27] Potential of Earth Observation and examples of climate services: Flood and drought monitoring; Landslide risk monitoring; Emergency management platform; Snow avalanche

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security'. Citizens expect their governments to design and operate capabilities to prevent risks from emerging, to prepare for crises and disasters, to protect values and infrastructures from harm, to respond effectively with sufficient capacity and effective decision-making when a crisis does occur, and to recover swiftly after a crisis strikes.

Extreme change can cause a disaster anytime, anywhere. However, proper planning, monitoring and early warning can prevent or reduce the damage. When disasters occur, alerting the population and emergency services is a priority and needs to be as fast as possible to save lives, protect jobs, and preserve the environment. Continuous monitoring and early warnings help better anticipate risks and warn the population in a potentially hazardous area.

Earth observation data can feed into systems monitoring extreme events and sending automated events to civil authorities and/or the population.

3.3. Results of the EU Survey questionnaire

An EU Survey questionnaire[28] was drafted and reviewed by the PROTECT partners. The final questionnaire was disseminated using different social channels and mailings to the networks of all the partners. The questionnaire remains open for interested parties to fill in information.

The EU Survey questionnaire had 33 responses[29] with feedback coming (mostly) from legal and technical experts in one of the five domains. The majority of them represent public organisations.

The highest interest is in the domain of Energy & Utilities, followed by sustainable urban communities, Marine and coastal environment, Agriculture, Forest and other Land use, and finally Civil security and protection.

The main pain point challenge is the transition to new processes, followed by lack of overview about existing and upcoming services, lack of data and tools to implement climate action, interoperability issues, difficulties to engage with the market, joint-cross border procurement and excessive energy costs.

The functions with the highest costs are the maintenance of operations, followed by data processing and analytics, specific human resources roles, and asset management.

The most pressing need is the transition (engineering) to sustainable processes, followed by real time data analytics and asset management.

Several respondents provided specific input on real time data analytic needs to be further explored during the workshops.

3.3.1. Respondents by area of expertise, type of organization and domain interest

[28] PROTEC EU Survey questionnaire: https://ec.europa.eu/eusurvey/runner/PROTECTSurvey
[29] This number may be updated as the EU Survey remains opened to interested parties.

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The results of the EU Survey questionnaire show the participation of experts in the different domains as follows, mostly coming from public organizations and interested in joining the different activities of PROTECT.

Area of expertise

		Answers	Ratio
Procurement Legal Expert		9	25 %
Technical Expert		13	36.11 %
Technical Expert in Energy and Utilities The Utilities sector includes all activities related to water supply, sewage services, electricity, dams, and natural gas. Earth observation-based data, in particular, can be used for climate services aimed at forecasting and nowcasting, planning and optimisation of renewable energy (onshore and offshore wind, solar, tidal and wave), and strategic monitoring for the utilities sector infrastructure (e.g. dams, pipelines).		2	5.56 %
Technical Expert in Sustainable urban communities Green and sustainable urban communities manage their human, natural, and financial capital with the goal to meet current and future needs in a sustainable manner, while prioritising a long-term perspective. The related climate services using Earth observation data have prominent application when it comes to assessing and forecasting air quality and pollen concentration and assisting urban planning and operations (monitoring and preventing heat islands, building greener cities) and optimising green cities, in particular when these are implementing elements of a smart (e.g., IoT) infrastructure.		5	13.89 %

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Technical Expert in Marine and coastal environment Marine environments are aquatic environments with high levels of dissolved salt. These include the open ocean, the deep-sea ocean, and coastal marine ecosystems, each of which have different physical and biological characteristics, thus representing different ecosystems. Marine and coastal environments can host complex ecosystems whose fragile equilibrium and prosperity depends on numerous environmental factors influencing each other and are thus a prime example of systematic approach to tackling climate needs (and providing corresponding services), making sure that addressing a single ecosystem indicator impacts other indicators in a foreseeable and favourable manner. The climate services in the marine domain rely on Earth observation data for precise nowcasting and forecasting, informing ocean weather algorithms, and monitoring parameters influencing water quality (for health, tourism, reporting purposes), such as turbidity, (potentially harmful) algae blooms and others.		3	8.33 %

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Technical Expert in Agriculture, Forestry and other Land use (including bioeconomy) Agriculture, forestry, and other land uses (AFOLU) covers an array of environments and encompasses great potential and need for climate services. Unsustainable use of agricultural and forest practices (e.g. overexploiting the soil, converting forests into agricultural land) create huge amounts of greenhouse gases and disrupt the already fragile equilibrium in the local ecosystems. Using sustainable forest and land management practices with a view on long term and systemic impact can instead help those ecosystems retain and store significant amounts of carbon and preserve their fragile equilibrium. The products of these sustainable practices could then fuel the bioeconomy - a corollary of the circular economy, where renewable biological resources from land and sea (such as crops, forests, fish, animals, micro-organisms etc.) are used to derive products, processes and services in all economic sectors within the frame of a sustainable economic system. Climate services using Earth observation in the domain of land use, agriculture and forestry can contribute to a more optimised and sustainable exploitation of the land (based on precision agriculture, natural resources management) as well as counter the growing challenges related to the climate crises (i.e., providing forecasting and alerts on extreme weather events).		6	16.67 %

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Technical Expert in Civil Security and Protection Civil security and protection include the policies, bodies and mechanisms that a country or region has in place to protect it against new and urgent threats to the security of people and/or the functioning of critical infrastructures. Earth observation data can feed into systems monitoring extreme events and sending automated alerts to civil authorities and/or the population.		5	13.89 %
Other		12	33.33 %

Type of organisation

		Answers	Ratio
Public Authority, Contracting Authority /Entity at EU level		3	8.33 %
Public Authority, Contracting Authority /Entity at national level		11	30.56 %
Public Authority, Contracting Authority /Entity at regional level		13	36.11 %
Public Authority, Contracting Authority /Entity at local level		9	25 %
Public undertaking		3	8.33 %
Private entity operating on the basis of special or exclusive rights		2	5.56 %
No Answer		0	0 %

Figure 14. EU Survey respondent by area of expertise and type of organization

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Are you interested in the PROTECT project?

		Answers	Ratio
Yes. I would like to receive more information about the PROTECT project, in particular about upcoming workshops, high-level conferences and training sessions.		32	88.89 %
Yes. I would like to get access to the PROTECT project procurement platform with exclusive content.		20	55.56 %
No Answer		3	8.33 %

1. The initial focus of PROTECT will be on five encompassing application domains. In which of these areas do you procure or is most interesting to you? Please put them in order (1 being the most interesting and 5 being the least interesting to you)

	1	2	3	4	5	Score
Energy and Utilities	**27.77%** 10	**30.55%** 11	**25.0%** 9	**16.66%** 6	**0.0%** 0	**3.69** 36
Sustainable urban communities	**19.44%** 7	**11.11%** 4	**11.11%** 4	**33.33%** 12	**25.0%** 9	**2.66** 36
Marine and coastal environment	**2.77%** 1	**13.88%** 5	**25.0%** 9	**19.44%** 7	**38.88%** 14	**2.22** 36
Agriculture, Forestry and other Land use (including bioeconomy)	**19.44%** 7	**27.77%** 10	**22.22%** 8	**13.88%** 5	**16.66%** 6	**3.19** 36
Civil Security and Protection	**30.55%** 11	**16.66%** 6	**16.66%** 6	**16.66%** 6	**19.44%** 7	**3.22** 36

Figure 15. EU Survey results on interest in PROTECT and application domain

3.3.2. Challenges, functions and needs

The results of the EU Survey questionnaire provided an initial baseline to identify most common needs which can be prioritized based on the selection of the respondents. The respondents pointed out the "Transition to new and sustainable processes" both as main challenge and pressing need, followed by real time analytics and asset management. The maintenance of operations is the function selected as with the highest costs, followed by data processing and analytics.

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2. Could you please indicate pain-points (challenges) that you experience at present?

		Answers	Ratio
Lack of data and tools to implement climate action		17	47.22 %
Interoperability issues to operate		16	44.44 %
Excessive energy costs		8	22.22 %
Transition to new processes		24	66.67 %
Joint cross-border procurement barriers		10	27.78 %
Difficulties regarding common needs analysis and business case development		18	50 %
Difficulties to engage with the market		13	36.11 %
Lack of overview about existing and upcoming services		18	50 %
Nobody in my organisation knows		5	13.89 %
Other		2	5.56 %
No Answer		0	0 %

3. For which functions do you experience the highest costs?

		Answers	Ratio
Data processing and analytics		12	33.33 %
Human resources specific roles		12	33.33 %
Asset management		10	27.78 %
Maintenance of operations		17	47.22 %
Nobody in my organisation knows		4	11.11 %
Other		2	5.56 %
No Answer		1	2.78 %

Figure 16. EU Survey results on pain points and functions with highest costs

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4. Could you indicate pressing needs in either of the areas - Energy and Utilities, Sustainable urban communities, Marine and coastal environment and Agriculture, Forestry and other Land use (including bioeconomy) and Civil Security and Protection- that would benefit from Climate Services?

		Answers	Ratio
Transition (engineering) to sustainable processes		25	69.44 %
Real time data analytics		17	47.22 %
Asset management		11	30.56 %
None		1	2.78 %
Nobody in my organisation knows.		5	13.89 %
Other		1	2.78 %
No Answer		1	2.78 %

Figure 17. EU Survey results on pressing needs

From the above answers to the questionnaire, the following summary shows a list and prioritization of main point challenges, pressing needs and functions/activities with the highest costs, as well as main human resources related problems are as follows:

Main pain points challenges
Transition to new processes.
Lack of overview about existing and upcoming services.
Lack of data and tools to implement climate action.
Difficulties regarding data common needs analysis and business case development.
Interoperability issues.

Other pain points
Not too much time to plan needs of territory and then design new infrastructure.
Use of climate change outcomes by considering i) life cycle of existing/proposed green and grey assets, ii) active participation of public-private-community stakeholders.

Pressing needs	Highest costs
Transition (engineering to sustainable processes)	Asset management
Real time data analytics	Maintenance of operations
Interoperability	Data processing, analytics
Asset management	Human resources

Human resources roles
There is not the right amount of human resources to use earth observation data to its fullest possibilities.
Additional training is required.
Greater importance must be given to the need to have adequate programs (and training) to process the data, many times there are bottlenecks for analysis due to not having the appropriate tools and in the end not all of them are used. the possibilities of the data obtained by the work involved in analyzing them).

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It is also important to establish specific roles for human resources (data collection and analysis require stable teams, sometimes traceability is lost due to the lack of such personnel and tasks are abandoned; specific training of said personnel).
Dedicated and specialized human resources are not only not available at our organization but also scarce, hence we must seek them in the market at higher costs.
It is difficult to find people with enough expertise in both, Earth Observation techniques and development of climatic services for specific issues (forest fires, risk of flooding, etc.).
There is high HR-costs and lack of knowledge.
Public procurement departments are not prepared for new task and new job roles.
The general cost of awareness is the main issue.

Table 1. Summary of EU Survey results on challenges, pressing needs and human resources

The respondents to the survey have only provided detailed comments specifically on pressing needs related to real time data analytics, which are dealt with in the following section.

3.3.3. Realtime data analytics needs

Regarding data analytics, several respondents pointed out specific problems to be address and the identification of TRL, (input as provided in the EU Survey) as follows.

Respondent	Real time analytics	TRL identified
DCMR	Real time data analytics needs the development of capable models and need to be combined with enough human resources to act on.	Not yet fully, but we have done -for example- a pilot project to monitor soil movement via satellite data, but are now stuck on at stage TRL8 due to lack in human resource and funds.
Ministère de l'Intérieur	No centralization of all available data in one place, facilitating decision-making	Yes, tests are in progress.
AGAPA	The importance of giving a rapid response to decision-making, especially in emergency situations caused by adverse weather conditions, and the need to have real-time data for inspection and control.	AGAPA is currently implementing a project for the use of UAS (Unmanned Aerial Systems) to simplify actions on the ground, whether in agricultural or fishing control and inspection and in characterization tasks of the Andalusian territory. We have been able to verify that the solutions based on available UAVs are around a TRL 6 or higher.
Regione Italia	A service would be needed that would allow an easier dissemination and application of the results of these analyzes	TRL 7
Hasičský a záchranný zbor	Asset management	Maybe just to begin with, at each fire station, or build large-capacity tanks for rainwater in public buildings and use it further, e.g. for fire water, service water.
Lisbon Municipality	For wicked problems, we need solutions like real-time data analytics. We have been	Partially

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	developing our platform (for this that allows different shareholders to use our API and take advantage of open data related to the city. There is still a lot to develop regarding climate change, such as acquiring and modelling data on the actual city supply chain. We want to start with the public procurement-related contracts to calculate the climate impacts of our supply chain as procurers.	
Asian Development Bank	Transition from real-time analytics to informed outcomes through use of decision support systems with spatial and temporal variation of data and associated indicators by considering expecting changes in climate, LULC, ecosystem services and other parameters	--
Porto Municipality	The needs we identify require development and innovative solutions, not available at the moment and therefore could benefit from Climate Services	On the topic of real time data analysis, we have already identified at least one possible solution which is at the moment on TRL 4-5. Many other projects that have required their impact analysis and monitoring at several levels (territorial, social, environmental) have required the implementation of innovation procurement through the co-design of tailored solutions with the market. On the transition to sustainable processes, the municipality is already working on a public procurement process to acquire services for a tailored solution for the design and implementation of more sustainable procurement processes in the municipality, which means that it, somehow, is already applying innovation procurement.
Consejería de Sostenibilidad Medio Ambiente y Economía Azul. Regional Government of Andalusia.	Many applications are related to risk assessments. This issue demands real time analytics for a quick answer to the problem. Usually data or data analysis are nor available causing important delays	No TRL have been identified.
Lisbon Municipality	Lisbon have defined a clear data analytics and open data strategy. A Platform for Managing Urban Intelligence is in place for some years, a Co-Creation Data Lab and other initiatives: https://lisboaaberta.cm-	We have been assessing other sources of data regarding the estimation of carbon in city supply chain. But there is the need to develop further solutions on climate change: measuring

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	lisboa.pt/index.php/pt/. To tackle climate change and to achieve carbon-neutrality there is a need to cooperate with other cities in order to define shared taxonomies, benchmarks, metrics and other important knowledge.	carbon in supply chains, simulating scenarios of climate impact, etc.
Creatio eu	Real time data can be used in large range of projects in municipalities to reduce energy consumptions, pollution etc.	Smart cities as example, usage real time data from traffic can be used to reduce energy consumptions, pollution in municipalities
University of Twente	Understanding the internal needs and matching external possibilities of suppliers can be enhanced by data analytics	Yes. In my organization the TRL is low
STIB-MIVB	Asset management	Companies like Microsoft already have presented their products and client projects to give us ideas on Digital Twin solutions. However, as STIB has its own electricity network, we could think wider. For instance developing multi model business cases around the charging of electric vehicles. Of companies, of people. etc.

Table 2. Summary of EU Survey results on data analytic needs

3.3.3. Conclusions

Based on the information provided in the EU Survey questionnaire, some main conclusions are:

- Some organizations completely lack real time data analytics or lack centralized information to facilitate decision-making. Furthermore, real time data analytics require the development of capable models, as well as sufficient and well trained human resources capable to take specific roles and interact with the tools. However, in some cases, existing pilots do not have enough funds and human resources.

- There is a need for the transition from real time analytics to informed outcomes through the use of decision support systems with spatial and temporal variation of data and associated indicators considering expected climate changes, land use and land cover (LULC - which plays a crucial role in city planning), ecosystem services and other parameters. Some cities have defined a clear data analytics and open data strategy establishing co-creation data labs. They are also working on modeling data to calculate the climate impacts of their supply chain in public procurement.

- There is an emphasis on the importance of giving a rapid response to decision-making, especially in emergency situations caused by adverse weather conditions. Although many applications are related to risk assessments, more real time analytics are needed for faster answers to the problems. The lack of data or data analysis cause important delays to respond in critical situations.

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- In addition, some organisations require real-time data for inspection and control to simplify actions on the ground (e.g., in agricultural or fishing control and inspection).

- Regarding asset management, it is suggested to begin with targeting specific facilities, such as fire stations, large-capacity tanks for rainwater in public buildings. Furthermore, it is important to explore Digital Twin related solutions. Another possibility is to consider developing multi model business cases around the charging of electric vehicles.
- To tackle climate change and to achieve carbon-neutrality there is a need to cooperate with other cities in order to define shared taxonomies, benchmarks, metrics and other important knowledge. It is important to assess different sources of data regarding the estimation of carbon in cities' supply chain. In this sense, there is a need to develop solutions on climate change to measure carbon in supply chains and simulating scenarios of climate impact.

- Real time data can be used in large range of projects in municipalities to reduce energy consumptions, and pollution. In smart cities, the usage of real time data from traffic can be used to reduce energy consumptions and pollution in municipalities.

4. Workshops using value methodologies

Based on the results of the questionnaire and the systems mapping, an online Workshop with Working Groups in the five application domains were carried out, in preparation of which invited participants received information on the outcome of the discussions during the high-level conference and on the background of the methodology to identify common needs and barriers.[30] Value methodologies were embedded during the workshop to prioritize and fine-tune needs based on the climate challenges identified in the five application domains. The results have been preliminarily translated into the description of challenges as functional requirements, use cases and initial keywords with the purpose to prepare for a SOTA analysis in T3.2 and give an overview of the needs and potential subsequent procurement challenges that could be addressed through one or several PCPs or PPIs (D1.2).

The first set of workshops consisted of online sessions of Working Groups in five application domains on 28 and 29 of March 2023. The second set of workshops to further finetune the common needs will take place on September 2023. The outcome of the workshops will provide the basis to identify common needs and rate different scenarios. Upon the results, an agreement will be reached to define 4 procurement challenges and agree on the final use cases and keywords for the State of the Art Analysis (SOTA).

[30] The high-level conference took place in Barcelona on 16-17 November 2022.

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4.1. Working groups preparation based on the results of the high-level conference

The high-level conference of PROTECT took place during the Smart City Expo World Congress 2022 in Barcelona on November 17th, 2022. The conference gathered representatives from cities and regions from all over Europe, including Helsinki, Bratislava, Haarlem, Grenoble and Flanders regions and many more. Participants were invited to discuss how can Pre-Commercial Procurement (PCP) and Earth Observation (EO) help them tackle climate change adaptation and implement mitigation measures and shape the next generation climate change services.

In the context of the high-level conference, a so-called light version of the Value techniques was prepared providing instructions and examples to moderators and rapporteurs to carry out discussions in the five application domains. The following examples on challenges and functional requirements were provided to start the discussions.

DOMAIN	EO FUNCTIONAL EXAMPLES
Energy and Utilities The Utilities sector includes all activities related to water supply, sewage services, electricity, dams, and natural gas. Climate-change-related risks affect water supply and utility infrastructures, as damages will have great impacts on operations and costs. The use of climate services can contribute to a better management of water flow, more resilient and independent energy systems, informed purchasing decisions based on accurate predictions, and others. Earth observation-based data, in particular, can be used into climate services aimed and forecasting and nowcasting, planning and optimisation of renewable energy (onshore and offshore wind, solar, tidal and wave), and monitoring of strategic for the utilities sector infrastructure (e.g. dams, pipelines).	**The potential of Earth Observation:** **Monitoring** the **solar yield** for **grid** optimization. **Detecting** **activities** in **energy** corridors. **Analyzing** historical data for **water** quantity and quality.

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Sustainable urban communities Green and sustainable urban communities operate their human, natural, and financial capital with the goal to meet current and future needs in a sustainable manner, while prioritising a long-term perspective. This is particularly important against the backdrop of the ongoing climate crisis, due to the sustainable communities' focus on anticipating and adapting to change in both the present and future. Moreover, the current reality of an increasing majority of the world's population living in cities which in turn grow rapidly and not always sustainably, puts urban communities at the forefront for climate services related to resilience and adaptation. Those using Earth observation data have prominent application when it comes to assessing and forecasting air quality and pollen concentration and assisting urban planning and operations (monitoring and preventing heat islands, building greener cities) and optimizing green cities, in particular when these are implementing elements of a smart (e.g., IoT) infrastructure.	**The potential of Earth Observation:** **Measuring** **carbon storage** capacity **Mapping** local climate **zones**. **Mapping** **air** quality **Obtaining** high resolution **vegetation** data. **Adapting** cities **policies** and **reducing** exposure to **pollution**. **Monitoring** in 3D **buildings, landslides, pipelines, bridges.** **Analyzing** **rooftops** and calculating the potential of **solar power**. **Mapping** thermal distribution to identify **heat losses** and to assess electrical consumption.
Marine and coastal environment: Marine environments are aquatic environments with high levels of dissolved salt. These include the open ocean, the deep-sea ocean, and coastal marine ecosystems, each of which have different physical and biological characteristics, and thus representing different ecosystems. Marine and coastal environments can host complex ecosystems whose fragile equilibrium and prosperity depends on numerous environmental factors influencing each other, and are thus a prime example of systematic approach to tackling climate needs (and providing corresponding services), making sure that addressing a single ecosystem indicator impacts other indicators in a foreseeable and favourable manner. The climate services in the marine and coastal domain rely on Earth observation data for precise nowcasting and forecasting, informing ocean weather algorithms, and monitoring parameters influencing water quality (for health, tourism, reporting purposes), such as turbidity, (potentially harmful) algae blooms and others.	**The potential of Earth Observation:** **Monitoring** climate change impact on natural coastal processes and **ecosystems**. **Sensing** remotely **time series data** for water constituents and other parameters. **Contributing** to models for **ocean surface**. **Assessing** environmental risks based on high resolution **wind** forecast.

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Agriculture, Forestry and other Land use **It includes bioeconomy* Agriculture, forestry, and other land uses (AFOLU) covers an array of environments and encompasses great potential and need for climate services. Unsustainable use of agricultural and forest practices (e.g. overexploiting the soil, converting forests into agricultural land) create huge amounts of greenhouse gases and disrupt the already fragile equilibrium in the local ecosystems. Using sustainable forest and land management practices with a view on long term and systemic impact can instead help those ecosystems retain and store significant amounts of carbon and preserve their fragile equilibrium. The products of these sustainable practices could then fuel bioeconomy - a corollary of circular economy, where renewable biological resources from land and sea (such as crops, forests, fish, animals, micro-organisms etc.) are used to derive products, processes and services in all economic sectors within the frame of a sustainable economic system. Climate services using Earth observation in the domain of AFOLU can contribute to a more optimised and sustainable exploitation of the land (based on precision agriculture, natural resources management) as well as counter the growing challenges related to the climate crises (i.e., providing forecasting and alerts on extreme weather events).	**The potential of Earth Observation:** **Monitoring** the state of a **forest inventory**. **Tracking and detecting forest and land** changes. **Identifying and mapping plants and trees**. **Detecting** stress in **plants** before they are visible to the naked eye. **Monitoring** large **areas.**
Civil Security and Protection Civil security and protection include the policies, bodies and mechanisms that a country or region has in place to protect it against new and urgent threats to the security of people and/or the functioning of critical infrastructures. Each government in Europe has such a system in place to provide 'societal security'. Citizens expect their governments to design and operate capabilities to prevent risks from emerging, to prepare for crises and disasters, to protect values and infrastructures from harm, to respond effectively with sufficient capacity and effective decision-making when a crisis does occur, and to recover swiftly after a crisis strikes. Extreme change can cause a disaster anytime, anywhere. However, proper planning, monitoring and early warning can prevent or reduce the damage. When disasters occur, alerting the population and emergency services is a priority and needs	**The potential of Earth Observation:** **Monitoring flood and drought**. **Monitoring landslide** risk. **Managing** an **emergency platform**. **Identifying avalanche** risks.

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to be as fast as possible to save lives, protect jobs, and preserve the environment. Continuous monitoring and early warnings help better anticipate risks and warn the population in a potentially hazardous area. Earth observation data can feed into systems monitoring extreme events and sending automated events to civil authorities and/or the population.	

Table 3. PROTECT application domains and examples of EO based functions

EXAMPLES OF RISKS AND FUNCTIONAL NEEDS

Risk challenge: Sea contamination, rising levels

Needs examples as functional requirement
Mapping trends in long-established hazardous substances and control contamination levels of Europe's regional seas using earth real time data analytics to map
Developing digital elevation models to understand and predict changes in earth's environment, and conserve and manage coastal and marine resources to meet economic, social, and environmental needs.

Risk challenge: Interruption/ disruption of services

Needs examples as functional requirement
Managing assets to reducing energy consumption using real time earth data.
Transitioning to renewable energy sources based on earth data analytics.

Risk challenge: Waste management

Needs examples as functional requirement
Identifying waste management blind hazard spots using real time earth data analytics.
Transitioning to sustainable asset management based on earth data analytics.

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Risk challenge: Food shortage, deforestation, drought

Needs examples as functional requirement
Spotting reforestation areas for planting trees of a specific sort based on real time earth data.
Advancing climate-smart agriculture and increased resilience to droughts based on earth data analytics and drones.

Risk challenge: Fire, flood

Needs examples as functional requirement
Preventing floods and improving control by **identifying rain and soil conditions** using real time earth data.
Preventing fire prevention by identifying danger areas using real time earth data.

Table 4. Example of challenges and functional needs

During the event, and given the dynamic with participants, the discussions were carried out in a plenary and resulted in one identified need to be further analyzed, namely: the illegal dumping of waste.

Participants were invited to take part in an open discussion regarding the challenges faced by sustainable urban communities, and they shared several concrete examples of how EO can support cities. Bratislava city spoke about the issues regarding the dumping of illegal waste, including dangerous substances such as flammables that can cause fires. Some waste may include hazardous chemicals and spread contaminated substances after heavy rainfall. Helsinki City mentioned that in order to have a more circular approach, they incinerate their waste and reuse the heat created. And nowadays, they are transitioning to more sustainable systems by recycling plastic and separating the waste collection. In a similar situation in the region of Flanders, the heating systems are derived from the incineration of waste. Currently, they have ongoing projects related to sharing heat and working on organizing low-cost heating solutions for residents.

In this context, it was discussed that EO may contribute to the monitoring and identification of illegal dumping of waste, such as burning waste, without requiring on the spot human intervention. EO could also feed into a warning system to anticipate problems and inform decision-makers about suspicious and potentially contaminated illegal dumping. A similar approach could be adopted before implementing significant water, heat, and road infrastructure projects, to consider how to monitor and evaluate the actions taken. EO might, in combination with other data sources, assist establishing strategies, policies, and measurements for the impacts of this project on the city.

Building on the results of the open discussion in Barcelona, the problem/challenge of illegal dumping of waste was further explored as relevant to all five PROTECT application domains (Marine and Coastal

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environment, Energy and Utilities Sustainable urban communities, Agriculture, forestry and other land use and City security protection) during the online Pain Point Workshop.

In this regard, those participants who replied to the EU Survey questionnaire and the open call of PROTECT, received material and were invited to think about the problem/challenge of dumping of illegal waste from their perspective/expertise in the five application domains, and using a few questions and techniques.

The participants were provided with the following use case example and some techniques.

4.1.1. Use case example

The dumping of illegal waste is a 'collective' problem, which can lead to dramatic consequences due to the effects of climate changes (e.g. heavy floods carrying waste that contaminates the soil or water causing health problems). This problem with consequences to the environment may impact the five PROTECT application domains. In the civil security domain, the hazardous waste jeopardizes the safety of the community, and it is a punishable crime. But also, for example, due to rain and water leak, the dumping of illegal waste could affect the provision of energy, the coasts and its flora and fauna, the soil for agriculture and the wellbeing in cities.

So how can EO help with waste management (and climate change adaptation and/or mitigation)? EO could contribute to detecting, monitoring, warning and alerting illegal dumping of waste. Indeed, data can be used to monitor and help locate instantly what is happening and open us up to possibilities about what can be done. In the value chain, public authorities can work together to provide a better public service. Ideally, there will not be illegal dumping. But next best option would be that it could be accurately measured (using EO) to then monitor and assess the situation and the options.

EO based application/solution example

Extreme change can cause a disaster anytime, anywhere. However, proper planning, monitoring and early warning can prevent or reduce the damage. When disasters occur, alerting the population and emergency services is a priority and needs to be as fast as possible to save lives, protect jobs, and preserve the environment. Continuous monitoring and early warnings can help better anticipate risks and warn the population in a potentially hazardous area.

Earth observation data can feed into systems monitoring extreme events and sending automated events to civil authorities and/or the population.

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4.1.2. Techniques applied to the workshop

To analyze the challenge "illegal dumping of waste" the techniques (FAST, VSM and VSD) were set in in the following exercises.

4.1.2.1. Function Analysis System Technique (FAST)

The following questions (five steps) guide the use of the Function Analysis System Technique.

QUESTIONS/STEPS:

1. What is the problem of study? Define the scope you consider applicable.
2. How can you tackle the problem? (how function)
3. Why do you tackle the problem? (why function)
4. What is the basic function to solve the problem?
5. Are there any other functions you require in order to tackle the problem?
6. Are there any functions that you specifically don't want or need to avoid?

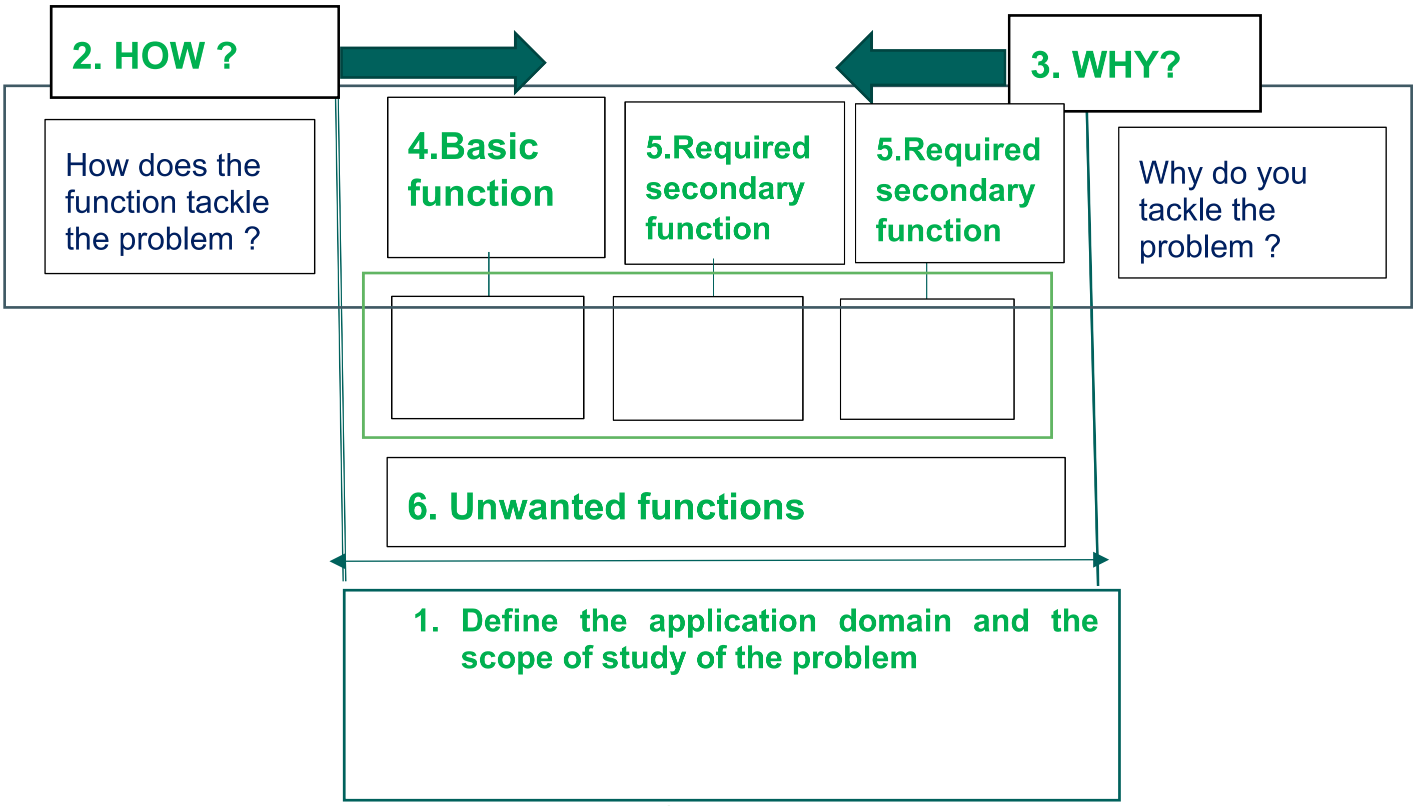

Figure 18. FAST diagram

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OUTCOME OF THIS EXERCISE: 1 concrete challenge/need expressed as a functional requirement using a sentence comprising a verb and a measurable noun.

CHALLENGE/NEED:

4.1.2.2. Value Stream Mapping (VSM)

To apply the Value Stream Mapping technique, the following instructions were provided under the 3 VSM steps.

VSM Step 1:

- Describe an end-to-end service process as use case.
- Select and briefly describe the service process identified.
- Break the process down into at least 5 logical and chronological steps/activities.'

VSM Step 2:

- Apply the 80% (waste) -20% (value) rule.[31]
- From the 5 activities which 2 create value & why?
- From the 5 activities which 2 do not create value (create waste) & why?

VSM Step 3:

- How would you improve the 2 activities that do not create value (only waste)?
- For these 2 activities, make short term actionable suggestions to improve these activities.

OUTCOME OF THIS EXERCISE: 1 concrete use case based on the problem identified in the FAST exercise (e.g. related to illegal dumping of waste). The use case will be related to what new (to be developed) Climate Services based on Earth Observation data/services can provide.

[31] The Pareto Principle, or the 80/20 rule, comes into play. The Pareto Principle was originally discovered by Vilfredo Pareto in 1906, in Italy. It simply states that 80% of your results, comes from 20% of your effort. Our 80% of your outcomes come from 20% of the inputs.

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USE CASE:
FIVE LOGICAL STEPS: **1.** **2.** **3.** **4.** **5.**

4.1.2.3. Value Stream Design (VSD)

To apply the Value Stream Design technique the following instructions were provided under 2 VDM steps:

VDM Step 1:

- Where is the biggest value in the use case identified in the exercise using VSM (3.2 above)?
  - (Close eyes) Dream and wake up
  - Dream state triggers disruptive ideas
- Identify value creation points
- Visualize the future state

VDM Step 2:

- State the goal
- Define the resources
- Identify the constraints
- Don't fix the symptom – don't hide waste
- Give extreme visibility to the problem
- Identify the context & behavior
- Find root causes
- Don't stop at the first root cause
- Identify pilots

Questions

- What can EO technology do to solve the problem?

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- Which new (non-existing) EO services and/or new (non-existing) EO products and technologies are needed?
- Who needs the information?
- Who is responsible?

OUTCOME OF THIS EXERCISE: Dream of an end-to-end solution to tackle (e.g.llegal dumping of waste). Ask yourself “Wouldn’t it be great if…”. The present and dreamed situation will be related to what new (non-existing) Climate Services based on Earth Observation (to be developed) can provide.

As is (present) situation	Desired dreamed (future) situation

VALUE PILOTS:

4.2. Working groups in-depth analysis per domain

The in-depth value engineering workshop was carried out in 5 Working Groups, one WG per domain. The techniques applied, embedded in the material and questions during the sessions were: FAST, VSM, VDM. The main material will be based on the needs reported in the questionnaire and during the high-level conference.

Each working group was integrated by (10 to 14) participants of a multidisciplinary background including at least 2 participants from the public sector from the relevant domain. Participants were selected and invited in advance (from the consortium, the submitted questionnaire, and the external advisors).

The Workshop (online sessions) consisted on 5 Working Groups of 90 minutes to cover the following:

- Introduction to the context and objectives of PROTECT→ including the potential of EO and climate Services in each application domain.
- Overview of the EAFIP methodology → focusing on the needs identification and assessment step.

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- Function analysis phase → based on challenges and problems stated by participants.
- Creative session → Value Stream Mapping to define a use case as a present situation and a future ideal situation.
- Judgmental phase → Value Stream Design to identify steps to reach the ideal situation.
- Evaluation of conclusions and next steps

5. Post-study of challenges and needs

As a result of the Working Groups per application domain, the following functional description, use cases, value pilots and preliminary keywords have been obtained.

5.1. Marine and Coastal Environments

Marine and coastal environments

Challenge and functional description of needs

Floods pose risks to the cities in coastal areas leading to potential disaster. More insights into the phenomena are needed, overcoming data gaps and combining data in a timely manner.

Reliable mapping of flooded areas is needed for planning, preventing, predicting and for post event intervention, as well as for cooperation towards a positive end result.

Use case

Present situation 'as is':

The **mapping of flooded areas** in case of serious events can take weeks.

Municipalities do not have reliable tools to predict, prevent and respond in a timely manner.

Desired – dreamed future situation

Rapid mapping **for projections** to identify risks and define benchmarks. This requires software for higher resolution and timely satellite information.

Steps from the present to the future situation

1. Implement one repository of (historical) data, and a single Application Programming Interface (API).
2. Connect rapid mapping and climate services to the repository.
3. Turn mapping into algorithms.
4. Use efficient hardware.
5. Apply the tools correctly, with a team with the needed skills.

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Value pilot

It would be useful for **municipalities of cities along the coast** to carry out an isolated rapid mapping test aimed to inform the planning and decision making of measures for the efficient management of (potential) coastal floods. Accurate data can help define ways of early intervention and decision making.

Keywords

Rapid mapping of flooded areas, projection, intervention, high resolution, EO data, climate services, API.

5.2. Sustainable Urban Communities

Sustainable urban communities

Challenge and functional description of needs

Thermal monitoring and predicting waste fire can help avoid the spontaneous ignition in waste storages. Certain conditions (like the level of humidity, air temperature, hight of the pile of waste, etc.) are conducive to spontaneous waste ignition. This causes bad air quality and if not controlled on time it could cause material and/or human damage and loses.

Use case

Present situation 'as is'

Facilities **where waste is stored** can suffer spontaneous fires 3 or more times a year. This happens especially in summer when the temperatures are higher. At present, although there is data on previous events, there is **no automated solution to predict fires** and take decisions to prevent them. Inspectors of environmental agencies monitor the facilities resulting in quite an effort for staff.

Desired – dreamed future situation

Automated notification of risk of fire so that the environmental agencies can take measures, such as contacting companies/industry that has/manage waste storage facilities, help **prevent** air pollution and damages.

Steps from the present to the future situation

1. Explore the technical borders to understand what is possible in order to provide frequent data updates, and establish the frequency for preparedness.
2. Develop a model out of (all) existing and new data for prediction of waste fires. Data aggregation, including all data from past waste fire situations can be useful.
3. Train the model based on defined conditions, relevant factors(e.g. evolving composition of waste through time, temperature)
4. Anticipate fire using data.
5. Notify action to prevent a fire timely.

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Value pilot

Managing waste is something necessary in all cities. Spontaneous fire from waste may be a same challenge of other cities (such as in Rotterdam). Perhaps there is no need to tailor made a solution, and it is possible to use existing (historical) and EO data to make a model. The **model shall predict waste fire based on aggregated data**. The investment could be worthy for **environmental agencies** that supervise and control, and **companies** that manage waste.

Keywords

Automated notification, waste fire, modelling, prediction, data aggregation.

5.3. Civil Security and Protection

Challenge and functional description of needs

Identifying illegal dumping of waste in the water can cause cross-border damage. Obtaining **standardised reports** can serve as proof of responsibility in (criminal) judicial proceedings. Identifying the kind of material dumped (e.g. asbestos) can help define the type of intervention required.

Use case

Present situation 'as is'

Waste is dumped Illegally and it is difficult for **law enforcement agencies** to trace the responsible of criminal behaviour. It is also not possible **to inform and prevent the flow of the waste cross-borders.** There is no data which can be used in criminal proceedings as proof.

Desired – dreamed future situation

Alerts are sent to competent authorities to prevent the illegal dumping of waste in the water and to inform of a possible risk preventing further (cross-border) damage. Standardized reports and information can serve in civil and criminal proceedings to establish responsibilities upon the applicable law in a specific judiciary system.

Steps from the present to the future situation

1. Examine current monitoring possibilities.
2. Define the type of substances illegally dumped in water based on previous experience and also the measures being taken in specific cases.
3. Notify timely environmental agencies, fire fighters and other relevant law enforcement agencies on potential risks and results.
4. Define possible interventions on site to prevent dumping and further damage.
5. Standardize the reports and data to be admissible in a civil and criminal court.

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Value pilot

There are **toxic substances** which are not yet listed in the regulatory framework, but which may be dumped in water bodies (e.g. rivers). There is a need of environmental data regarding the damage that can be caused by such toxic substances. **A chain can be geographically (e.g., in a region) measured** to identify pollutants, types of vegetation and other relevant environmental factors to trace changes and damaging effects. For example, factory sources can be monitored to alert and trace pollutants. Environmental agencies and law enforcement agencies can help assess, based on experience and historical data, the requirements **for standardization of reports and data for traceability and identification of responsibility** which can be used in court.

Keywords

Monitoring, waste dumping, toxic substances, notification, intervention, pollutants. Vegetation changes, traceability, identification of responsibility.

5.4. Energy and Utilities

Energy & Utilities

Challenge and functional description of needs

Drought can put in stress in the provision of water for different uses, such as farming. The depletion of water sources (e.g. less water in the rivers due to lack of melting ice from mountains) may be overcome by connecting the **supply and demand of sweet water with data from the whole water cycle** with insights (e.g., on sewage system water and the requirements of treated water for farming) and a common language/taxonomy.

Use case

Present situation 'as is'

The demand for sweet water is unpredictable. The supply and demand of sweet water is not connected. There are regulations determining the use of water from channels, treated water from the sewage and drinking water (in each EU Member State). There is no common language among different stakeholders in the water cycle chain. There is a lot of data in certain regions but the data hubs or repositories are not connected.

Desired – dreamed future situation

The demand for sweet water is predictable. The regulatory landscape and policies are clearly defined. The system can cope with stress situations based on data for informed decision making and interventions. **Supply and demand for sweet water are connected based on needs of diverse users** (e.g., famers, companies, industry) and the understanding on the conditions and water quality required for different purposes. Decision and guidance from a policy perspective is achieved to understand the consequences and combine relevant data in the whole water chain cycle under a taxonomy.

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Steps from the present to the future situation

1. Understand what is happening at present and the mechanisms in place (also from a policy perspective). Learn how the problem of drought regarding supply and demand of water is addressed, to define the type of new services that support coping with stress situations based on a common language. Understand which are the relevant responsible public authorities and users. Also, identify the data gaps.
2. Develop a system that combines data and uses AI for modelling.
3. Use database driven solutions to improve the distribution of water (e.g. identify saline concentration, pollution, substances, algea, etc.)
4. Provide information to water authorities that need to know how to collect, when and how to distribute water (treated in a certain way) to supply the specific demand, and avoid discharging sweet water.
5. Build a resilient system where different stakeholders (water companies, farmers, industry) cooperate during drought.

Value pilot

Take as example regions with similar challenges. Some regions may have more consensus among stakeholders in the water chain cycle than others. Identify the policies and stakeholders. Define how to know where the water is and when it can be used. Make use and combine existing data lakes or hubs and develop applicable models.

Keywords

Drought, AI for modelling, data combination, water demand and supply connection, water quality, distribution.

5.5. Agriculture, Forestry and Land Use

Agriculture, forestry and other land use

Challenge and functional description of needs

Detecting climate vulnerability and planning resilience in the face of challenges like salinity affecting reproductivity.

Use case

Present situation 'as is'

Planning is realized based on data collected mostly manually in a database and analysed by field experts.

Desired – dreamed future situation

Automated analysis to support the decision of experts in preparing resilience plans.

Steps from the present to the future situation

1. Combine existing data with new EO data.

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2. Validate data with field experts.
3. Use AI to define scenarios.
4. Work on resilience plans based on input from data analysis and predictions.
5. Implement resilience plans.

Value pilot

Select a specific area to perform climate vulnerability analysis for agriculture. EO data is only part of the solution, other data related to social and economic aspects are relevant to.

Keywords

Automated analysis, climate resilience plans, AI scenarios, forest and land, prediction, salinity, reproductivity.

6. Conclusions

1. The Value (engineering) methodology for the identification of common needs in five application domains based consists of three stages: (1) Pre-study, (2) Value Workshops, and (3) Post-study.

2. The Pre-Study stage comprised desk research to: (i) identify environmental sustainable activities of substantial contribution based on the EU Taxonomy Regulation; (ii) identify Earth Observation taxonomies and examples of services; (iii) a questionnaire to preliminary identify and prioritize challenges/needs; (iv) develop a methodology for workshops in the form of exercises to lead the discussion; and (v) the identification of potential participants to Working Groups.

3. The analysis of the environmental sustainable activities provides insights into what a substantial contribution to climate change adaptation and mitigation is, in particular preventing and tackling those risks relevant to the application domains in the context of PROTECT.

4. The Earth Observation taxonomy provides an overview of the services from the user and provider perspective. The description of the EO services in the five domains are useful for the future information and training to the community of PROTECT, especially because one of the main problems identified in the EU Survey questionnaire is the lack of information of such services.

5. The results of the EU Survey questionnaire provided with an initial baseline to identify most common needs which can be prioritized based on the selection of the respondents. The respondents pointed out as main challenge and pressing need the "Transition to new and sustainable processes", followed by real time analytics and asset management. The maintenance of operations is the function selected as with the highest costs, followed by data processing and analytics.

6. From the results of the EU Survey, some main conclusions are:

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6.1. There is a need of real time data analytics and centralized information to facilitate decision-making. This requires the development of capable models and well trained human resources capable to take specific roles and interact with the tools.

6.2. It is important to move beyond real time analytics to informed outcomes through the use of decision support systems with spatial and temporal variation of data and associated indicators considering expected climate changes, land use and land cover, ecosystem services and other parameters.

6.3. It is crucial to have a rapid decision-making, especially in emergency situations caused by adverse weather conditions. The lack of data or data analysis cause important delays to respond in critical situations.

6.4. Real-time data can simplify actions on the ground for agricultural and fishing control and inspection. It can also be used for asset management targeting specific facilities and public buildings. Furthermore, it is important to explore Digital Twin related solutions. Another possibility is to consider developing multi model business cases around the charging of electric vehicles.

6.5. To tackle climate change and to achieve carbon-neutrality there is a need to cooperate with other cities in order to define shared taxonomies, benchmarks, metrics and other important knowledge. It is important to assess different sources of data regarding the estimation of carbon in cities' supply chain and to develop solutions on climate change to measure carbon in supply chains and simulating scenarios of climate impact. In Smart cities, real time data (e.g. traffic data) can be used in large range of projects to reduce energy consumptions, and pollution.

7. During the workshops (a first session during the high-level event in Barcelona on November 2022 and the online session in 5 Working Groups on 28 and 29 March 2023) the exercises developed based on the preliminary results of the EU Survey and Value methodologies (FAST, VSM, VSD) provided a template for dynamic discussion aiming for a specific outcome: (a) functional description need per domain, (b) use case per domain; (c) value pilot per use case; and (d) a first set of keywords. The outcome is the basis for further analysis and consensus in the definition of needs to be translated into definitive keywords which will be used to perform a state of the art analysis (SOTA) in Work Package 3.

8. In Post-study, the results of the Pain Point Workshop provided in section 5 indicate as initial challenges: (1) Rapid flood mapping; (2) Predicting and preventing waste fire; (3) Connecting the demand and supply of water to overcome drought and satisfy the need of several users in the water chain (e.g. farmers, industry): (4) Prevent, monitoring and prosecute the illegal dumping of waste (in water); and (5) Respond to climate vulnerability through resilience planning in agriculture, forest and land use. The relevance of these challenges for other organizations was validated by a follow up EU Survey, where a total of 20 respondents indicated that one or more of the challenges are relevant and most of them confirmed their interest in participating in a joint cross-border PCP (see Annex 4).

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Annex 1

EU Survey questionnaire

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Innovation Procurement of Climate Change services & National Legal Framework

Fields marked with * are mandatory.

PROCURING INNOVATIVE CLIMATE CHANGE SERVICES

Instructions to fill in this questionnaire

* The information provided will only be used in the context of the PROTECT project. Processing of this information is fully compliant with data protection regulations in place (learn more about GDPR here).
* You can share the questionnaire and ask support within your organisation as you see fit. Please fill in as many questions as possible. If you don´t have an answer to a particular question, it is possible to leave it blank.
* It is recommended to discuss the questionnaire with your procurement legal expert and your technical expert in a cooperative manner.
*You can download the Annex to have more information about Innovation procurement, it´s two modalities and TRLs.
NEW: This online survey is open without deadline!

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Feel free to only fill in sections 1 to 3 to tell us about your needs!

Innovation Procurement - download file

What_is_Innovation_Procurement.pdf

PROTECT Flyer - download flyer for more information about the project

PROTECT_Flyer_v2new.pdf

1. Personal and Organisation Information

* Name(s) Surname(s)

* Area of expertise

You may select as many answers as you see fit

- [ ] Procurement Legal Expert
- [ ] Technical Expert
- [ ] Technical Expert in Energy and Utilities

  The Utilities sector includes all activities related to water supply, sewage services, electricity, dams, and natural gas.

  Earth observation-based data, in particular, can be used for climate services aimed at forecasting and nowcasting, planning and optimisation of renewable energy (onshore and offshore wind, solar, tidal and wave), and strategic monitoring for the utilities sector infrastructure (e.g. dams, pipelines).
- [ ] Technical Expert in Sustainable urban communities

  Green and sustainable urban communities manage their human, natural, and financial capital with the goal to meet current and future needs in a sustainable manner, while prioritising a long-term perspective.

  The related climate services using Earth observation data have prominent application when it comes to assessing and forecasting air quality and pollen concentration and assisting urban planning and operations (monitoring and preventing heat islands, building greener cities) and optimising green cities, in particular when these are implementing elements of a smart (e.g., IoT) infrastructure.
- [ ] Technical Expert in Marine and coastal environment

  Marine environments are aquatic environments with high levels of dissolved salt. These include the open ocean, the deep-sea ocean, and coastal marine ecosystems, each of which have different physical and biological characteristics, thus representing different ecosystems.

  Marine and coastal environments can host complex ecosystems whose fragile equilibrium and prosperity depends on numerous environmental factors influencing each other and are thus a prime example of systematic approach to tackling climate needs (and providing corresponding services), making sure that addressing a single ecosystem indicator impacts other indicators in a foreseeable and favourable manner.

  The climate services in the marine domain rely on Earth observation data for precise nowcasting and forecasting, informing ocean weather algorithms, and monitoring parameters influencing water quality (for health, tourism, reporting purposes), such as turbidity, (potentially harmful) algae blooms and others.
- [ ] Technical Expert in Agriculture, Forestry and other Land use (including bioeconomy)

  Agriculture, forestry, and other land uses (AFOLU) covers an array of environments and encompasses great potential and need for climate services. Unsustainable use of agricultural and forest practices (e.g. overexploiting the soil, converting forests into agricultural land) create huge amounts of greenhouse gases and disrupt the already fragile equilibrium in the local ecosystems. Using sustainable forest and land management practices with a view on long term and systemic impact can instead help those ecosystems retain and store significant amounts of carbon and preserve their fragile equilibrium.

  The products of these sustainable practices could then fuel the bioeconomy - a corollary of the circular economy, where renewable biological resources from land and sea (such as crops, forests, fish, animals, micro-organisms etc.) are used to derive products, processes and services in all economic sectors within the frame of a sustainable economic system.

  Climate services using Earth observation in the domain of land use, agriculture and forestry can contribute to a more optimised and sustainable exploitation of the land (based on precision agriculture, natural resources management) as well as counter the growing challenges related to the climate crises (i.e., providing forecasting and alerts on extreme weather events).
- [ ] Technical Expert in Civil Security and Protection

  Civil security and protection include the policies, bodies and mechanisms that a country or region has in place to protect it against new and urgent threats to the security of people and/or the functioning of critical infrastructures.

  Earth observation data can feed into systems monitoring extreme events and sending automated alerts to civil authorities and /or the population.
- [ ] Other

- [ ] All of the above

* Name of organisation

Website

* E-mail

* Country of the organisation

* Type of organisation

- [ ] Public Authority, Contracting Authority/Entity at EU level
- [ ] Public Authority, Contracting Authority/Entity at national level
- [ ] Public Authority, Contracting Authority/Entity at regional level
- [ ] Public Authority, Contracting Authority/Entity at local level
- [ ] Public undertaking
- [ ] Private entity operating on the basis of special or exclusive rights

2. Background and objectives of this questionnaire

The PROTECT project aims to support urgent action for climate adaptation, mitigation and resilience. The project aims to enable public authorities to use state-of-the-art public procurement approaches in order to identify solutions – climate services based on Earth observation - that best fit the specific and systemic needs of public demand. The initial focus is on five encompassing application domains: Energy and Utilities, Sustainable urban communities, Marine and coastal environment and Agriculture, Forestry and other Land use (including bioeconomy) and Civil Security and Protection.

This project is backed by the European Commission and aims to prepare a future – also funded European project – Pre-Commercial Procurement.

Learn more about Innovation procurement and its two modalities - Pre-Commercial procurement (PCP) and Public procurement of Innovative solutions (PPI) ***– in the attached document above***

This questionnaire has been elaborated to identify your needs, as well as blocking points for the implementation of innovation procurement.

The information gathered will serve to provide procurement, climate services providers, technology development and policy decision-makers, at EU, national, regional, and local levels, with practical recommendations and guidelines to enable and encourage much stronger use of Innovation Procurement for climate action.

Are you interested in the PROTECT project?

- ☐ Yes. I would like to receive more information about the PROTECT project, in particular about upcoming workshops, high- level conferences and training sessions.
- ☐ Yes. I would like to get access to the PROTECT project procurement platform with exclusive content.

3. Five application domains and procurement needs

* 1. The initial focus of PROTECT will be on five encompassing application domains. In which of these areas do you procure or is most interesting to you?
Please put them in order (1 being the most interesting and 5 being the least interesting to you)

Reminder:

- *Energy and Utilities*

The Utilities sector includes all activities related to water supply, sewage services, electricity, dams, and natural gas.
Earth observation-based data, in particular, can be used for climate services aimed at forecasting and nowcasting, planning and optimisation of renewable energy (onshore and offshore wind, solar, tidal and wave), and strategic monitoring for the utilities sector infrastructure (e.g. dams, pipelines).

- *Sustainable urban communities*

Green and sustainable urban communities manage their human, natural, and financial capital with the goal to meet current and future needs in a sustainable manner, while prioritising a long-term perspective.
The related climate services using Earth observation data have prominent application when it comes to assessing and forecasting air quality and pollen concentration and assisting urban planning and operations (monitoring and preventing heat islands, building greener cities) and optimising green cities, in particular when these are implementing elements of a smart (e.g., IoT) infrastructure.

- *Marine and coastal environment*

Marine environments are aquatic environments with high levels of dissolved salt. These include the open ocean, the deep-sea ocean, and coastal marine ecosystems, each of which have different physical and biological characteristics, thus representing different ecosystems.
Marine and coastal environments can host complex ecosystems whose fragile equilibrium and prosperity depends on numerous environmental factors influencing each other and are thus a prime example of systematic approach to tackling climate needs (and providing corresponding services), making sure that addressing a single ecosystem indicator impacts other indicators in a foreseeable and favourable manner.
The climate services in the marine domain rely on Earth observation data for precise nowcasting and forecasting, informing ocean weather algorithms, and monitoring parameters influencing water quality (for health, tourism, reporting purposes), such as turbidity, (potentially harmful) algae blooms and others.

- *Agriculture, Forestry and other Land use (including bioeconomy)*

Agriculture, forestry, and other land uses (AFOLU) covers an array of environments and encompasses great potential and need for climate services. Unsustainable use of agricultural and forest practices (e.g. overexploiting the soil, converting forests into agricultural land) create huge amounts of greenhouse gases and disrupt the already fragile equilibrium in the local ecosystems. Using sustainable forest and land management practices with a view on long term and systemic impact can instead help those ecosystems retain and store significant *amounts of carbon and preserve their fragile equilibrium.*

The products of these sustainable practices could then fuel the bioeconomy - a corollary of the circular economy, where renewable biological resources from land and sea (such as crops, forests, fish, animals, micro-organisms etc.) are used to derive products, processes and services in all economic sectors within the frame of a sustainable economic system.

Climate services using Earth observation in the domain of land use, agriculture and forestry can contribute to a more optimised and sustainable exploitation of the land (based on precision agriculture, natural resources management) as well as counter the growing challenges related to the climate crises (i.e., providing forecasting and alerts on extreme weather events).

- *Civil Security and Protection*

Civil security and protection include the policies, bodies and mechanisms that a country or region has in place to protect it against new and urgent threats to the security of people and/or the functioning of critical infrastructures.

Earth observation data can feed into systems monitoring extreme events and sending automated alerts to civil authorities and/or the population.

Use drag&drop or the up/down buttons to change the order or accept the initial order.

- Energy and Utilities
- Sustainable urban communities
- Marine and coastal environment
- Agriculture, Forestry and other Land use (including bioeconomy)
- Civil Security and Protection

Please explain your answer above

2. Could you please indicate pain-points (challenges) that you experience at present?

More than one choice is possible

- [ ] Lack of data and tools to implement climate action
- [ ] Interoperability issues to operate
- [ ] Excessive energy costs
- [ ] Transition to new processes
- [ ] Joint cross-border procurement barriers
- [ ] Difficulties regarding common needs analysis and business case development
- [ ] Difficulties to engage with the market
- [ ] Lack of overview about existing and upcoming services
- [ ] Nobody in my organisation knows
- [ ] Other

3. For which functions do you experience the highest costs?

Functions are the functional needs that you may have, e.g., service performance, maintenance, etc.

(More than one choice is possible)

- [ ] Data processing and analytics
- [ ] Human resources specific roles
- [ ] Asset management
- [ ] Maintenance of operations
- [ ] Nobody in my organisation knows
- [ ] Other

4. Could you indicate pressing needs in either of the areas - Energy and Utilities, Sustainable urban communities, Marine and coastal environment and Agriculture, Forestry and other Land use (including bioeconomy) and Civil Security and Protection- that would benefit from Climate Services?

Climate Services are, for example, water leak detection and forecasting system for solar energy under the utilities domain; heat island effect detection under the green communities domain; assessing environmental impacts and carbon sequestration monitoring under the circular and bioeconomy domain; high resolution wind forecast to assess environmental risks, tracking effect of climate change in the Mediterranean and landcover overview at regional scale under the land use and marine environment domain; flood and drought monitoring, landslide risk monitoring and emergency management platform under the civil security and protection domain.

(If there are no pressing needs at this moment, please indicate 'None' as your answer)
(More than one choice is possible)

- [ ] Transition (engineering) to sustainable processes
- [ ] Real time data analytics
- [ ] Asset management
- [ ] None
- [ ] Nobody in my organisation knows.
- [ ] Other

5. If your answer to the previous question was affirmative, have you identified the Technology Readiness Level (TRL) of possible solutions that could tackle this need/these needs?

TRL1 Basic principles observed
TRL2 Technology concept formulated
TRL3 Experimental proof of concept
TRL4 Technology validated in lab
TRL5 Technology validated in relevant environment
TRL6 Technology demonstrated in relevant environment
TRL7 System model or prototype demonstration in operational environment
TRL8 System complete and qualified
TRL9 Actual system proven in operational environment

4. Innovation Procurement legal framework

6. Is Pre-Commercial Procurement (PCP) regulated in your national Public Procurement legislation? If so, please provide with a link to the provision or upload the relevant provision.

Please upload your file(s)

7. Does your national Public Procurement legislation regulate the deployment of market consultations (dialogue with the economic operators) in preparation of a procurement? If so, please provide with a link to the provision or upload the relevant provision.

Please upload your file(s)

8. Are there any specific mandatory legal provisions in your national legislation that could limit the subcontracting/and or joint procurement approach under a PCP procedure? If so, please provide with a link to the provision or upload the relevant provision.

Please upload your file(s)

9. Are there any mandatory Intellectual Property Rights requirements stemming from your national legislation/policy applicable to PCP (e.g. IPR sharing, contractual clauses etc.)? If so, please provide with a link to the provision or upload the relevant provision.

Please upload your file(s)

10. Is there a national/regional/local policy in place to set targets/stimulate PCP? If so, please provide with a link to the policy or upload the relevant document.

Please upload your file(s)

11. Is there any national regulation/policy that restricts your freedom to purchase technologies owned by companies from specific countries? If so, please provide with a link to the provision or upload the relevant provision.

Please upload your file(s)

5. Joint Procurement legal framework

12. Does your national Public Procurement legislation allow joint procurement with procurers from other countries (crossborder joint procurement)? If so, please provide with a link to the provision or upload the relevant provision.

13. Do you see any legal obstacles for an entity from your Member State to act as a potential lead procurer in a PCP? If yes, please indicate which obstacles you foresee.

14. Do you foresee any other legal obstacles in the deployment of the PCP that are not addressed in the questions above? If yes, please indicate which obstacles you foresee.

6. Concluding remarks

15. Do you have any additional comments and/or remarks?

16. Is there any particular procurement entity, network with whom we should share information about the PROTECT project and this questionnaire?

Contact

Contact Form

Annex 2

Pain Point Workshop presentation

This project has received funding from the Horizon Europe Framework Programme (HORIZON)
under grant agreement No 101060592

PROTECT
PROCURING INNOVATIVE CLIMATE CHANGE SERVICES

Pain point workshop

Problems & challenges to tackle through Innovation Procurement of climate services based on earth observation

PROTECT consortium

28 – 29 March 2023

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Agenda

0. Tour de table

1. Context and objectives of PROTECT: **Climate services & EO PCP**
2. The EAFIP Methodology: **Step 1. Needs assessment – expected outcome**
3. **Questions and open discussions**
4. Next steps

1. Context and objectives of PROTECT

PROTECT's mission is to prepare and equip a **community of public authorities/ buyers** to undertake one or more joint, cross border or coordinated **Pre-Commercial Procurement(s)** processes in order to steer the development of the **next generation of climate services based on Earth Observation data**.

By taking part in PROTECT activities, public authorities/ buyers will be strategically positioned for an upcoming Horizon PCP call expected to be launched in fall 2024 with a funding amount of up to EUR 19 million: (***HORIZON-CL6-2024-GOVERNANCE-01-5: Customisation/pre-operationalisation of prototypes end-user services in the area Climate Change Adaptation and Mitigation***)

Through PROTECT, public authorities/ buyers facing **similar pressing challenges related to climate change** will be connected and supported in the formulation of concrete and realistic **needs for EO-based climate services applicable to 5 selected domains** that can be the subject of future PCP or PPI.

Question 1

- What is the experience of your organisation with EO data and/or related services?

Go to www.menti.com and use the code 7961 6101

Mentimeter

Instructions

Go to

www.menti.com

Enter the code

7961 6101

Or use QR code

https://www.menti.com/algrtkuw68rs

Objectives and key actions

- PROTECT will facilitate the **definition and aggregation of needs and functional requirements for climate services**, explaining, fostering and supporting a ‘buying with impact’ approach.

- PROTECT will **prepare the operational ground** for one or more joint, cross border or coordinated **pre-commercial procurement (PCP)** processes.

Functional specifications

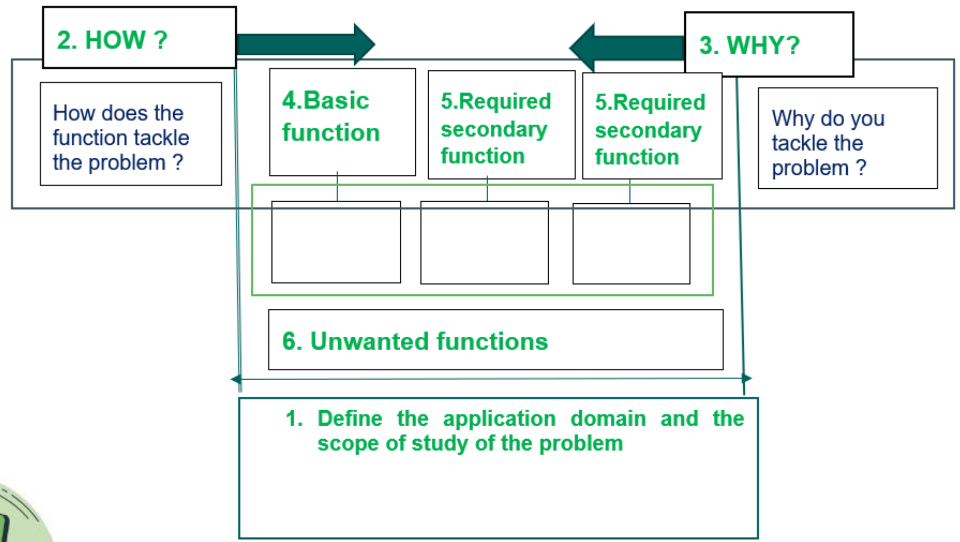
- With functional specification you clearly **describe the requirements that an innovative solution must meet**, but you give suppliers sufficient space and freedom to come up with their own ideas.
- This gives them the space to offer the best solution. This may be a solution that you could not have imagined beforehand.
- **There is no innovation without functional specification.**

Functional and performance-related requirements are appropriate means to favor innovation in public procurement and should be used as widely as possible.

Recital 74 and Article 42 of Directive 2014/24/EU

Functional specifications: main questions

- When drawing up functional specifications, **you want to find out what function the service, product or solution will fulfill. And why this is important for your organization.**
- In this process you ask questions such as:
  - **What problem do we want to solve?**
  - **What is the cause of that problem?**
- Answering these questions will give you insight into the solution to the problem.



Function Analysis System Technique (FAST)

Climate change problems & risks

Application domain	Examples of common risks
1. Marine and coastal environments	Sea contamination, pollution, rising levels, coastal erosion
2. Energy & utilities	Interruption/disruption of services
3. Sustainable urban communities	Waste management, contamination, heat waves, water scarcity
4. Agriculture, forestry and other land use	Food shortage, deforestation, drought
5. Civil security protection	Fire, flood, loss of inhabitability

- An economic activity that pursues the environmental objective of climate **change adaptation should contribute substantially to reducing or preventing the adverse impact of the current or expected future** climate, or the risks of such adverse impact, whether on that activity itself or on people, nature or assets.

Recital 25 of the EU Taxonomy Regulation

Example of common problem: illegal dumping of waste

- The illegal dumping of waste is a ‘collective’ problem, which can lead to dramatic consequences due to the effects of climate changes **(e.g., heavy floods carrying waste that contaminates the soil or water causing health problems).**
- **How can EO help with waste management (and climate change adaptation and/or mitigation)?**
- EO could contribute to detecting, monitoring, warning and alerting illegal dumping. Data can be used to monitor and help locate instantly what is happening and open us up to possibilities about what can be done.
- **In the value chain, public authorities can work together to provide a better public service.**
- Ideally, there will not be illegal dumping. But the next best option would be that it could be accurately measured (using EO) to then monitor and assess the situation and the options.

Result from PROTECT’s high level conference

EO based application / solution example

Extreme change can cause a disaster anytime, anywhere. However, proper planning, monitoring and early warning can prevent or reduce the damage. When disasters occur, alerting the population and emergency services is a priority and needs to be as fast as possible to save lives, protect jobs, and preserve the environment. Continuous monitoring and early warnings help better anticipate risks and warn the population in a potentially hazardous area.

Earth observation data can feed into systems monitoring extreme events and sending automated alerts to civil authorities and/or the population.

Question 2

- Is the detection of illegal waste dumping a relevant need for your organisation?

Go to www.menti.com and use the code 7961 6101

Mentimeter

Instructions

Go to

www.menti.com

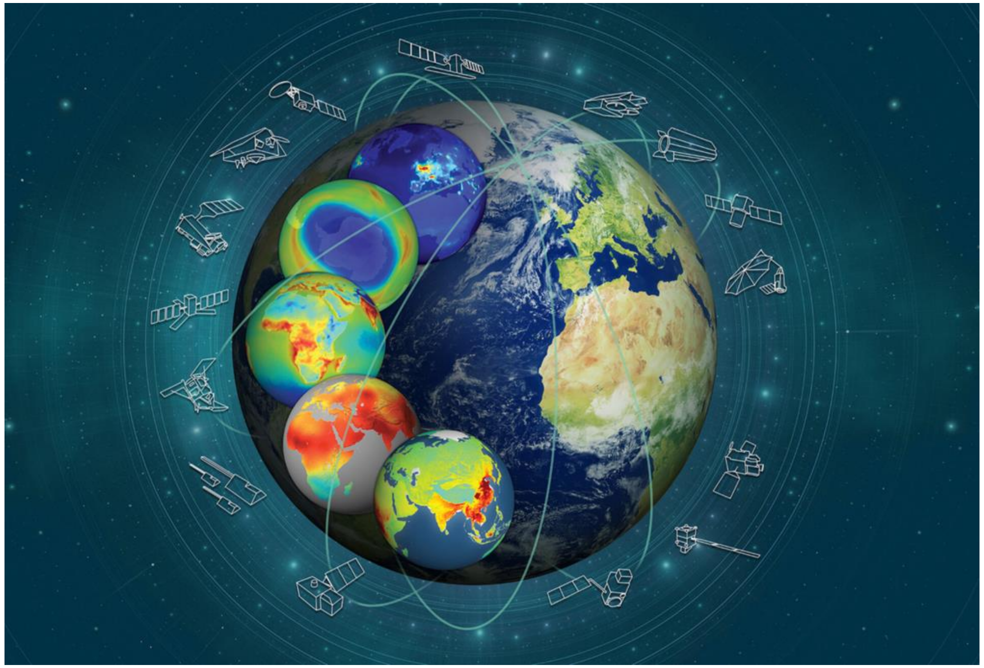
Enter the code

7961 6101

Or use QR code

https://www.menti.com/algrtkuw68rs

What is Earth Observation?



Credits: ESA - Earth observation data access portal

According to European Space Agency (ESA) , Earth Observation (EO) is defined as the process of acquiring observations of the Earth’s surface and atmosphere via sensors mounted on satellites, aircrafts, drones or at the surface, resulting in data in the form of digital imagery.

Two supporting technologies enable this intermediate step of processing EO data:

- ✓ artificial intelligence (AI)
- ✓ cloud computing

Copernicus Programme

- One of the largest EO programme managed by the European Commission
- Monitor and forecast the state of the environment on land, sea and in the atmosphere
- Support climate change mitigation and adaptation strategies
- Efficient management of emergency situations and the improvement of the security of every citizen
- Applications of EO data from the Copernicus programme

Credits: À propos de Copernicus | Copernicus

What is the role of Earth Observation in climate services (CS)?

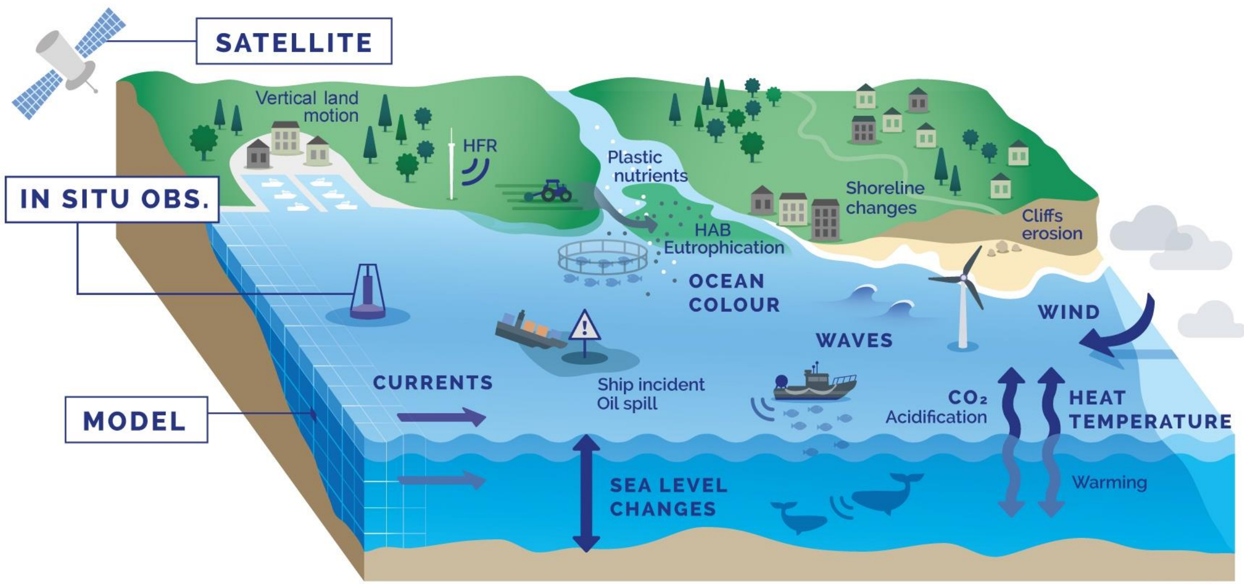
Credits: Earth observation big data for climate change research - ScienceDirect

- ✓ EO data is playing a crucial role
- ✓ Satellites provide vital information regarding the state, evolution of the environment and human activities on Earth
- ✓ CS support the governments and businesses

How can climate services apply to the five application domains?

Marine and coastal environment - Definition

- Aquatic environments with high levels of dissolved salt
- Includes open ocean, the deep-sea ocean and coastal marine ecosystems
- CS rely on EO data for precise nowcasting and forecasting, informing ocean weather algorithms, and monitoring parameters influencing water quality



Credits: Monitoring Marine Coastal Hazards with Earth Observations and Copernicus Data | CMEMS

Marine and coastal environment – Examples of usage

Category: Environmental monitoring

Example of usage: Marine pollution monitoring

List of applications: SAR-based and optical satellite data can be used for detecting and monitoring of oil spills and marine litter. EO also provides forecasts of sea currents and sea-surface heights (altimetry), sea-surface salinity, sea-surface temperature, ocean colour and sea-ice data - useful for monitoring and forecasting the course of the pollution. Moreover, remote sensing data can also contribute to identifying the polluters

Credits: The 2022 Market report is now available for download! | EU Agency for the Space Programme (europa.eu)

Credits: Remote Sensing | Free Full-Text | Measuring Marine Plastic Debris from Space: Initial Assessment of Observation Requirements (mdpi.com)

Example of functional requirements

Marine and coastal environment:	The potential of Earth Observation:
Marine environments are aquatic environments with high levels of dissolved salt. These include the open ocean, the deep-sea ocean, and coastal marine ecosystems, each of which have different physical and biological characteristics, and thus representing different ecosystems. Marine and coastal environments can host complex ecosystems whose fragile equilibrium and prosperity depends on numerous environmental factors influencing each other, and are thus a prime example of systematic approach to tackling climate needs (and providing corresponding services), making sure that addressing a single ecosystem indicator impacts other indicators in a foreseeable and favourable manner. The climate services in the marine and coastal domain rely on Earth observation data for precise nowcasting and forecasting, informing ocean weather algorithms, and monitoring parameters influencing water quality (for health, tourism, reporting purposes), such as turbidity, (potentially harmful) algae blooms and others.	**Monitoring** climate change impact on natural coastal processes and **ecosystems**. **Sensing** remotely **time series data** for water constituents and other parameters. **Contributing** to models for **ocean surface**. **Assessing** environmental risks based on high resolution **wind** forecast.

Marine and coastal environments

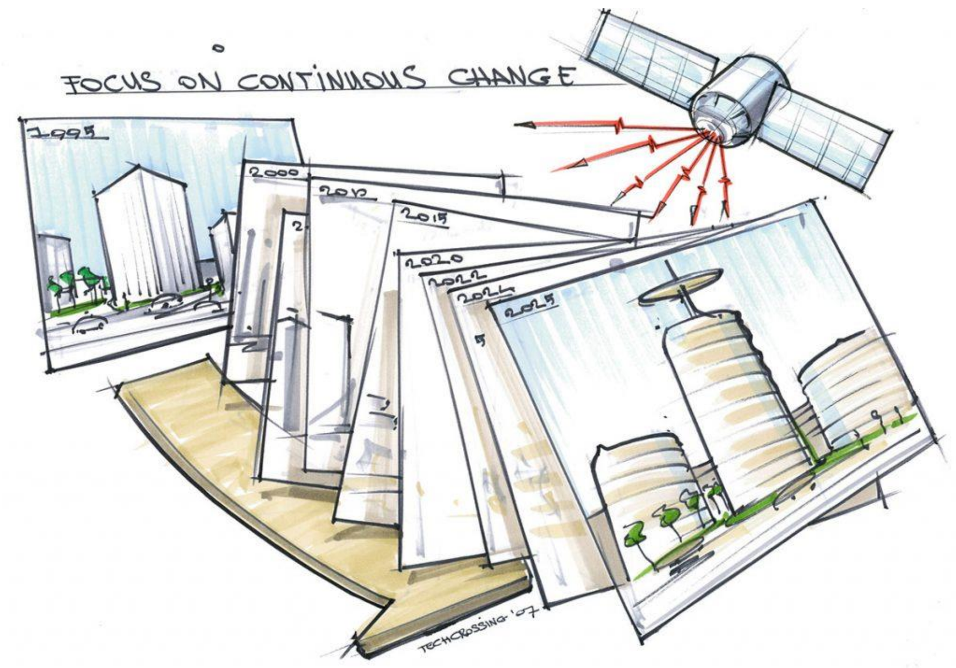
What climate services is PROTECT looking at?

Sub-domain	Category of climate services
Environmental monitoring	Marine pollution monitoring
Maritime engineering	Marine surveying and mapping
Maritime engineering	Dredging
Navigation	Climate data and modelling for navigation
Ocean services	Metocean
Ports	Climate data and modelling for ports
Vessel tracking	Dark vessel monitoring
Aquaculture	Climate data and modelling for aquaculture
Fisheries	Illegal, unreported and unregulated fishing (IUU) control
Fisheries	Catch optimisation
Fisheries	Fish stock detection

Extract from the PROTECT taxonomy, the domain “**Marine and coastal environment**”

Sustainable urban communities - Definition

- Green and sustainable urban communities operate their human, natural, and financial capital with the goal to meet current and future needs in a sustainable manner, while prioritising a long-term perspective
- CS rely on EO data for assessing and forecasting air quality and pollen concentration and assisting urban planning and operations (monitoring and preventing heat islands, building greener cities) and optimizing green cities, in particular when these are implementing elements of a smart (e.g., IoT) infrastructure



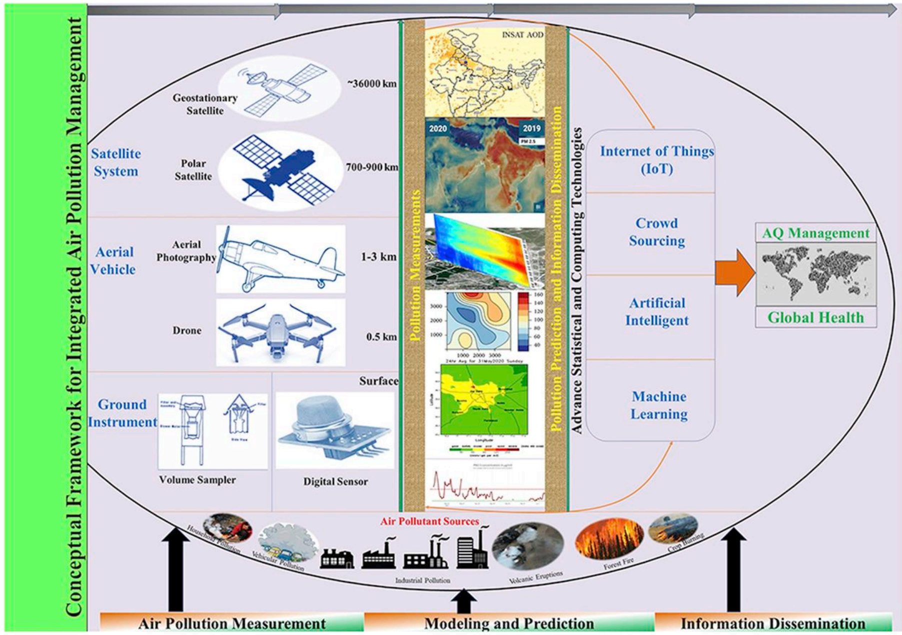
Credits: Earth observation for Smart Cities (neo.nl)

Sustainable urban communities – Examples of usage

Category: Environmental monitoring

Example of usage: Air quality monitoring in urban environments

List of applications: Using satellite data and in-situ measurements, EO can support detecting, collecting, and interpreting information on a multitude of air pollutants, including their origins, movement, and expected health risks.



Credits: The 2022 Market report is now available for download! | EU Agency for the Space Programme (europa.eu)

Credits: Sensors and systems for air quality assessment monitoring and management: A review - ScienceDirect

Example of functional requirements

Sustainable urban communities	The potential of Earth Observation:
Green and sustainable urban communities operate their human, natural, and financial capital with the goal to meet current and future needs in a sustainable manner, while prioritising a long-term perspective. This is particularly important against the backdrop of the ongoing climate crisis, due to the sustainable communities' focus on anticipating and adapting to change in both the present and future. Moreover, the current reality of an increasing majority of the world's population living in cities which in turn grow rapidly and not always sustainably, puts urban communities at the forefront for climate services related to resilience and adaptation. Those using Earth observation data have prominent application when it comes to assessing and forecasting air quality and pollen concentration and assisting urban planning and operations (monitoring and preventing heat islands, building greener cities) and optimizing green cities, in particular when these are implementing elements of a smart (e.g., IoT) infrastructure.	**Measuring** **carbon storage** capacity **Mapping** local climate **zones**. **Mapping** **air** quality **Obtaining** high resolution **vegetation** data. **Adapting** cities **policies** and **reducing** exposure to **pollution**. **Monitoring** in 3D **buildings, landslides, pipelines, bridges.** **Analyzing** **rooftops** and calculating the potential of **solar power**. **Mapping** thermal distribution to identify **heat losses** and to assess electrical consumption.

Sustainable urban communities

What climate services is PROTECT looking at?

Sub-domain	Category of climate services
Environmental monitoring	Air quality monitoring in urban environments
Environmental monitoring	Thermal auditing
Environmental monitoring	Urban greening
Environmental monitoring	Urban heat islands
Smart cities operations	Smart waste management
Urban planning and monitoring	Cultural heritage monitoring
Urban planning and monitoring	Surveying and mapping of urban areas
Urban planning and monitoring	Urban modelling, 3D modelling, Digital Twins
Urban planning and monitoring	Urban planning
Urban mobility	Climate data and modelling for urban mobility monitoring and forecasting

Extract from the PROTECT taxonomy, the domain “**Sustainable urban communities**”

Civil security and protection - Definition

- Includes the policies, bodies and mechanisms that a country or region has in place to protect it against new and urgent threats to the security of people and/or the functioning of critical infrastructures
- CS using EO can can feed into systems monitoring extreme events and sending automated events to civil authorities and/or the population

Credits: Civil Security From Space Industry Day | ESA TIA

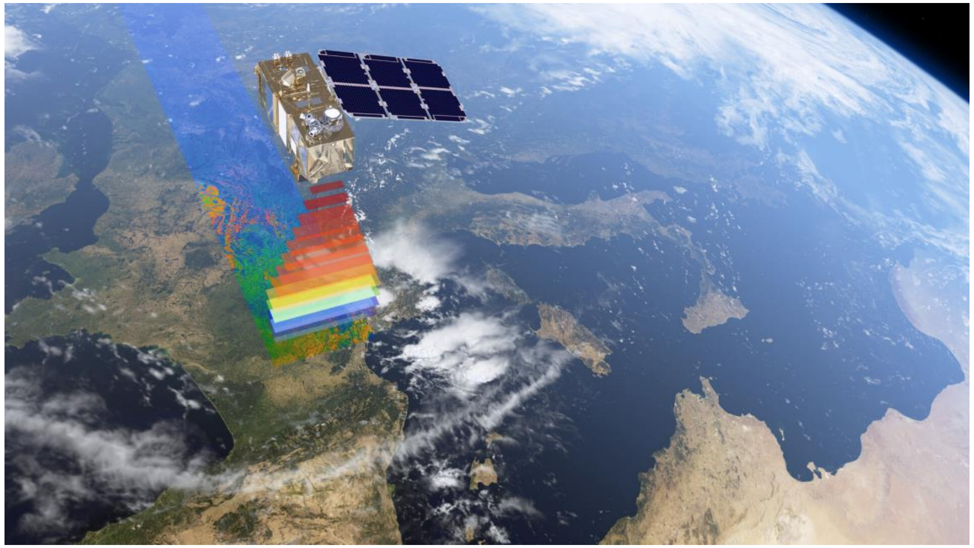
Civil security and protection – Example of usage

Category: Infrastructure

Example of usage: Environmental impact assessment of infrastructures

List of applications: EO can support the analysis of the impact of existing infrastructures (including during the construction phase) on the environment and ecosystem in their surroundings. Relevant EO-based products and services include pollution monitoring (air, water, soil), vegetation and biodiversity monitoring, etc.

Credits: The 2022 Market report is now available for download! | EU Agency for the Space Programme (europa.eu)



Credits: ESA - Earth Observation Programmes

Example of functional requirements

Civil Security and Protection	The potential of Earth Observation:
Civil security and protection include the policies, bodies and mechanisms that a country or region has in place to protect it against new and urgent threats to the security of people and/or the functioning of critical infrastructures. Each government in Europe has such a system in place to provide 'societal security'. Citizens expect their governments to design and operate capabilities to prevent risks from emerging, to prepare for crises and disasters, to protect values and infrastructures from harm, to respond effectively with sufficient capacity and effective decision-making when a crisis does occur, and to recover swiftly after a crisis strikes. Extreme change can cause a disaster anytime, anywhere. However, proper planning, monitoring and early warning can prevent or reduce the damage. When disasters occur, alerting the population and emergency services is a priority and needs to be as fast as possible to save lives, protect jobs, and preserve the environment. Continuous monitoring and early warnings help better anticipate risks and warn the population in a potentially hazardous area. Earth observation data can feed into systems monitoring extreme events and sending automated events to civil authorities and/or the population.	**Monitoring** **flood and drought**. **Monitoring** **landslide** risk. **Managing** an **emergency platform**. **Identifying** **avalanche** risks.

Civil security protection

What climate services is PROTECT looking at?

Extract from the PROTECT taxonomy, the domain of “**Civil security and protection**”

Sub-domain	Category of climate services
Early warning	Forecast
Early warning	Monitoring and warning services
Migration and settlement	Monitoring and forecasting the climate impact of migration
Migration and settlement	Forecasting of climate drivers for migration
Post-event analysis	Post-event analysis
Preparedness	Preparedness
Rapid mapping	Rapid mapping
Search and Rescue	Beacons for aviation
Search and Rescue	Beacons for land
Search and Rescue	Situational awareness supporting search and rescue

Sub-domain	Category of climate services
Infrastructure Planning	Permitting
Infrastructure Planning	Vulnerability analysis
Insurance for natural disa	Risk modelling
Critical infrastructure	Design of infrastructure
Critical infrastructure	Construction operations
Critical infrastructure	Monitoring of impact of human activities on infrastructure
Critical infrastructure	Infrastructure monitoring
Critical infrastructure	Predictive maintenance
Critical infrastructure	Emergency assistance

Energy and utilities - Definition

Credits: Globe's solar and wind energy sites mapped for the first time (smart-energy.com)

- Includes all activities related to water supply, sewage services, electricity, dams, and natural gas
- CS rely on EO data for forecasting and nowcasting, planning and optimisation of renewable energy (onshore and offshore wind, solar, tidal and wave), and monitoring of strategic for the utilities sector infrastructure (e.g. dams, pipelines)

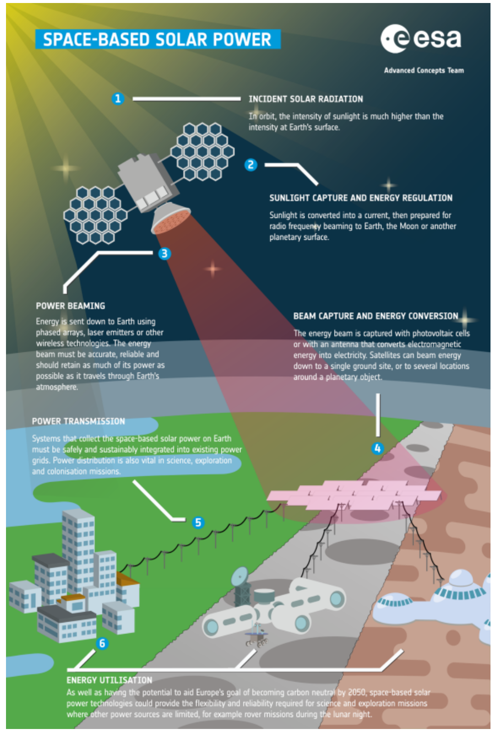
Energy and utilities – Examples of usage

Category: Environmental impact monitoring

Example of usage: Environmental impact assessment of energy and mineral resources plant

List of applications: EO can support the mitigation of energy/mining effects of the environment through continuous monitoring of relevant environmental characteristics and through the capacity of EO to detect changes. Relevant products and services include coastal ecosystems monitoring, water quality monitoring, air quality monitoring, erosion monitoring, pollution monitoring, vegetation monitoring, etc. In some cases, EO-based products could also include the production of environmental impact assessment “certificate”

Credits: The 2022 Market report is now available for download! | EU Agency for the Space Programme (europa.eu)



Credits: ESA - Space-based solar power

Example of functional requirements

Energy and Utilities	The potential of Earth Observation:
The Utilities sector includes all activities related to water supply, sewage services, electricity, dams, and natural gas. Climate-change-related risks affect water supply and utility infrastructures, as damages will have great impacts on operations and costs. The use of climate services can contribute to a better management of water flow, more resilient and independent energy systems, informed purchasing decisions based on accurate predictions, and others. Earth observation-based data, in particular, can be used into climate services aimed and forecasting and nowcasting, planning and optimisation of renewable energy (onshore and offshore wind, solar, tidal and wave), and monitoring of strategic for the utilities sector infrastructure (e.g. dams, pipelines).	**Monitoring** the **solar yield** for **grid** optimization. **Detecting activities** in **energy** corridors. **Analyzing** historical data for **water** quantity and quality.

Energy & Utilities

What climate services is PROTECT looking at?

Sub-domain	Category of climate services
Renewable energy	Site selection, planning and monitoring for renewable energy
Renewable energy	Renewable energy assessment potential and forecast
Energy - other	Energy network conditions monitoring
Energy - other	Power plant design optimisation
Energy - other	Environmental impact assessment of energy and mineral resources plants
Energy - other	Pipeline monitoring
Waste	Climate data and modelling for waste monitoring and management
Drinking water	Climate data and modelling for drinking water monitoring and management

Extract from the PROTECT taxonomy, the domain “**Energy and utilities**”

Agriculture, forestry and other land uses - Definition

Credits: Precision Agriculture Solutions For Agribusiness Needs (eos.com)

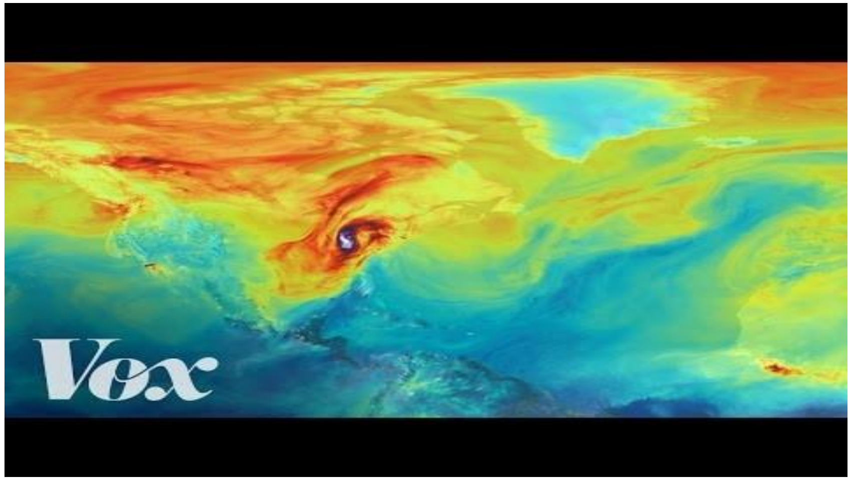
- Includes crops, forests, animals, micro-organisms
- CS using EO in the domain of AFOLU can contribute to a more optimised and sustainable exploitation of the land (based on precision agriculture, natural resources management) as well as counter the growing challenges related to the climate crises (e.g., providing forecasting and alerts on extreme weather events)

Agriculture, forestry and other land uses – Examples of usage

Category: Environmental monitoring

Example of usage: Carbon capture & content assessment

List of applications: The monitoring of agricultural vegetation and grassland cover through EO can help inform carbon sink capacity of different terrains. EO can also be used to monitor the maintenance of agricultural practices which pertain to CO_2 sequestration.



Credits: The 2022 Market report is now available for download! | EU Agency for the Space Programme (europa.eu)

Credits: (248) A visual tour of the world's CO2 emissions - YouTube

Example of functional requirements

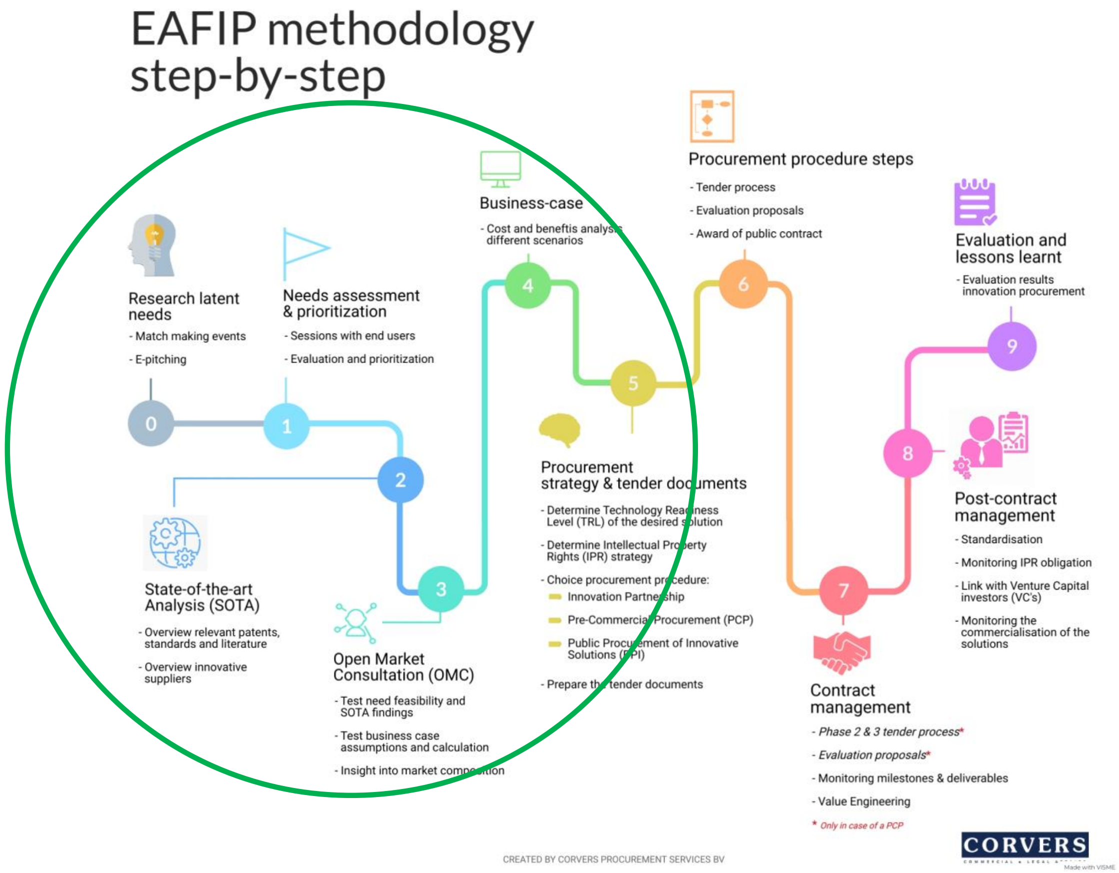
Agriculture, Forestry and other Land use	The potential of Earth Observation:
**It includes bioeconomy* Agriculture, forestry, and other land uses (AFOLU) covers an array of environments and encompasses great potential and need for climate services. Unsustainable use of agricultural and forest practices (e.g. overexploiting the soil, converting forests into agricultural land) create huge amounts of greenhouse gases and disrupt the already fragile equilibrium in the local ecosystems. Using sustainable forest and land management practices with a view on long term and systemic impact can instead help those ecosystems retain and store significant amounts of carbon and preserve their fragile equilibrium. The products of these sustainable practices could then fuel bioeconomy - a corollary of circular economy, where renewable biological resources from land and sea (such as crops, forests, fish, animals, micro-organisms etc.) are used to derive products, processes and services in all economic sectors within the frame of a sustainable economic system. Climate services using Earth observation in the domain of AFOLU can contribute to a more optimised and sustainable exploitation of the land (based on precision agriculture, natural resources management) as well as counter the growing	**Monitoring** the state of a **forest inventory**. **Tracking and detecting forest and land** changes. **Identifying and mapping plants and trees**. **Detecting** stress in **plants** before they are visible to the naked eye. **Monitoring** large **areas.**

What climate services is PROTECT looking at?

Sub-domain	Category of climate services
Renewable energy	Site selection, planning and monitoring for renewable energy
Renewable energy	Renewable energy assessment potential and forecast
Energy - other	Energy network conditions monitoring
Energy - other	Power plant design optimisation
Energy - other	Environmental impact assessment of energy and mineral resources plants
Energy - other	Pipeline monitoring
Waste	Climate data and modelling for waste monitoring and management
Drinking water	Climate data and modelling for drinking water monitoring and management

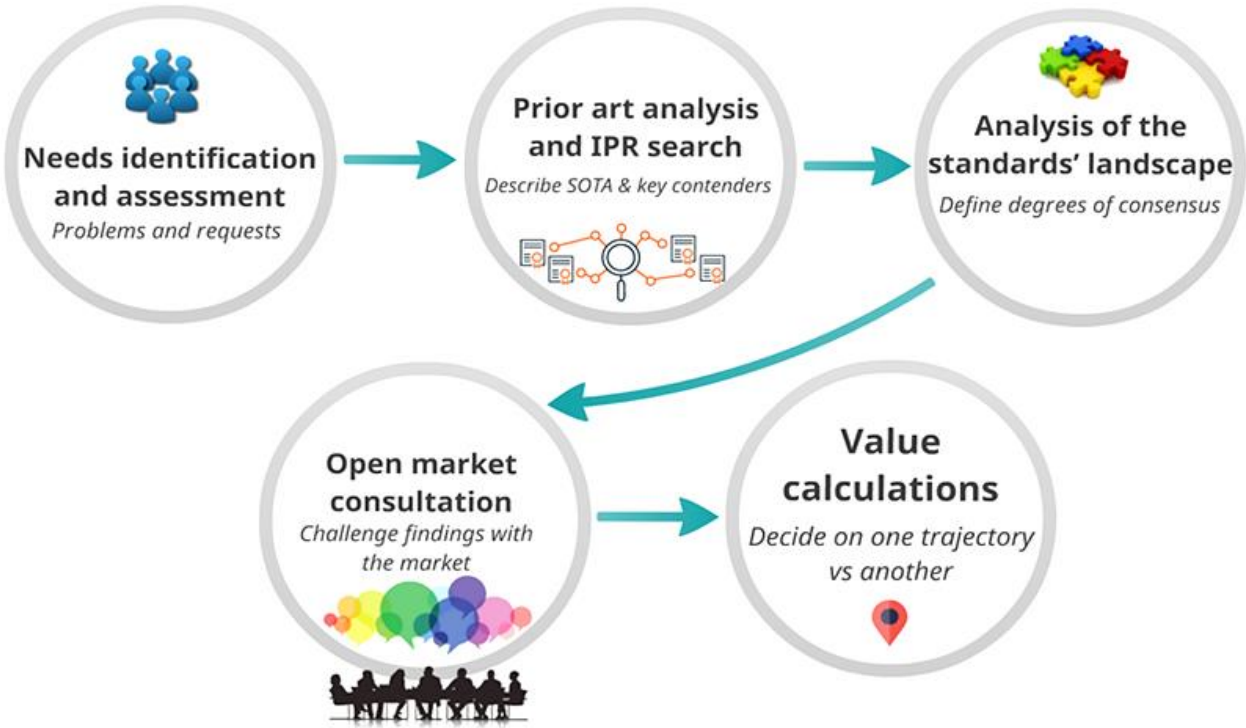
Extract from the PROTECT taxonomy, the domain “**Energy and utilities**”

2. The EAFIP methodology



EAFIP step-by-step methodology
www.eafip.eu

The EAFIP business case methodology



EAFIP Business Case Methodology
www.eafip.eu

Step 1. Needs assessment & prioritization

Needs identification and assessment

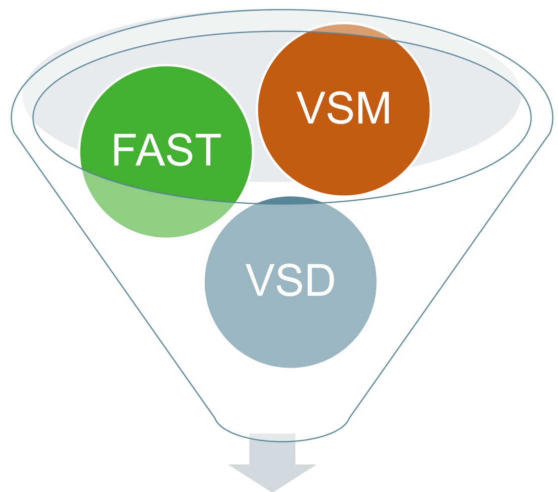
- What challenges and problems do users face?
  - Current
  - Future
- Workshop, interviews
- Function-based specification

Expected outcome:

- Description of problems → needs as functional requirements
- Use cases related to CS using EO
- Value pilots – scenarios related to new (to be developed) CS using EO

Value methodologies

- **Value methodologies*** are used to prioritize and fine-tune needs based on the climate challenges identified in the five application domains.
- The outcome sets the basis **to define keywords on functions and performance with the purpose to conduct a SOTA analysis** and give an overview of the needs and subsequent procurement challenges that could be addressed through one or several PCPs or PPIs.



Functions, use cases, value pilots

* *FAST:* *Function Analysis System Technique*
VSM: *Value Stream Mapping*
VSD: *Value Sensitive Design / Value Stream Design*

Question 3

- What are the most pressing climate challenges/problems your organisation faces?

Go to www.menti.com and use the code 7961 6101

Mentimeter

Instructions

Go to

www.menti.com

Enter the code

7961 6101

Or use QR code

https://www.menti.com/algrtkuw68rs

Question 4

- How can EO data/services support the tasks of your organisation to contribute to climate change mitigation and adaptation?

Go to www.menti.com and use the code 7961 6101

Mentimeter

Instructions

Go to

www.menti.com

Enter the code

7961 6101

Or use QR code

https://www.menti.com/algrtkuw68rs

Use case description

As is (present) situation	Step 1	Step 2	Step 3	Step 4	Step 5	Desired dreamed (future) situation

Results

- Problem and functionalities required
- **Use case of CS using EO**
- **Value pilots**

4. Next steps

- **Select procurement challenges**
- Vote and score to prioritize challenges
- **Define the final use cases & keywords**
- Perform a SOTA analysis to identify the room for R&D

PROTECT
PROCURING INNOVATIVE CLIMATE CHANGE SERVICES

Thank you!

PROTECT consortium

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Corvers Procurement Services B.V.

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This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Annex 3

Presentation on the results of the Pain Point workshops

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Pain Point workshop results

Use cases - Functional description - keywords

Marine and Coastal environment

As is (present) situation

The **mapping of flooded areas** in case of serious events can take weeks.
Municipalities do not have reliable tools to predict, prevent and respond in a timely manner.

Step 1 | Step 2 | Step 3 | Step 4 | Step 5

1. Implement one repository of (historical) data, and a single Application Programming Interface (API).
2. Connect rapid mapping and climate services to the repository.
3. Turn mapping into algorithms.
4. Use efficient hardware.
5. Apply the tools correctly, with a team with the needed skills.

Keywords: Rapid mapping of flooded areas, projection, prediction, intervention, high resolution, EO data, climate services, API.

Desired dreamed (future) situation

Rapid mapping **for predictions/projections** to identify risks and define benchmarks. This requires software for higher resolution and timely satellite information.

Marine and Coastal Environment: Is this use case relevant to your organization?

	Answers	Ratio
Yes	10	50 %
No	5	25 %
Perhaps	4	20 %
No Answer	1	5 %

Identified functionalities : 1. Rapid and reliable mapping of flooded areas for planning, preventing, predicting and post event intervention and cooperation.

	Answers	Ratio
Yes	14	70 %
No	2	10 %
Perhaps	3	15 %
No Answer	1	5 %

Sustainable Urban Communities

As is (present) situation

Facilities **where waste is stored** can suffer spontaneous fires 3 or more times a year. This happens especially in summer when the temperatures are higher. At present, although there is data on previous events, there is **no automated solution to predict fires** and take decisions to prevent them. Inspectors of environmental agencies monitor the facilities resulting in quite an effort for staff.

Step 1 | Step 2 | Step 3 | Step 4 | Step 5

1. Explore the technical borders to understand what is possible in order to provide frequent data updates, and establish the frequency for preparedness.
2. Develop a model out of (all) existing and new data for prediction of waste fires. Data aggregation, including all data from past waste fire situations can be useful.
3. Train the model based on defined conditions, relevant factors(e.g. evolving composition of waste through time, temperature)
4. Anticipate fire using data.
5. Notify action to prevent a fire timely.

Desired dreamed (future) situation

Automated notification of risk of fire so that the environmental agencies can take measures, such as contacting companies/industry that has/manage waste storage facilities, help **prevent** air pollution and damages.

Sustainable Urban Communities: Is this use case relevant to your organization?

		Answers	Ratio
Yes		8	40 %
No		4	20 %
Perhaps		8	40 %
No Answer		0	0 %

Keywords: Automated notification, waste fire, modelling, prediction, data aggregation.

Identified functionalities : 2.Thermal monitoring and predicting waste fire to avoid spontaneous ignition in waste storages and air pollution, using automated notification of risk of fire based on the modelling of certain conditions (like the level of humidity, air temperature, height of the pile of waste, etc.).

		Answers	Ratio
Yes		7	35 %
No		5	25 %
Perhaps		5	25 %
No Answer		3	15 %

Civil Security and Protection

As is (present) situation

Waste is dumped illegally and it is difficult for **law enforcement agencies** to trace the responsible of criminal behaviour. It is also not possible **to inform and prevent the flow of the waste cross-borders.** There is no data which can be used in criminal proceedings as proof.

Step 1 | Step 2 | Step 3 | Step 4 | Step 5

1. Examine current monitoring possibilities.
2. Define the type of substances illegally dumped in water based on previous experience and also the measures being taken in specific cases.
3. Notify timely environmental agencies, fire fighters and other relevant law enforcement agencies on potential risks and results.
4. Define possible interventions on site to prevent dumping and further damage.
5. Standardize the reports and data to be admissible in a civil and criminal court.

Desired dreamed (future) situation

Alerts are sent to competent authorities to prevent the illegal dumping of waste in the water and to inform of a possible risk preventing further (cross-border) damage. Standardized reports and information can serve in civil and criminal proceedings to establish responsibilities upon the applicable law in a specific judiciary system.

Identified functionalities : 3. Identifying illegal dumping of waste in water and sending automated alerts to law enforcement agencies to prevent the flow of waste causing cross-border damages, and producing standardized reports that can serve as proof of responsibility in (criminal) judicial proceedings.

		Answers	Ratio
Yes		8	40 %
No		6	30 %
Perhaps		4	20 %
No Answer		2	10 %

Keywords: Monitoring, waste dumping, toxic substances, notification, intervention, pollutants. Vegetation changes, traceability, identification of responsibility

Civil Security and Protection: Is this use case relevant to your organization?

		Answers	Ratio
Yes		9	45 %
No		6	30 %
Perhaps		5	25 %
No Answer		0	0 %

Energy and Utilities

As is (present) situation

The demand for sweet water is unpredictable. The supply and demand of sweet water is not connected. There are regulations determining the use of water from channels, treated water from the sewage and drinking water (in each EU Member State). There is no common language among different stakeholders in the water cycle chain. There is a lot of data in certain regions but the data hubs or repositories are not connected.

Step 1 | Step 2 | Step 3 | Step 4 | Step 5

1. Understand what is happening at present and the mechanisms in place (also from a policy perspective). Learn how the problem of drought regarding supply and demand of water is addressed, to define the type of new services that support coping with stress situations based on a common language. Understand which are the relevant responsible public authorities and users. Also, identify the data gaps.
2. Develop a system that combines data and uses AI for modelling.
3. Use database driven solutions to improve the distribution of water (e.g. identify saline concentration, pollution, substances, algea, etc.)
4. Provide information to water authorities that need to know how to collect, when and how to distribute water (treated in a certain way) to supply the specific demand, and avoid discharging sweet water.
5. Build a resilient system where different stakeholders (water companies, farmers, industry) cooperate during drought.

Desired dreamed (future) situation

The demand for sweet water is predictable. The regulatory landscape and policies are clearly defined. The system can cope with stress situations based on data for informed decision making and interventions. **Supply and demand for sweet water are connected based on needs of diverse users** (e.g., famers, companies, industry) and the understanding on the conditions and water quality required for different purposes. Decision and guidance from a policy perspective is achieved to understand the consequences and combine relevant data in the whole water chain cycle under a taxonomy.

Identified functionalities : 4. Predicting the demand for sweet water from different users aimed at connecting the supply and demand of water for diverse uses (such as farming) in the water value chain to tackle periods of drought.

	Answers	Ratio
Yes	9	45 %
No	5	25 %
Perhaps	3	15 %
No Answer	3	15 %

Keywords: Drought, AI for modelling, data combination, water demand and supply connection, water quality, distribution.

Energy and Utilities: Is this use case relevant to your orhganization?

	Answers	Ratio
Yes	10	50 %
No	5	25 %
Perhaps	5	25 %
No Answer	0	0 %

Agriculture, Forestry and other Land Use

As is (present) situation

Planning is realized based on data collected mostly manually in a database and analysed by field experts.

Step 1 | Step 2 | Step 3 | Step 4 | Step 5

1. Combine existing data with new EO data.
2. Validate data with field experts.
3. Use AI to define scenarios.
4. Work on resilience plans based on input from data analysis and predictions.
5. Implement resilience plans.

Desired dreamed (future) situation

Automated analysis supports the decision of experts in preparing resilience plans.

Keywords: Automated analysis, climate resilience plans, AI scenarios, forest and land, prediction, salinity, reproductivity.

Agriculture, Forestry and other Land use: Is this use case relevant to your organization?

	Answers	Ratio
Yes	11	55 %
No	4	20 %
Perhaps	4	20 %
No Answer	1	5 %

Identified functionalities : 5.Detecting climate vulnerability in the face of challenges like salinity affecting reproductivity of vegetation, through automated analysis that supports the decision of experts in preparing resilience plans.

	Answers	Ratio
Yes	8	40 %
No	5	25 %
Perhaps	5	25 %
No Answer	2	10 %

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PROCURING INNOVATIVE CLIMATE CHANGE SERVICES

Thank you!

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Annex 4

Results of the EU Survey on functionalities and use cases

This project has received funding from the Horizon Europe Framework Programme (HORIZON) under grant agreement No 101060592

Statistics: PROTECT Pain Point follow up results and votin

Identified functionalities : 1. Rapid and reliable mapping of flooded areas for planning, preventing, predicting and post event intervention and cooperation.

		Answers	Ratio
Yes		14	70 %
No		2	10 %
Perhaps		3	15 %
No Answer		1	5 %

Identified functionalities : 2.Thermal monitoring and predicting waste fire to avoid spontaneous ignition in waste storages and air pollution, using automated notification of risk of fire based on the modelling of certain conditions (like the level of humidity, air temperature, height of the pile of waste, etc.).

		Answers	Ratio
Yes		7	35 %
No		5	25 %
Perhaps		5	25 %
No Answer		3	15 %

Identified functionalities : 3. Identifying illegal dumping of waste in water and sending automated alerts to law enforcement agencies to prevent the flow of waste causing cross-border damages, and producing standardized reports that can serve as proof of responsibility in (criminal) judicial proceedings.

		Answers	Ratio
Yes		8	40 %
No		6	30 %
Perhaps		4	20 %
No Answer		2	10 %

Identified functionalities : 4. Predicting the demand for sweet water from different users aimed at connecting the supply and demand of water for diverse uses (such as farming) in the water value chain to tackle periods of drought.

		Answers	Ratio
Yes		9	45 %
No		5	25 %
Perhaps		3	15 %
No Answer		3	15 %

Identified functionalities : 5.Detecting climate vulnerability in the face of challenges like salinity affecting reproductivity of vegetation, through automated analysis that supports the decision of experts in preparing resilience plans.

		Answers	Ratio
Yes		8	40 %
No		5	25 %
Perhaps		5	25 %
No Answer		2	10 %

Please prioritize the above functionalities based on the needs of your organization.

	1	2	3	4	5	Score
1. Rapid mapping of floods	**35.29%** 12	**47.05%** 16	**11.76%** 4	**5.88%** 2	**0.0%** 0	**4.11** 34
2. Predicting (waste) fire	**5.88%** 2	**11.76%** 4	**29.41%** 10	**23.52%** 8	**29.41%** 10	**2.41** 34
3. Identifying ilegal dumping of waste and tracing	**17.64%** 6	**5.88%** 2	**0.0%** 0	**41.17%** 14	**35.29%** 12	**2.29** 34
4. Predicting the demand for water to match supply and demand (specially in drought)	**11.76%** 4	**23.52%** 8	**29.41%** 10	**17.64%** 6	**17.64%** 6	**2.94** 34
5. Detecting climate vulnerability to prepare resilience plans	**29.41%** 10	**11.76%** 4	**29.41%** 10	**11.76%** 4	**17.64%** 6	**3.23** 34
No Answer	-70 % -14					

Marine and Coastal Environment: Is this use case relevant to your organization?

		Answers	Ratio
Yes		10	50 %
No		5	25 %
Perhaps		4	20 %
No Answer		1	5 %

Sustainable Urban Communities: Is this use case relevant to your organization?

		Answers	Ratio
Yes		8	40 %
No		4	20 %
Perhaps		8	40 %
No Answer		0	0 %

Civil Security and Protection: Is this use case relevant to your organization?

		Answers	Ratio
Yes		9	45 %
No		6	30 %
Perhaps		5	25 %
No Answer		0	0 %

Energy and Utiities: Is this use case relevant to your orhganization?

		Answers	Ratio
Yes		10	50 %
No		5	25 %
Perhaps		5	25 %
No Answer		0	0 %

Agriculture, Forestry and other Land use: Is this use case relevant to your organization?

		Answers	Ratio
Yes		11	55 %
No		4	20 %
Perhaps		4	20 %
No Answer		1	5 %

Would you be interested in joining an EU-funded cross-border Innovation Procurement project (Pre-Commercial Procurement) in the framework of Horizon Europe?

		Answers	Ratio
Yes		12	60 %
No		1	5 %
Perhaps		5	25 %
No Answer		2	10 %

Annex 5

Pain Point Workshops

External invited participants per application domain[32]

	MARINE AND COASTAL ENVIRONMENT					7
No.	Name(s) Surname(s)	Name of organisation	Expertise	E-mail	Country	
1	Paula Trindade	LNEG - National Laboratory of Energy and Geology	Technical Expert in Marine and coastal environment Marine environments	paula.trindade@lneg.pt	Portugal	
2	Ismail Kaan Tuncok	Asian Development Bank	Technical Expert in Marine and coastal environment; and in sustainable urban communities	ituncok.consultant@adb.org	Philippines	
3	Juraj Tkac	creatio eu	Procurement legal expert	tkac@creatioeu.sk	Slovakia	
4	Miguel Angel Mendez	AGAPA	Technical Expert in Agriculture, Forestry and other Land use	st.cpi.agapa@juntadeandalucia.es	Spain	
5	Sofia Segura	AGAPA	Procurement legal expert	st.cpi.agapa@juntadeandalucia.es	Spain	
6	Roberta Costa	Arpae Osservatorio Clima	Procurement legal expert	calessandrini@arpae.it	Italy	
7	MARINE VOSKANYAN	"EcoManagement" NGO		voskanyanmarine@gmail.com	Armenia	

[32] Based on the interest expressed in the EU Survey and the registrations to the PROTECT community. Not all invited persons participated in the Teams online working sessions.

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SUSTAINABLE URBAN COMMUNITIES						21
No.	Name(s) Surname(s)	Name of organisation	Expertise	E-mail	Country	
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2	Perpere	Pyrénées Méditerranée Invest	Procurement legal expert. Business developer.	l.perpere@perpignan-mediterranee.org	France	
3	Camilla Iuzzolino	Regione	Technical expert	camilla.iuzzolino@regione.emilia-romagna.it	Italy	
4	Eveliina Varis	City of Vantaa	Procurement Legal Expert; Technical Expert in Sustainable urban communities Green	eveliina.varis@vantaa.fi	Finland	
5	Gonçalo Negrão Serra	Lisbon Municipality	Technical Expert in Sustainable urban communities Green and sustainable urban communities	ext.goncalo.negrao@cm-lisboa.pt	Portugal	
6	Jean-François BENON	CEEVO- The Val d'Oise Development and Attractiveness Agency (Paris Region)	Technical Expert in Sustainable urban communities Green and sustainable urban communities	jf.benon@ceevo95.fr	France	
7	Alvaro Zabala Ordóñez	Consejería de Sostenibilidad Medio Ambiente y Economía Azul. Regional Government of Andalusia.	Technical Expert in Agriculture, Forestry and other Land use (including bioeconomy)	alvaro.zabala@juntadeandalucia.es	Spain	
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9	Ovidiu Slimac	ROVEST Cluster		cluster@rovest.eu	Romania	
10	Isaura Melo	EMH- DomusSocial, EM		imelo@domussocial.pt	Portugal	
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			CIVIL SECURITY AND PROTECTION DOMAIN			15
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2	Radoslav Brehuv	Hasičský a záchranný zbor	Technical Expert in Civil Security and Protection Civil security	radoslav.brehuv@minv.sk	Slovenská republika	
3	Nicole Kührer	Landratsamt Fürstenfeldbruck	Climate protection manager	nicole.kuehrer@lra-ffb.de	Deutschland	
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7	Rick Meynen	STIB-MIVB	Project manager of an ongoing PCP (non-legal expert)	Hendrick.Meynen@mivb.brussels	Belgium	
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10	Sujith V	Government of India		sujith.govt@gmail.com	India	
11	Kees Koudenburg	DCMR Environmental Protection Agency		kees.koudenburg@dcmr.nl	Netherlands	
12	Martijn Linnartz	Ministry of Justice Netherlands		m.linnartz@minjenv.nl	Netherlands	
13	Claudia Vezznani	Agenzia per la Sicurezza Territoriale e la protezione Civile - Regione Emilia Romagna		claudia.vezzani@regione.emilia-romagna.it	Italy	
14	Eva Struhárová	Department of Detection of Hazardous Materials and Environmental Crime of the National Central Office of Special Types of Crime, Presidium of the Police Force, Ministry of the Interior of the Slovak Republic	Technical Expert in Civil Security and Protection	eva.struharova2@minv.sk	Slovakia	
15	Pavel	Police	Technical expert police officer	pavel.matulay@minv.sk	Slovakia	

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ENERGY AND UTILITIES						17
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3	Beatriz Casado Sáenz	Business Competitiveness Institute	Technical Expert; Technical Expert in Agriculture, Forestry and other Land use	beatriz.casado@jcyl.es	Spain	
4	Francisco FERRANDO CASANOVA	IVACE (The Valencian Institute of Entrepreneurial Competitiveness of the Valencian Regional Government)	Technical Expert	ferrando_fra@gva.es	Spain	
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15	Sophie Harbers	City of Rotterdam		sbbg.harbers@rotterdam.nl	Netherlands	
16	Juraj Tkac	creatio eu		tkac@creatioeu.sk	Slovakia	
17	Ondrej Koporec	Ministry of Interior of	Technical Expert in Energy and Utilities	ondrej.koporec@minv.sk	Slovakia	

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	AGRICULTURE FORESTY AND LAND USE DOMAIN					16
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10	Lavinia Laiti	Agenzia Provinciale per la Protezione dell'Ambiente, Provincia autonoma di Trento		lavinia.laiti@provincia.tn.it	Italy	
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15	Pavel Broum	Ministry of Argiculture		Pavel.Broum@mze.cz	Czech Republic	
16	Fabio Paglione	Burana Land Reclamatio	Technical Expert in Agriculture	f.paglione@consorzioburana.it	Italy	

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