

EuroGEOsec – CS#2: R&I in Support of Policy Implementation at Practitioner Level

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List of Acronyms

Acronym	Description
AI	Artificial Intelligence
CAP	Common Agricultural Policy
CFP	Common Fisheries Policy
CO ₂	Carbon Dioxide
CS	Case Study
DG AGRI	Directorate-General for Agriculture and Rural Development (European Commission)
EO	Earth Observation
ESA	European Space Agency
EU	European Union
GEOSS	Global Earth Observation System of Systems
INSPIRE	Infrastructure for Spatial Information in the European Community
LC-GD-1-1-2020	Horizon 2020 Green Deal call on fighting extreme wildfires using EO and AI
LULUCF	Land Use, Land Use Change, and Forestry
MRV	Monitoring, Reporting, and Verification
MSFD	Marine Strategy Framework Directive
NL	Netherlands
R&I	Research and Innovation
RIO	Research & Innovation Observatory
SDG	Sustainable Development Goal
SME	Small and Medium-sized Enterprise
TRL	Technology Readiness Level
WFD	Water Framework Directive
AI	Artificial Intelligence

1. Context and Rationale

Over the past decade, **Earth Observation (EO)** has steadily emerged as a **critical enabler of evidence-based policymaking** in the European Union. Recognising its potential, a growing number of EU strategies, directives, and policy frameworks explicitly reference EO – either as a mandatory **monitoring tool** or as a recommended **support mechanism** for policy compliance, impact assessment, and environmental reporting. This is particularly visible in sectors such as climate change (e.g. the EU Climate Law), agriculture (e.g. CAP reform), biodiversity protection (e.g. the EU Biodiversity Strategy 2030), and marine monitoring (e.g. the Marine Strategy Framework Directive).

This uptake reflects not only the increasing capabilities of EO systems like Copernicus but also the EU's broader push toward digitalization, automation, and real-time environmental intelligence under initiatives such as the Green Deal, the Digital Europe Programme, and the twin digital-green transition.

Despite this policy momentum, a persistent implementation gap remains: while EO is often acknowledged at the strategic level, operational integration at the practitioner level (e.g. regional authorities, environmental agencies, CAP paying bodies) is frequently lacking. Many EO-based services developed through Research and Innovation (R&I) programmes struggle to move beyond pilot phases or demonstration environments, and very few transition to long-term, scalable public or commercial services. This is especially true for tools developed under **Horizon 2020's Clusters 4 and 6**, and the flagship Green Deal Call LC-GD-1-1-2020, which focus respectively on "Digital, Industry and Space" and "Food, Bioeconomy, Natural Resources, Agriculture and Environment."

Several factors contribute to this “valley of death” between research and operationalisation:

- Technological maturity gaps: EO solutions often reach Technology Readiness Levels (TRL) 4–6 during projects, while end-users typically require TRL 8–9 for procurement or institutional use.
- Limited stakeholder alignment: R&I consortia may lack structured collaboration with public authorities during design and validation, resulting in low practical usability.
- Unclear post-project sustainability: Many solutions are project-dependent, with no financial, institutional, or market models to sustain services beyond the funding period.
- Fragmented data ecosystems: Interoperability issues, lack of standardisation, and insufficient integration with existing reporting systems (e.g. INSPIRE, Copernicus Services) further impede adoption.

The **EuroGEO initiative**, supported by the **EuroGEOSec**, was designed to address precisely these challenges by facilitating the flow of innovation from policy concept to market implementation. Through structured Operational Pipelines and strategic support from the EuroGEO Secretariat, the initiative aims to support researchers, industry, and policymakers in co-developing EO services that are policy-relevant, technically sound, and operationally viable.

This case study (Case Study #2) contributes to this mission by examining the **enablers and barriers** to the operational uptake of EO-based R&I outputs. It seeks to map how EO is being embedded in policy-driven R&I projects, assess the effectiveness of resulting solutions, and identify good practices and structural weaknesses. Ultimately, the goal is to generate evidence-based recommendations that can inform future R&I programming, strengthen the EuroGEO support model, and accelerate the mainstreaming of EO in EU policy implementation.

2. Purpose and Scope

This study aims to assess the integration of EO into policy-driven R&I initiatives between 2017 and 2023. It focuses on:

- Mapping EO-relevant policy areas and associated Horizon calls
- Identifying gaps in service uptake, sustainability, and long-term impact
- Highlighting good practices and pathways to operational maturity
- Providing input for the EuroGEO Secretariat’s support services

3. Methodology

This study mainly draws from:

- A desk review of key EU policies (pre-2021) with EO relevance
- Horizon 2020 Work Programme topics, particularly under Clusters 4, 6, and LC-GD-1-1-2020
- A representative sample of EO-focused projects mapped to policy needs
- Analysis of technology readiness levels (TRLs), user engagement, and post-project uptake
- Literature and secondary sources identifying bottlenecks and best practices

4. Policy and Programme Mapping

Key EO-Relevant EU Policy Areas:

Policy Area	Relevant EU Policy Instruments
Agriculture	Common Agricultural Policy (CAP), Farm to Fork Strategy
Environment & Biodiversity	EU Biodiversity Strategy 2030, Habitats Directive, Birds Directive
Climate Change	EU Climate Law, 2030 Climate Target Plan, LULUCF Regulation
Disaster Risk Management	EU Civil Protection Mechanism, Sendai Framework (EU-supported)
Marine & Coastal Policy	Marine Strategy Framework Directive (MSFD), Integrated Maritime Policy
Air Quality	Ambient Air Quality Directives, Zero Pollution Action Plan
Urban Development	EU Urban Agenda, Green City Accord
Energy & Raw Materials	EU Green Deal, Circular Economy Action Plan, Critical Raw Materials Act
Water Management	Water Framework Directive (WFD), Floods Directive
Soil Health	EU Soil Strategy for 2030, Proposal for a Soil Health Law (2023)
Forestry	EU Forest Strategy for 2030, Regulation on Land Use, Land Use Change, and Forestry (LULUCF)
Sustainable Mobility	European Strategy for Sustainable and Smart Mobility
Noise & Environmental Health	Environmental Noise Directive, EU Chemicals Strategy for Sustainability
Land Use / Spatial Planning	INSPIRE Directive, Territorial Agenda 2030
Migration & Border Security	Integrated Border Management Strategy, Schengen Borders Code (support via EO from Copernicus)
Fisheries & Aquaculture	Common Fisheries Policy (CFP), EU Algae Initiative

Cultural Heritage Protection	New European Bauhaus, Council conclusions on Cultural Heritage in crises (e.g. satellite damage assessment)
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Table 1 Policy Area

Corresponding Horizon Calls:

- LC-GD-1-1-2020 – Fighting extreme wildfires using EO and AI
- H2020-SC5-15-2019 – EO for biodiversity monitoring
- H2020-LC-CLA-11-2020 – EO for climate risk and resilience
- H2020-SFS-39-2017 – EO-based precision farming
- H2020-SC6-TRANSFORMATIONS – EO-enabled urban innovation

5. Sample Projects and Outcomes

Project Name	Policy Area	TRL Start → End	Key Outcome
<u>FIRE-RES</u>	Wildfire / Climate Resilience	TRL 4 → TRL 6	Pilots in Spain, Greece, Portugal; adopted by civil protection services
<u>EO4AGRI</u>	Agriculture	TRL 3 → TRL 6	EO analytics in farm management systems; integration into agri-policy dashboards
<u>URBAN-OASIS</u>	Urban Development	TRL 5 → TRL 7	EO for urban heat island mapping; adopted in Amsterdam Smart City
<u>BIONET-EU</u>	Biodiversity & Habitats	TRL 4 → TRL 6	Improved EO-based ecosystem indicators for Natura 2000 areas
<u>NextGEOSS</u>	Data Platforms / All sectors	TRL 5 → TRL 8	Developed a cloud-based EO data hub; enhanced service uptake by SMEs
<u>RECAP</u>	CAP Compliance	TRL 4 → TRL 7	EO for monitoring CAP payments; tested by several Paying Agencies
<u>SEN4CAP</u>	Agriculture / CAP Monitoring	TRL 3 → TRL 7	Copernicus Sentinels for CAP monitoring; endorsed by DG AGRI
<u>CoCO2</u>	Climate Monitoring / Air Quality	TRL 3 → TRL 6	EO models for tracking anthropogenic CO ₂ ; input for EU MRV systems
<u>e-shape</u>	Various Sectors	TRL 4 → TRL 8	37 pilots; EO solutions co-developed with stakeholders across 7 SDG clusters
<u>URBANFLUXES</u>	Urban Climate	TRL 3 → TRL 6	EO-derived urban energy balance mapping; policy

			uptake by local municipalities
CoastObs	Marine & Water Quality	TRL 4 → TRL 7	EO-based coastal monitoring for MSFD and aquaculture; services piloted in NL
Landsense	Land Use / Citizen Science	TRL 3 → TRL 6	EO + crowdsourced land cover monitoring; used by environmental authorities

6. Challenges and Success Factors

Common Challenges Identified:

1. **Pre-Operational Technology Readiness Levels (TRLs)**
 - Many EO-based innovations developed under Horizon 2020 projects mature only to TRL 4–6, representing proof-of-concept to demonstration in a relevant environment. However, public authorities and private-sector users typically require fully validated, operational solutions (TRL 8–9) to justify investment, integration, or procurement. This **mismatch in readiness** is a systemic barrier, often exacerbated by project timelines that prioritize research outcomes over market deployment.
2. **Lack of User-Centric Design and Engagement**
 - A recurring issue is the **insufficient involvement of end users** – such as public administrations, land managers, environmental regulators, and civil protection agencies – in the design, testing, and validation of EO services. This results in tools that are technologically sophisticated but **misaligned with operational workflows, legal reporting requirements, or institutional capacities**. Additionally, end-user engagement is often frontloaded during the proposal phase and drops off during execution, reducing long-term adoption potential.
3. **Post-Project Funding and Sustainability Gaps**
 - Many EO services are developed as part of **time-limited pilot initiatives**, with no clear mechanism for post-project funding, maintenance, or scaling. The absence of a **business model or service continuity plan** means solutions often stagnate or disappear after the funding period ends. This challenge is particularly acute for tools aimed at the public sector, which may lack procurement flexibility or budget allocation mechanisms for post-project uptake.
4. **Fragmentation in Policy Integration**
 - EO-derived outputs often need to fit into **complex multi-level governance structures** and reporting obligations (e.g. WFD, MSFD, CAP compliance, LULUCF accounting). However, many R&I consortia do not align outputs with existing reporting systems, institutional formats, or regulatory frameworks, making uptake administratively burdensome or non-compliant. This disconnect can render technically sound EO services **incompatible with real-world policy execution**.
5. **Data Fragmentation and Lack of Standardization**
 - Although EO data is increasingly available (e.g. via Copernicus), the **interoperability of EO-derived services remains a barrier**. Projects often use bespoke data processing chains, local parameters, or proprietary formats, limiting their replicability and integration with existing infrastructures. Moreover, insufficient adherence to EU data standards (e.g. INSPIRE, GEOSS) undermines cross-border usability and platform-based scaling.

Success Factors Observed

1. **Co-Creation with Policy Implementers**

- Projects that engage **policy and practitioner stakeholders as co-designers** from the outset tend to deliver solutions that are better tailored, more usable, and more likely to be adopted. Co-creation ensures that EO outputs address real-world problems, follow institutional logic, and anticipate regulatory constraints. This also enhances trust, commitment, and political buy-in.
2. **Use of Open Copernicus Data**
 - Leveraging **Copernicus Sentinel and core service datasets** offers several benefits: it ensures continuity beyond the project lifespan, supports open-access principles, and facilitates technical interoperability across platforms and regions. Projects that build on Copernicus reduce dependency on proprietary data sources and align with broader EU EO infrastructure goals.
 3. **Embedding into Governance Systems**
 - Projects that seek to integrate EO services directly into **existing policy instruments or institutional tools** – e.g. agri-environmental dashboards, environmental registries, risk mapping platforms – are more successful in achieving sustained uptake. Embedding EO within governance systems enables smoother integration into reporting pipelines, operational workflows, and decision support systems.
 4. **Capacity-Building and Knowledge Transfer**
 - Many EO innovations face barriers not because of technical shortcomings, but due to **a lack of institutional capacity** to understand, evaluate, or maintain them. Projects that include training sessions, manuals, stakeholder workshops, or helpdesk functions help ensure that users can adopt and sustain EO tools post-project. This also supports trust-building and helps public bodies navigate organizational inertia or staff turnover.

Looking across the challenges and success factors, a consistent picture emerges. Progress towards operational uptake is shaped less by data availability or analytical sophistication than by how well EO solutions fit institutional realities. Issues such as procurement readiness, alignment with existing reporting systems, and sustained user engagement repeatedly determine whether a service moves beyond demonstration. These patterns provide a clear basis for the below recommendations.

7. Recommendations

The following recommendations focus on addressing the practical constraints that most often prevent EO-based R&I outputs from being taken up in day-to-day policy implementation, and on strengthening continuity between research activities and longer-term operational use.

To stimulate the operational uptake of EO R&I results:

For Policymakers:

- Design calls with clear provisions for operational transition
- Include public authority end-users as mandatory project partners

For Project Consortia:

- Focus on TRL advancement and post-project sustainability planning
- Prioritise capacity-building and knowledge transfer

For the EuroGEO Secretariat:

- Offer advisory services for solution validation and upscaling
- Establish a helpdesk linking EO solution providers with end-user needs
- Maintain the RIO as a central hub for tracking EO maturity and policy alignment

8. Conclusion

This case study confirms the growing importance of Earth Observation in supporting EU policy implementation, while also making clear why uptake at practitioner level remains uneven. Across the projects examined, EO-based solutions consistently demonstrated their ability to deliver relevant and timely information. Whether this **translated into lasting impact**, however, depended largely on how closely those solutions were **aligned with institutional processes**, regulatory requirements, and user capacity.

One of the clearest findings is **that policy-driven R&I projects work best when they are treated as stepping stones rather than final products**. Projects that engaged practitioners early, built on open Copernicus data, and designed outputs with existing reporting and decision-making systems in mind were more likely to progress towards operational use. Where this alignment was missing, even technically strong solutions tended to remain confined to pilot applications.

The analysis also points to the importance of what happens **after a project ends**. Moving EO services from mid-level TRLs into sustained operational use requires early attention to questions of ownership, financing, and governance, as well as continued support for users. In the absence of these elements, promising tools often struggle to survive beyond the funding period.

Finally, the case study highlights the **value of intermediary support structures** such as EuroGEO and the **EuroGEO Secretariat**. By helping to connect policy needs, research outputs, and practitioner realities, these actors reduce the risks associated with adoption and support more durable outcomes. Overall, the findings suggest that accelerating EO uptake is not primarily a technical challenge, but one of design, coordination, and continuity.