Task 1.5: Common needs in five domains using value methodologies

CORVERS PROCUREMENT SERVICES B.V.

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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 <u>to define keywords on functions and performance</u>** 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

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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)

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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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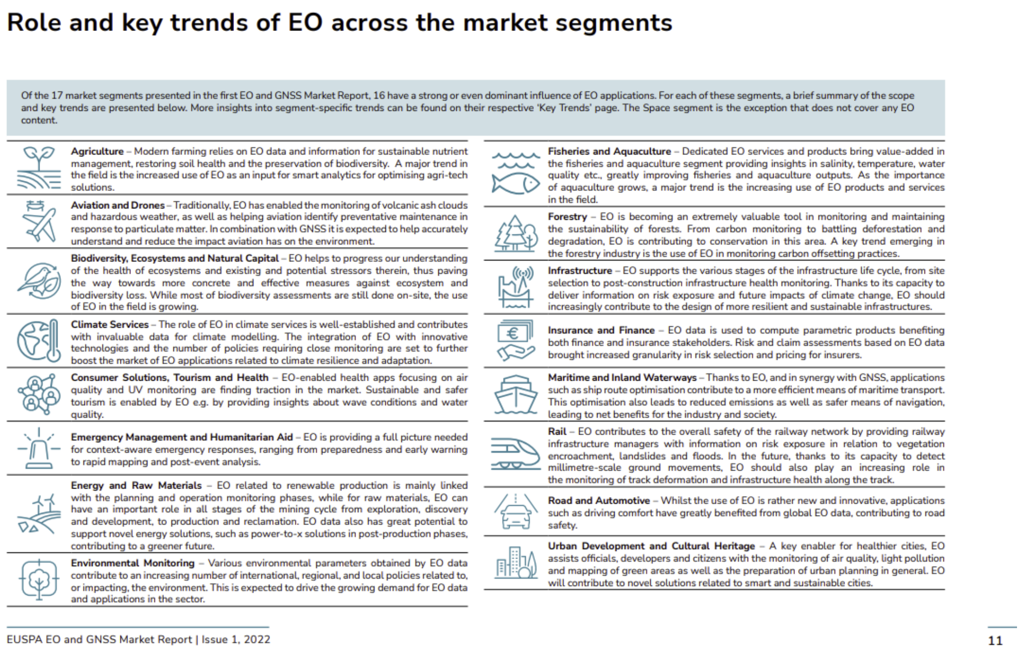

Role and key trends of EO across the market segments

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.

EUSPA EO and GNSS Market Report | Issue 1, 2022

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Figure 5. Role and Key trends of EO across the market segments, EUSPA EO and GNSS Market Report, 2022

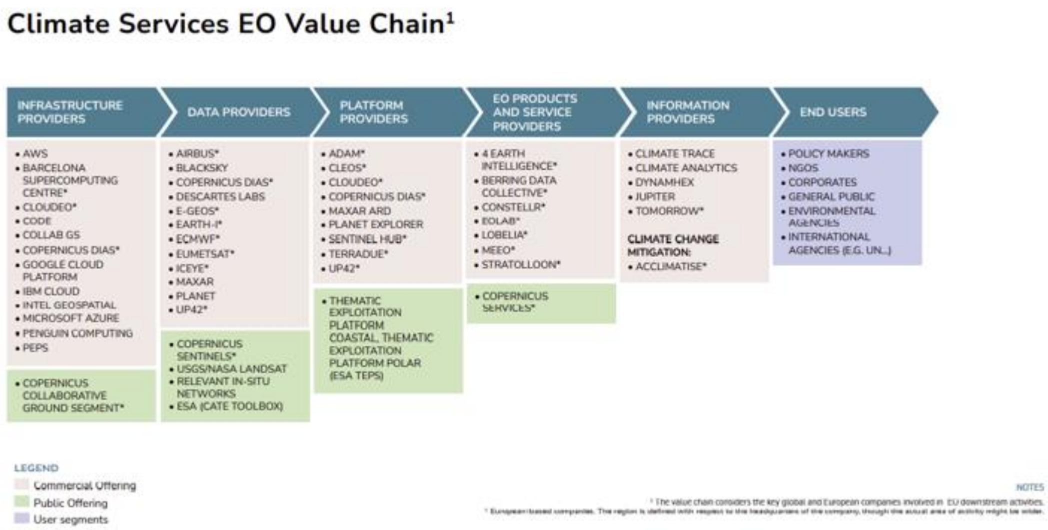

Figure 6. Climate Services EO Value Chain, EUSPA EO and GNSS Market Report, 2022

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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]

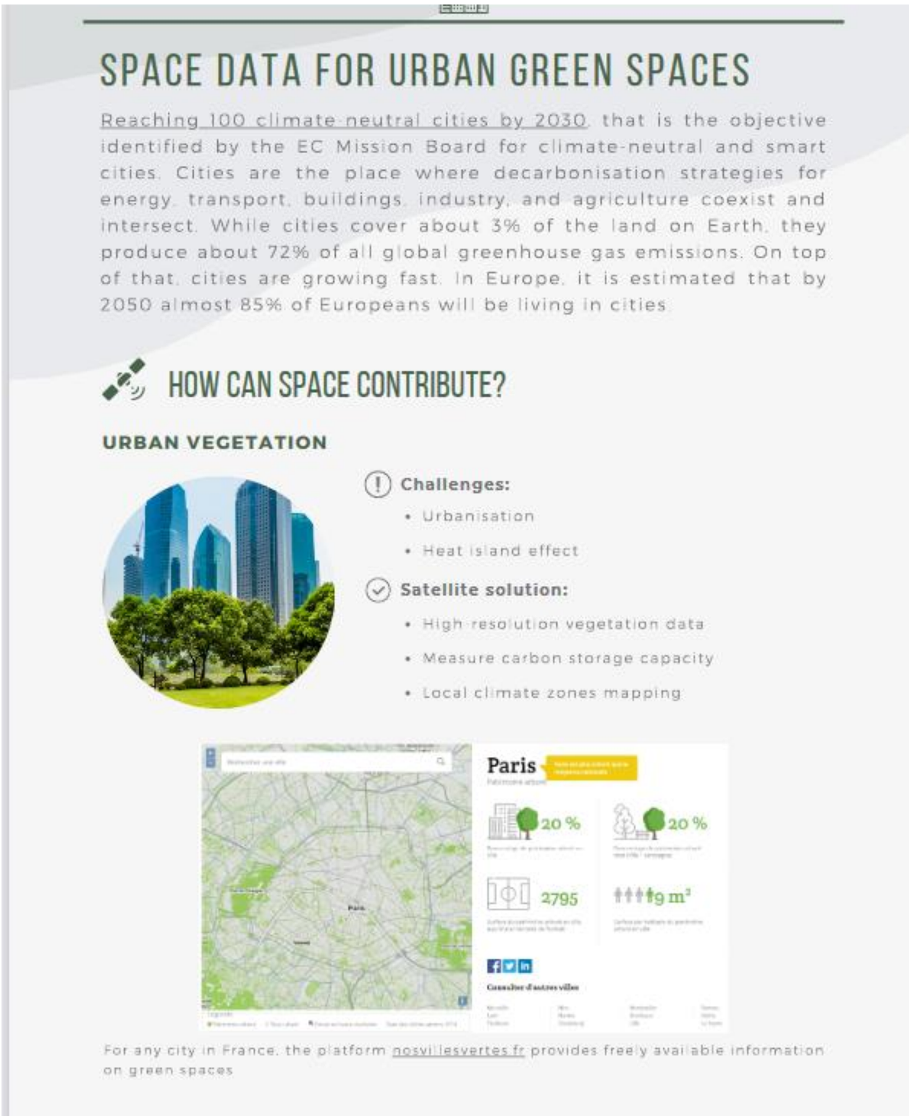

Figure 10. Example of EO potential for Urban Green Spaces

[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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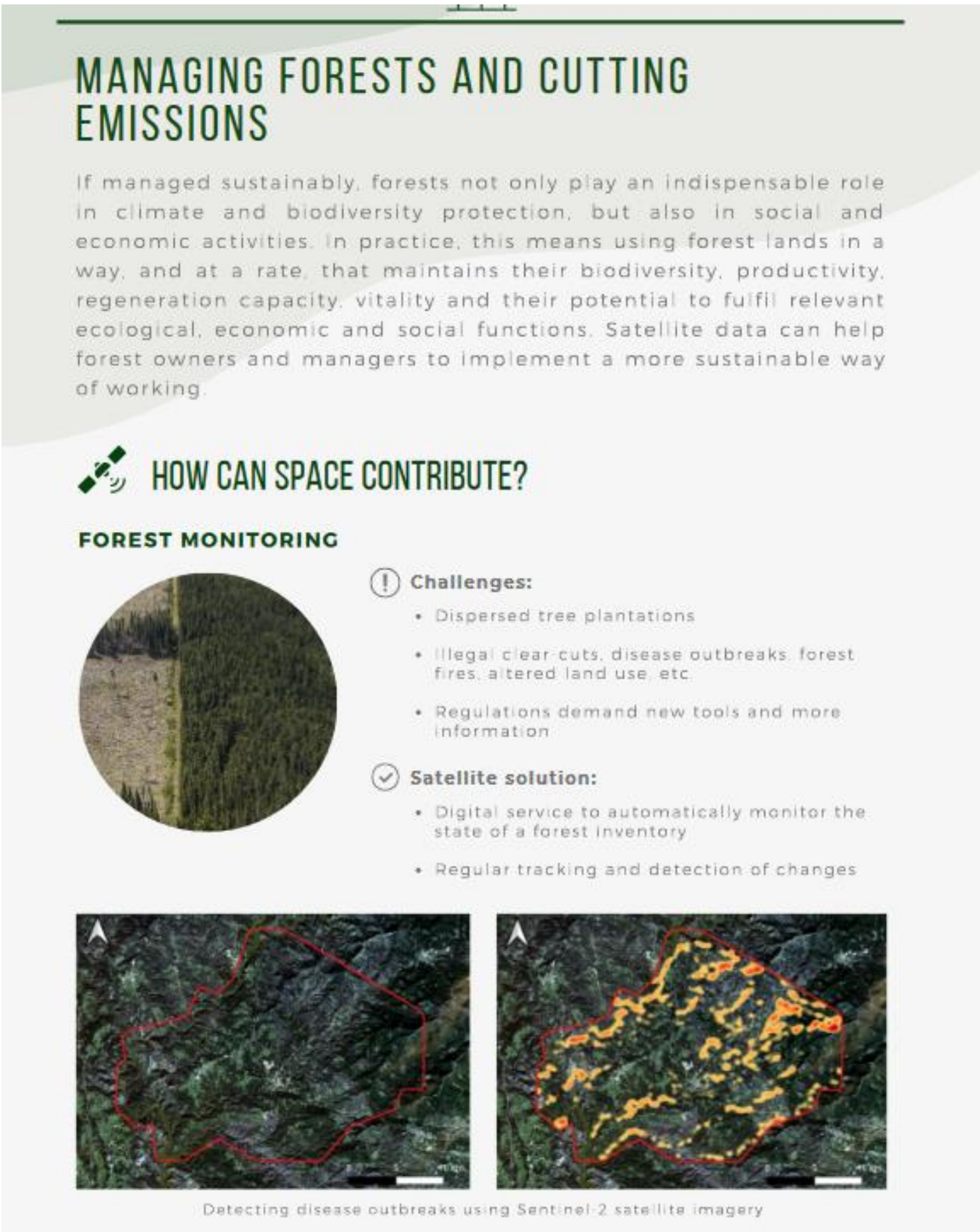

Figure 12. Example of EO potential for managing forests and cutting emissions

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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?

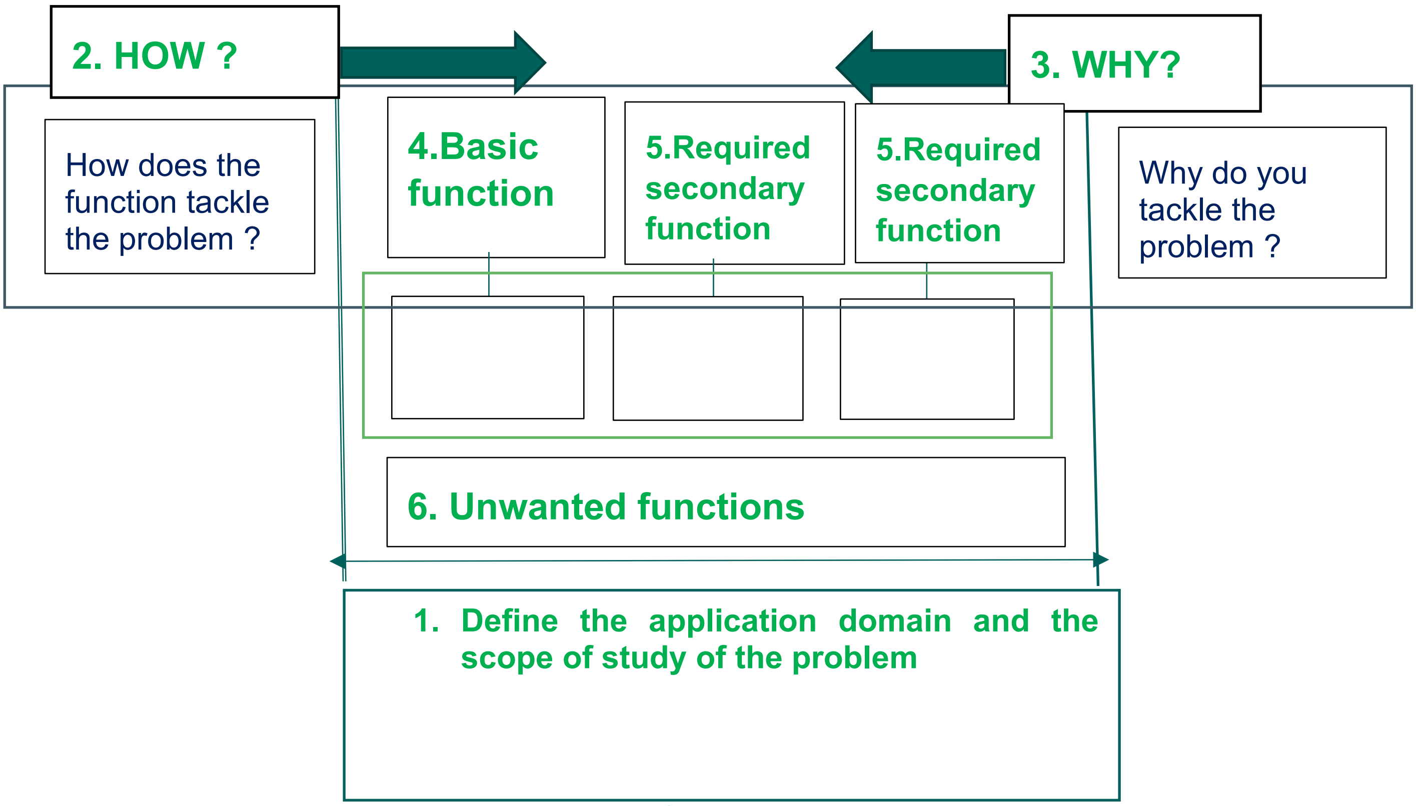

Figure 18. FAST diagram

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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.

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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

Civil security 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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Date: 21/08/2023 15:09:42

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

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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

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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?

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Mentimeter

Instructions

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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

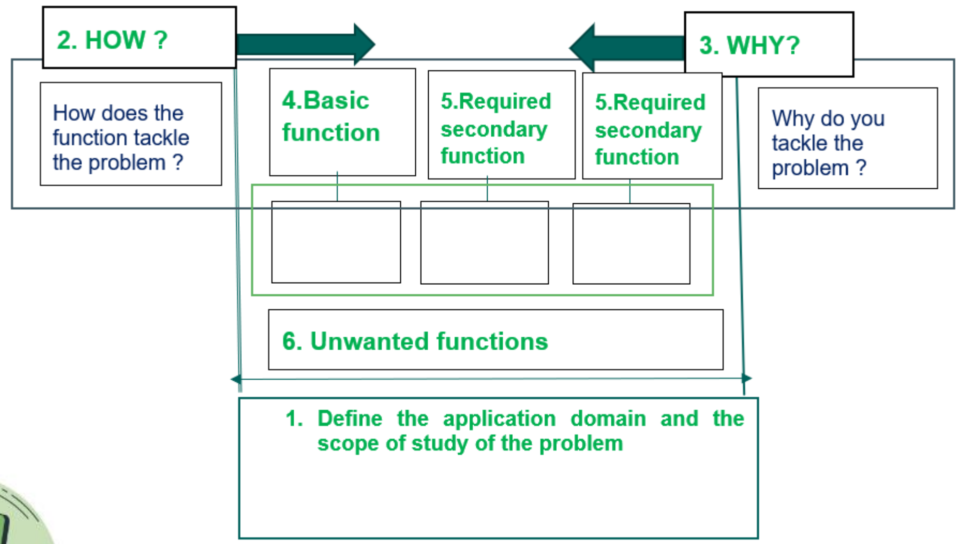
- With functional specification you clearly **describe the requirements that an innovative solution must meet**, but you give suppliers sufficient space and freedom to come up with their own ideas.
- This gives them the space to offer the best solution. This may be a solution that you could not have 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?

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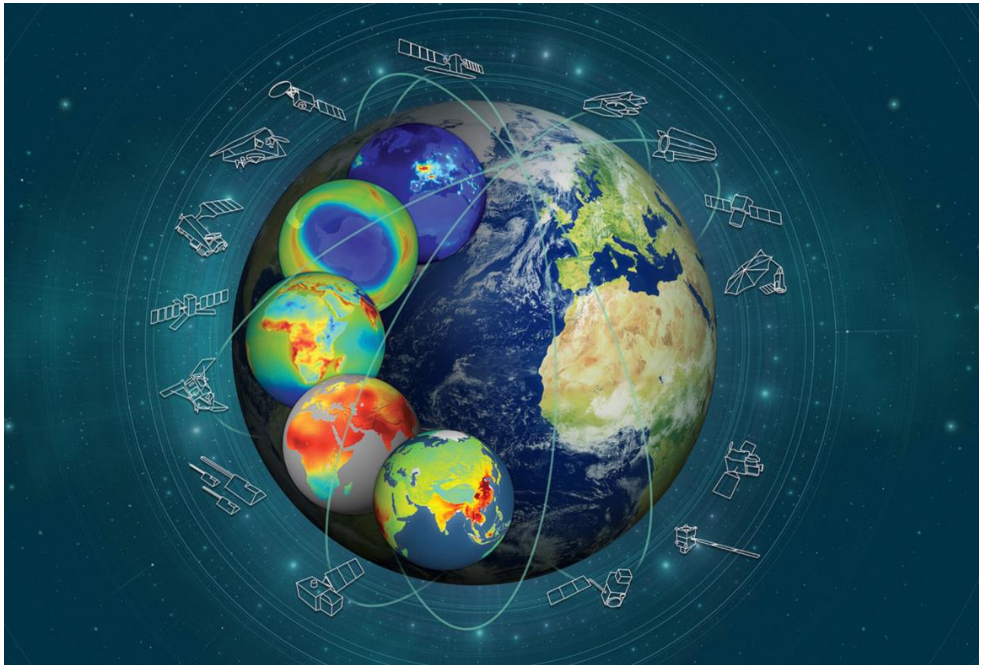
What is Earth Observation?



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)?

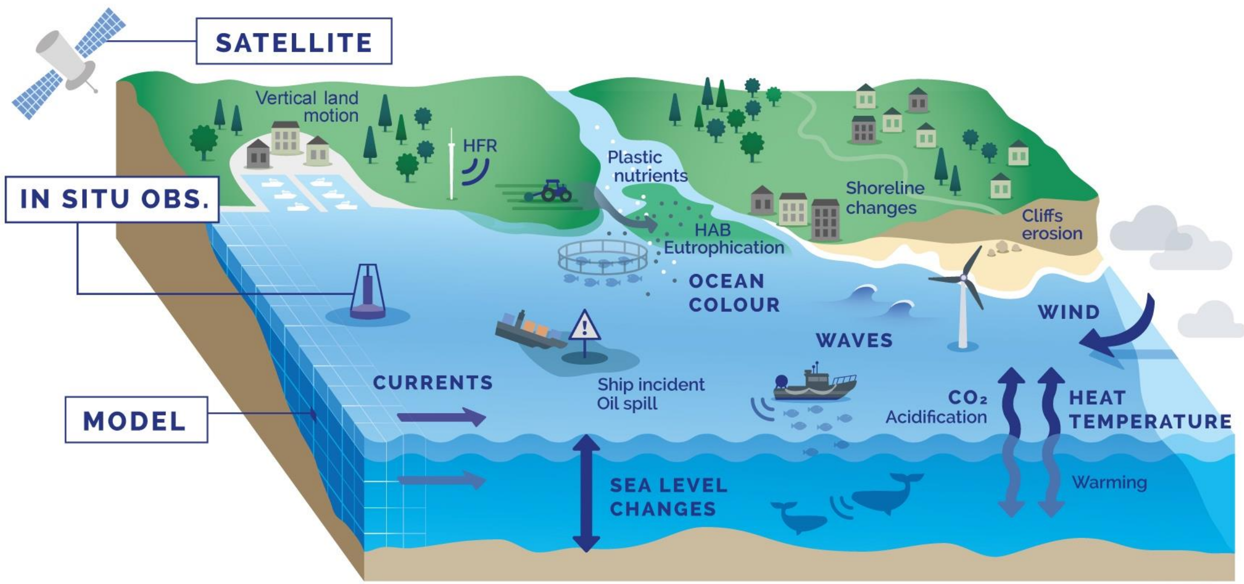
Credits: Earth observation big data for climate change research - ScienceDirect

- ✓ 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

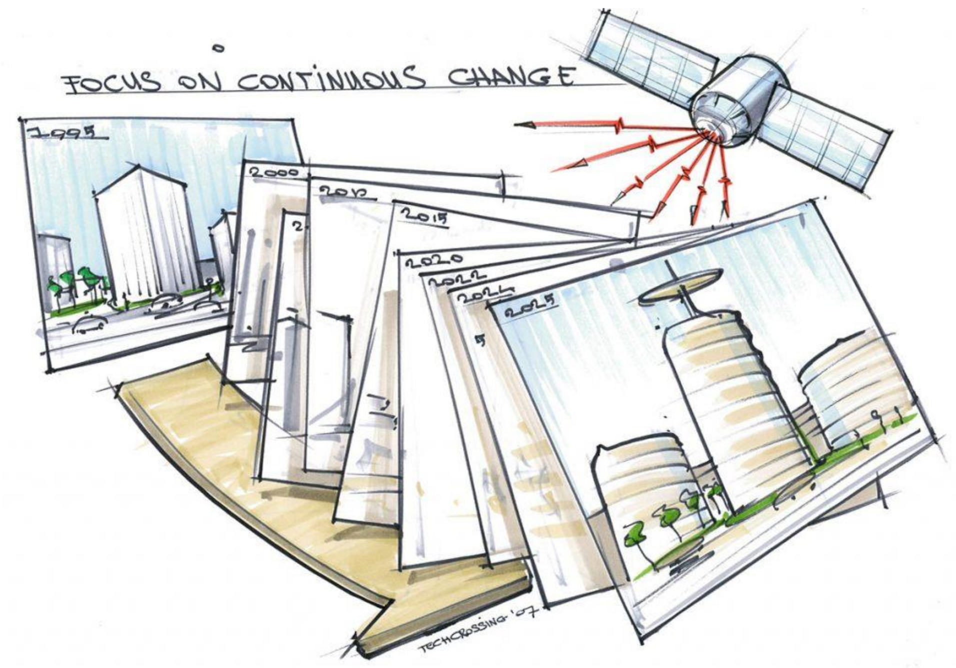
What climate services is PROTECT looking at?

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



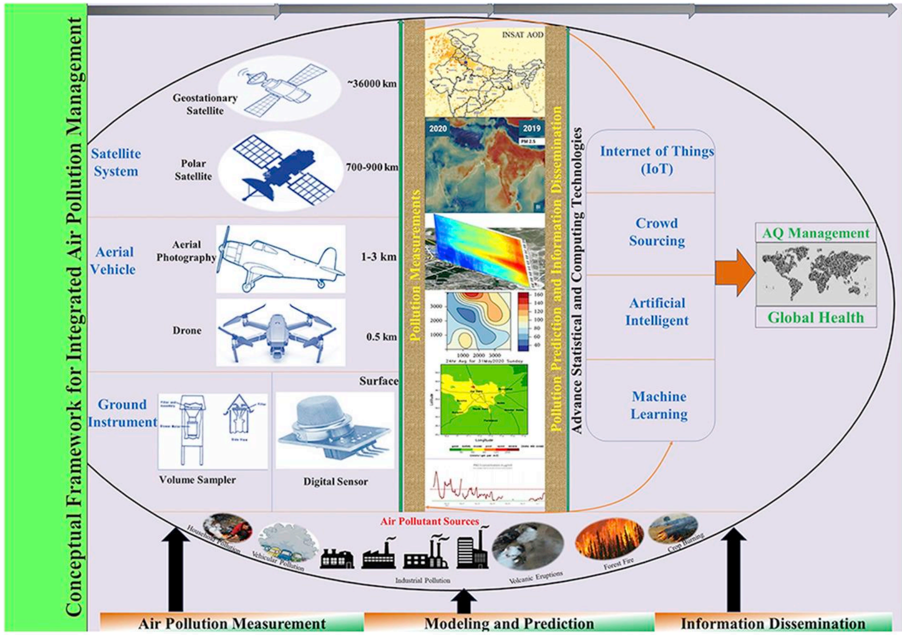
Credits: Earth observation for Smart Cities (neo.nl)

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 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.

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

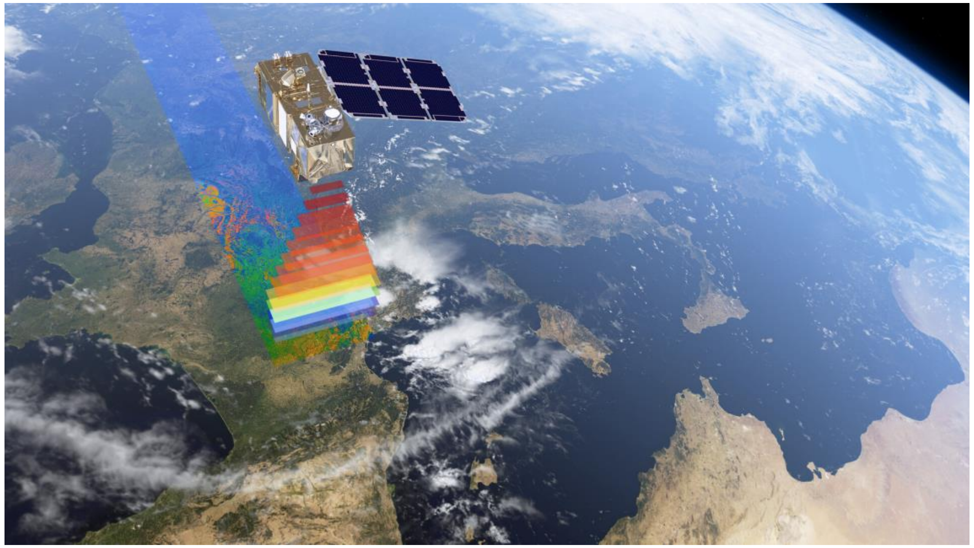
Credits: Civil Security From Space Industry Day | ESA TIA

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.

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)

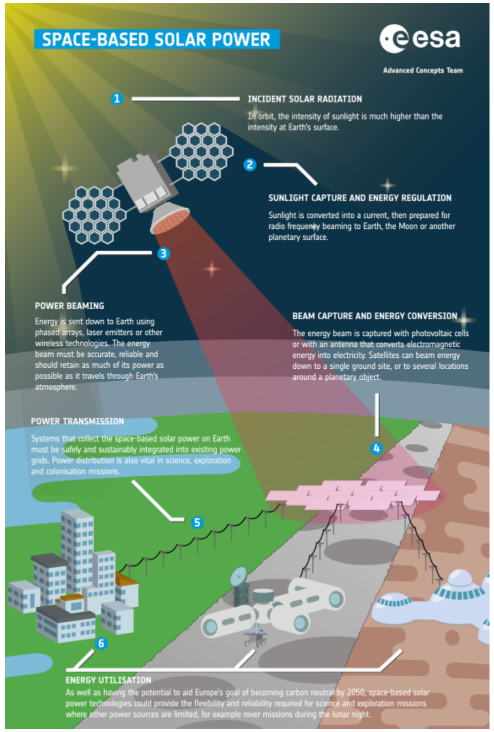
Energy and utilities – Examples of usage

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 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.

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)

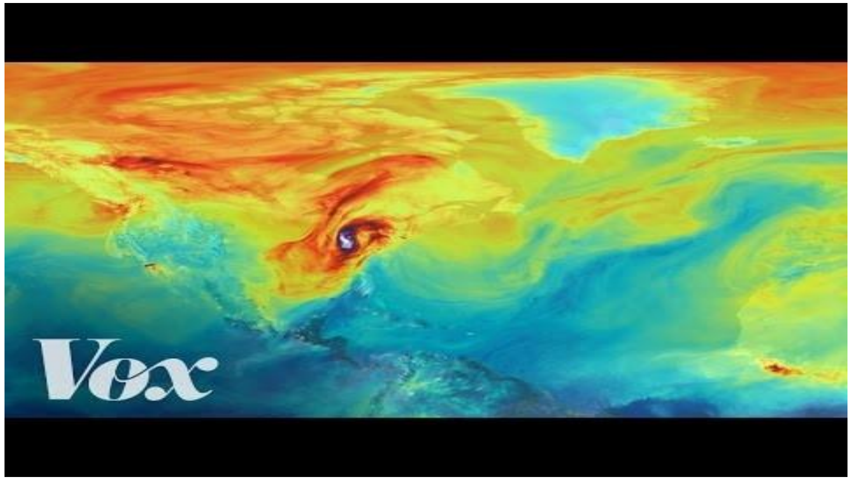
- Includes crops, forests, animals, micro-organisms
- CS using EO in the domain of AFOLU can contribute to a more optimised and sustainable exploitation of the land (based on precision agriculture, natural resources management) as well as counter the growing challenges related to the climate crises (e.g., 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

**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

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.**

Agriculture, forestry and other land use

What climate services is PROTECT looking at?

Sub-domain	Category of climate services
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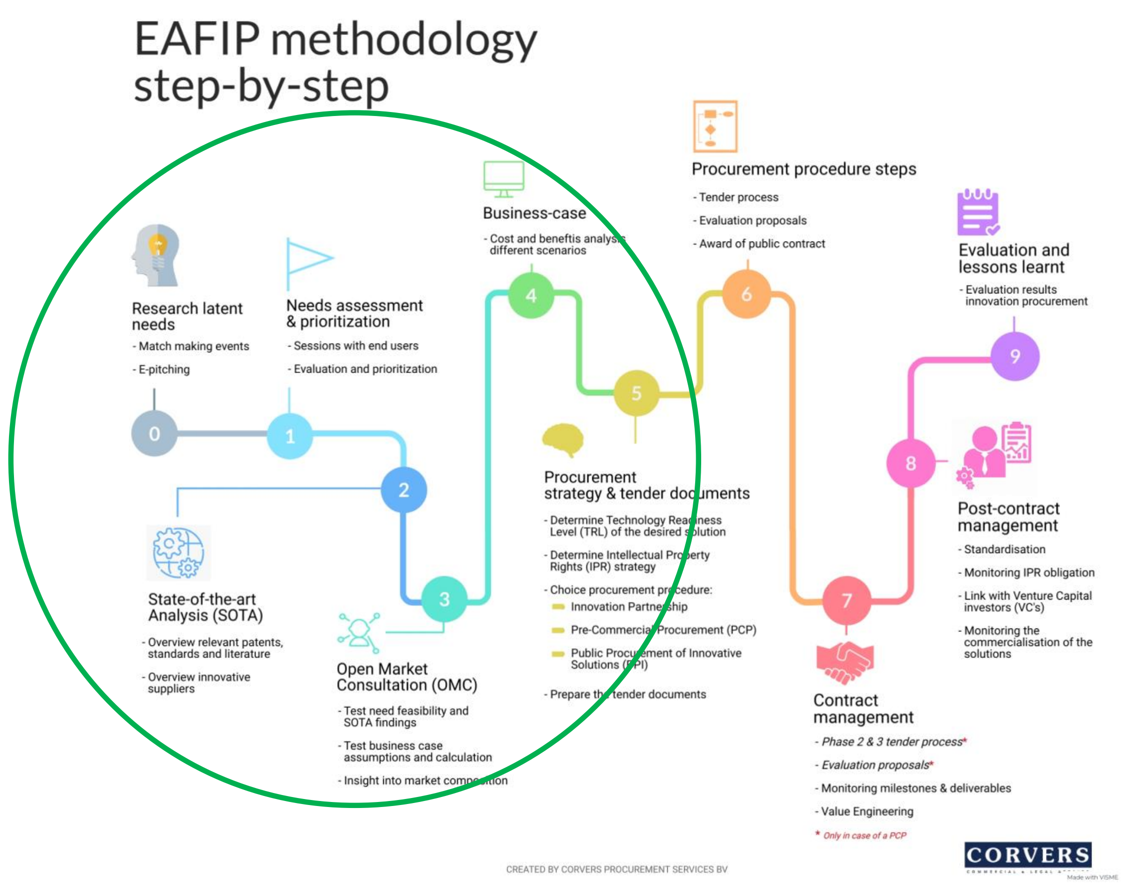
Energy - other	Pipeline monitoring
Waste	Climate data and modelling for waste monitoring and management
Drinking water	Climate data and modelling for drinking water monitoring and management

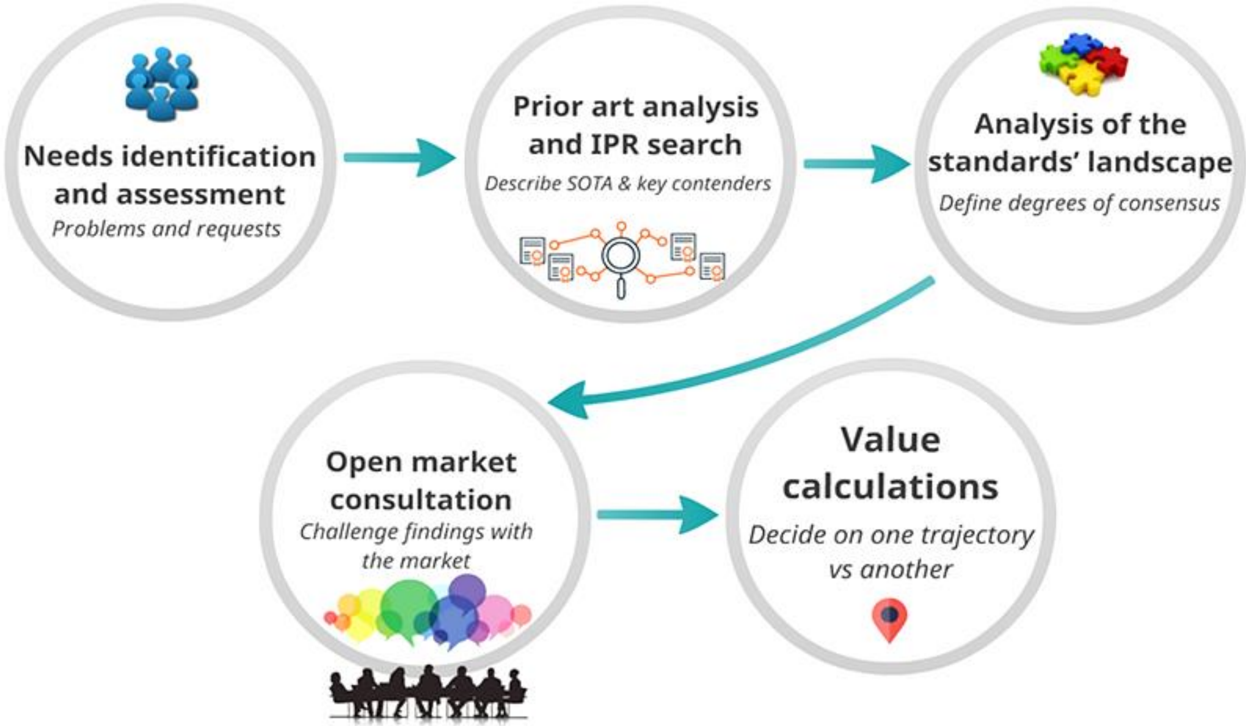
Extract from the PROTECT taxonomy, the domain “**Energy and utilities**”

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

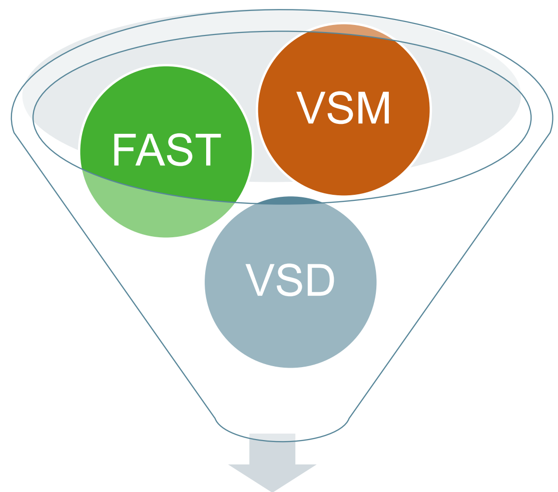
- What challenges and problems do users face?
  - Current
  - Future
- Workshop, interviews
- Function-based specification

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?

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Question 4

- How can EO data/services support the tasks of your organisation to contribute to climate change mitigation and adaptation?

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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
COMMERCIAL & LEGAL AFFAIRS

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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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CORVERS
COMMERCIAL & LEGAL AFFAIRS

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Annex 4

Results of the EU Survey on functionalities and use cases

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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	
1	C.J. Koudenburg	DCMR Environmental protection agency	Technical Expert in Sustainable urban communities Green and sustainable urban communities. Teammanager at an EPA teamlead technological innovation in environmental protection	kees.koudenburg@dcmr.nl	The Netherlands	
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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10	Isaura Melo	EMH- DomusSocial, EM		imelo@domussocial.pt	Portugal	
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19	Gary Robinson	Scottish Procurement		Gary.Robinson@gov.scot	Scotland	
20	Jenni Rovio	KEINO		jenni.rovio@motiva.fi	Finland	
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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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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	
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16	Juraj Tkac	creatio eu		tkac@creatioeu.sk	Slovakia	
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	AGRICULTURE FORESTY AND LAND USE DOMAIN					16
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5	Tuula Jutila	EFA	Procurement legal expert	tuula.jutila@efca.europa.eu	Spain	
6	Kristiina Bailey	Helsinki Region Environmental Services Authority HSY	Procurement Manager with some expertise of several topics	kristiina.bailey@hsy.fi	Finland	
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