

LEONSEGS

LARGE EARTH OBSERVATION  
NEW SPACE ECOSYSTEM  
GROUND SEGMENT

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LEONSEGS POLICY RECOMMENDATIONS ON  
SUSTAINABLE AND SAFE EXPLORATION ON SPACE

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Dissemination Level: **PUBLIC**



Grant Agreement No.: 101082493  
Call: HORIZON-CL4-2022-SPACE-01  
Topic: HORIZON-CL4-2022-SPACE-01-13  
Type of action: HORIZON-IA

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# LEONSEGS POLICY RECOMMENDATIONS ON SUSTAINABLE AND SAFE EXPLORATION ON SPACE

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## ABBREVIATIONS

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EC	European Commission
EO	Earth Observation
EU	European Union
GSaaS	Ground Segment as a Service
POC	Proof of Concept

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## 1. EXECUTIVE SUMMARY

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Europe has done a great job creating ways to share and use Earth Observation (EO) satellite data. However, there is a big gap in how we manage these systems. Current policies do not cover shared, multi-mission ground systems. These ground systems process data, store archives, send instructions to satellites (tasking), and deliver services across public and private groups.

This document explains five main policy problems we found after reviewing the current space landscape. We propose ten practical, evidence-based recommendations to fix them. Using the LEONSEGS shared ground system as a real world test, this document shows European and national decision-makers how to move from simply sharing files to running secure, connected satellite services that work together smoothly.

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## 2. INTRODUCTION

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The LEONSEGS project is built around a shared ("federated") network of Earth Observation (EO) data providers. These providers work together using harmonized (standard) interfaces. The entire system is managed by a central, automated service that takes complex user requests and turns them into ready-to-use EO products. This model shows how to build an affordable, modular ground system that connects different satellites, New Space constellations, and user demands.

To turn this technology into a real commercial success, we need better policy and government rules. The main challenge in Europe is no longer a lack of technology. Instead, we lack the shared rules, trust, and procurement models needed to run these connected systems. This white paper outlines the policy changes Europe needs to protect its space independence, help businesses grow, and prepare for future emergencies.

### Why the Policy Dimension Matters

Without official policy support, shared ground networks are hard to scale up, buy, certify, or use in public services. Satellite services are changing fast. They now combine public archives, new satellite imagery, commercial data, and automated computer processing. Because of this, our rules must change to moving from governing static datasets to managing live, connected service networks.

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### 3. METHODOLOGY

We created the findings and recommendations in this document using a five-stage process:

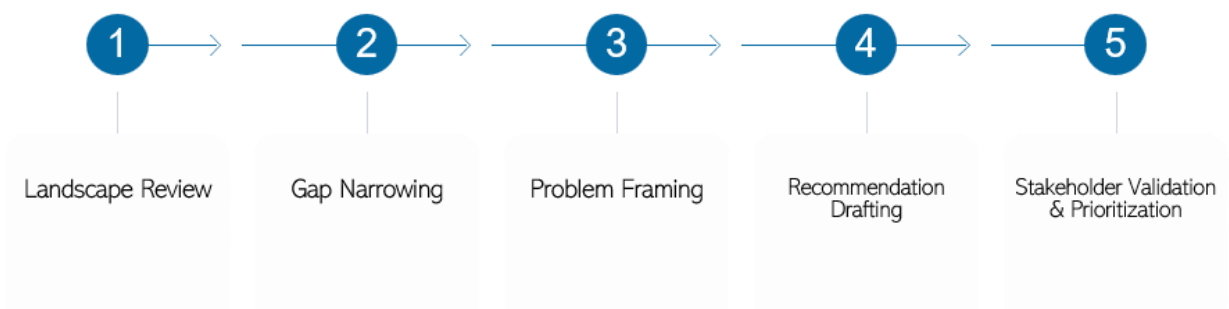


Figure 1 Five stage process of defining the final recommendations

1. **Landscape Review:** We reviewed the main European EO programs, rules, and trust standards (including Copernicus, INSPIRE, ESA Strategy, and repository guidelines).
2. **Gap Narrowing:** Looking at how our satellite technology actually works, comparing it to current government rules, and finding exactly where the technology and those regulations clash or cause delays.
3. **Problem Framing:** We turned these bottlenecks into five simple "Policy Problem Cards" that describe what is broken, why, who is affected, and why it matters.
4. **Recommendation Drafting:** Based on the five policy problem cards, we defined ten practical recommendations to directly address each bottleneck.
5. **Stakeholder Validation & Prioritization:** Internal validation with LEONSEGS partners has been conducted; however, we will leave the option open for further feedback and refinement with the wider relevant EU policy maker community following publication. During these validation steps, we used an Impact/Feasibility matrix to separate immediate, high-value actions from long-term strategic policy goals.

### 4. HOW LEONSEGS CONTRIBUTES IN POLICY TERMS

LEONSEGS is a real-world proof-of-concept that shows where current policies fall short. It bridges the gap between technological innovation and public policy goals by addressing four key areas:

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- **Scientific and Technical Goals (ST):** We are automating advanced satellite processes and making it easy to combine data from different sensors. This handles complex user requests automatically, scales up multi-satellite operations, and gives users a much better experience by making data available faster, with lower delays and higher quality.
- **Economic Goals (E):** We are reducing the high costs of satellite services and building a sustainable, shared space business network (ecosystem) in Europe.
- **Societal Goals (S):** We are helping new businesses grow using space data, lowering the cost of running satellite networks, and making satellite apps easier to use across different public and commercial sectors.
- **Policy Goals (P):** We are strengthening Europe's leadership in space globally, reducing our dependency on foreign high-resolution space data, and making better use of Europe's existing space assets.

## Connecting Tech to European Policy

The overall message is clear: by moving from technological innovation to business growth and wider public adoption, LEONSEGS helps Europe to secure its **strategic independence** (autonomy) and global competitiveness in space.

By connecting private New Space satellites with public European archives, LEONSEGS shows how to lower entry costs for startups, protect data privacy, and run hybrid space operations safely.

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## 5. THE EARTH OBSERVATION POLICY LANDSCAPE: KEY PROGRAMS AND INITIATIVES

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The European space policy landscape is not empty. Europe already has strong EO programmes, strong spatial-data rules, strong interoperability communities, and strong public-value narratives. However, they were not designed with shared, multi-mission ground systems in mind.

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### 5.1 KEY INITIATIVES AND POLICIES

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#### 1. Copernicus Programme:

- **Objective:** This is a key component of the EU Space Programme, providing EO data through own satellites (Sentinel), contributing missions, and in-situ sources as well as dedicated services from different domains (e.g. Land, Atmosphere, Emergency, Security etc.). It supports environmental management and climate change mitigation.

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- **Strategic Research and Innovation Agenda (SRIA):** The SRIA outlines priorities for Copernicus' evolution, focusing on agile data streams, digital transformation, and expanded services to meet EU policy goals like the European Green Deal. For further details, see the [Copernicus Programme and SRIA on Knowledge for Policy](#).<sup>1</sup>
- 2. **European Commission's Support for Earth Observation Infrastructures:**
  - The Joint Research Centre (JRC) is working on mapping user requirements to existing EO infrastructures, identifying overlaps and gaps to enhance interoperability and accessibility, as outlined in the [European Commission's Earth Observation Initiatives](#).<sup>2</sup>
- 3. **GEO Work Programme and Africa Multi-Hazard Early Warning Systems:**
  - The European Commission supports the strengthening of Africa's early warning systems through the Group on Earth Observations (GEO) Work Programme, emphasizing disaster risk reduction and climate adaptation. More details can be found via the [Group on Earth Observations](#).<sup>3</sup>
- 4. **Earth Observation Data Policy and Europe (EOPOLE):**
  - This project aimed to review and coordinate European national research in EO data policy, identifying improvements to support the expansion of the EO sector, as coordinated by [University College London](#).<sup>4</sup>
- 5. **ESA's Earth Observation Science Strategy:**
  - While not an EU policy per se, the European Space Agency (ESA) plays a crucial role in EO. Its new strategy focuses on leveraging satellite technology to address global environmental challenges by 2040. Access the strategy on the [ESA Website](#).<sup>5</sup>
- 6. **CoreTrustSeal:**
  - CoreTrustSeal offers to any interested data repository a core level certification based on the Core Trustworthy Data Repositories Requirements. This universal catalogue of requirements reflects the core characteristics of trustworthy data repositories. This certification is based on a catalogue of data repository requirements criteria, which reflects trustworthy data repositories' core characteristics.<sup>6</sup>
- 7. **INSPIRE:**
  - INSPIRE aims to enhance the sharing of environmental spatial information among public sector organisations and facilitate public access to environmental

<sup>1</sup> [https://knowledge4policy.ec.europa.eu/earthobservation/topic/research-innovation\\_en](https://knowledge4policy.ec.europa.eu/earthobservation/topic/research-innovation_en)

<sup>2</sup> <https://earthobservations.org/partners/member-gov/european-commission>

<sup>3</sup> <https://earthobservations.org/our-work/geo-work-programme>

<sup>4</sup> <https://www.sciencedirect.com/science/article/abs/pii/S0265964600000540>

<sup>5</sup> [https://www.esa.int/Applications/Observing\\_the\\_Earth/ESA\\_releases\\_new\\_strategy\\_for\\_Earth\\_observation](https://www.esa.int/Applications/Observing_the_Earth/ESA_releases_new_strategy_for_Earth_observation)

<sup>6</sup> <https://www.coretrustseal.org/>

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information across Europe. Based on a collection of established standards created by various organisations (W3C, ISO/TC211, OGC, etc.), the INSPIRE Technical Guidelines describe the legal requirements for data and data services and recommendations on implementation. The INSPIRE directive is underpinned by technical implementing rules as a legal framework for a European Spatial Data Infrastructure (SDI). It enables spatial information to be interoperable, discoverable, viewable, and downloadable to assist in policy-making across boundaries.<sup>7</sup>

**8. Many communities have developed their recommendations for data and metadata, which have often evolved to become de facto standards through their breadth of adoption. Examples include:**

- **a.** The International Virtual Observatory Alliance (IVOA) develops standards to ensure the interoperability of astronomical data collected by its members, enabling the international utilisation of astronomical archives as an integrated and interoperating virtual observatory;<sup>8</sup>
- **b.** The Open Geospatial Consortium (OGC) addresses interoperability challenges for the geospatial community, such as publishing map content on the Web, exchanging critical location data during disaster response & recovery, and enabling the fusion of information from diverse Internet of Things (IoT) devices;<sup>9</sup>
- **c.** The WIGOS Data Quality Monitoring System: monitors the availability, quality, and timeliness of data from the WMO International Global Observing system. WIGOS ensures data and products are dependable and correspond to an agreed set of needs;<sup>10</sup>
- **d.** Some relevant standards coming from the most prominent standardisation body, International Standardization Organisation (ISO): 191nn (geographic information/geomatics and geographic information), 900n (quality management), 250nn (systems and software engineering), 8000 (data quality).<sup>11</sup>

**9. LANDSAT:**

- **a.** From the book Landsat and beyond: as the Landsat program was started in 1972 some gaps were found over the years. To address these gaps, the National Academies propose establishing a Sustained and Enhanced Land Imaging Program (SELIP), which would ensure continuity of data, integrate spaceborne and airborne

<sup>7</sup> [https://knowledge-base.inspire.ec.europa.eu/index\\_en](https://knowledge-base.inspire.ec.europa.eu/index_en)

<sup>8</sup> <https://www.ivoa.net/>

<sup>9</sup> <https://www.ogc.org/standards/>

<sup>10</sup> <https://community.wmo.int/site/knowledge-hub/programmes-and-initiatives/wmo-integrated-global-observing-system-wigos/implementation-of-wmo-integrated-global-observing-system-wigos/wdqms-wigos-data-quality-monitoring-system>

<sup>11</sup> <https://www.iso.org/committee/54904.html>

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systems, leverage commercial and international partnerships, and maintain a free and open data policy to maximize scientific and operational use.<sup>12</sup>

- **b.** The report acknowledges the growing need for global coordination. The initiative calls for interoperable systems, long-term planning, and broader collaboration.
- **c.** Other key documents are referenced in the book such as the 2007 OSTP report "A Plan for a U.S. National Land Imaging Program"<sup>13</sup>, the 2010 National Space Policy<sup>14</sup>, and the 2007 NRC Decadal Survey<sup>15</sup>.

#### 10. UNOOSA United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER):

- **a. Mission statement:** "Ensure that all countries and international and regional organizations have access to and develop the capacity to use all types of space-based information to support the full disaster management cycle".<sup>16</sup>

The overview suggests that current frameworks are still mainly built around:

- Data access,
- Programme-level service delivery, or
- Repository trust.

In contrast, LEONSEGS wants to address the need for policy thinking to be built around:

- Federated EO infrastructures,
- Multi-mission orchestration,
- Public-private tasking and service chains,
- Trustworthy processing environments, and
- Responsible use of advanced EO products and VHR data.

LEONSEGS tends to demonstrate that Europe needs policy not only for EO data and EO programmes, but also for the federated digital infrastructures that combine heterogeneous EO assets into operational services.

<sup>12</sup> <https://www.nationalacademies.org/read/18420/chapter/2>

<sup>13</sup> [https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/fli\\_iwg\\_report\\_print\\_ready\\_low\\_res.pdf](https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/fli_iwg_report_print_ready_low_res.pdf)

<sup>14</sup> [https://obamawhitehouse.archives.gov/sites/default/files/national\\_space\\_policy\\_6-28-10.pdf](https://obamawhitehouse.archives.gov/sites/default/files/national_space_policy_6-28-10.pdf)

<sup>15</sup> <https://science.nasa.gov/earth-science/decadal-surveys/>

<sup>16</sup> <https://un-spider.org/>

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## 6. THE FIVE POLICY PROBLEMS

### Policy Problem 1: Fragmented governance for federated EO ground segments

**Policy problem:** European EO policy frameworks strongly support EO data provision, interoperability, and environmental information sharing, but they do not yet clearly recognise or govern federated, multi-mission EO ground-segment infrastructures that coordinate data, archives, tasking, and downstream service delivery across public and private actors.

#### Why this emerged from the landscape review:

Copernicus is a mature EO programme and service ecosystem, but its policy framing is centred on data and thematic services rather than governance models for external federated infrastructures.

INSPIRE is strong on spatial-data interoperability and access, but less specific on operational federation of multi-provider EO processing and mission-service orchestration. Existing standards ecosystems support interoperability technically, but adoption in operational multi-actor ground-segment environments remains uneven.

#### What is not working:

- No clear policy category for “federated EO ground segment” as strategic infrastructure.
- Weak alignment between EO policy, digital infrastructure policy, and New Space market development.
- Limited policy guidance for infrastructures that connect archives, mission operators, processors, and service providers without centralising all assets.

#### Root causes:

- Legacy policy focus on flagship programmes and datasets rather than service orchestration infrastructure.
- Fragmentation between upstream, downstream, and digital-platform governance.
- Lack of policy language for Ground Segment as a Service and multi-mission coordination.

**Affected stakeholders:** New Space mission operators; EO product providers; Service integrators; Public authorities procuring EO-enabled services; End users who need seamless cross-source products

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**Why it matters:** Without policy recognition, federated infrastructures remain harder to scale, procure, certify, and integrate into public and cross-border service chains.

**LEONSEGS relevance:** LEONSEGS is explicitly building a federated, automated, harmonised, multi-mission ground-segment model and therefore exposes this governance gap in practice.

**Linked recommendations:**

- R1. Recognise Federated EO Ground Segments as a Policy Object
- R2. Extend Copernicus SRIA to Include Federated Infrastructure Models.

**Policy Problem 2: Interoperability exists, but not yet at the level needed for service federation**

**Policy problem:** Europe has matured interoperability frameworks for spatial data, metadata, and geospatial services, but there is still a gap between data interoperability and operational interoperability for federated EO services, especially where tasking, processing pipelines, archive access, and multi-source product generation must work across heterogeneous providers.

**Why this emerged from the landscape review:**

INSPIRE supports discoverability, interoperability, and sharing of spatial information across public-sector boundaries.

Standardisation bodies such as OGC and ISO provide important building blocks, but implementation in operational multi-provider EO environments remains uneven.

GEO and EuroGEO reinforce the need for coordinated, reusable, interoperable infrastructures rather than isolated systems.

**What is not working:**

- Harmonized interfaces are not consistently adopted across EO provider types.
- Interoperability is stronger for datasets than for end-to-end workflows.
- Multi-mission orchestration still often depends on custom integration.

**Root causes:**

- Technical heterogeneity across commercial, institutional, and legacy systems.
- Weak incentives for providers to align interfaces and operational protocols.
- Lack of policy-backed service-level interoperability profiles.

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**Affected stakeholders:** Platform integrators; Mission operators; Downstream service companies; Public authorities needing rapid cross-source products.

**Why it matters:** If interoperability stops at the metadata layer, Europe misses the full benefit of federated service delivery and keeps paying the “integration tax” every time a new actor joins.

**LEONSEGS relevance:** LEONSEGS is designed around harmonised interfaces, federation of heterogeneous resources, and transparent response to complex end-user requests, making it a live demonstration of why service-level interoperability matters.

**Linked recommendations:**

- R3. Develop Interoperability Profiles for Federated EO Services
- R7. Incentivise Adoption of Open and Harmonised Interfaces

**Policy Problem 3: Trust, quality, and accountability frameworks do not yet fit federated EO platforms**

**Policy problem:** Existing trust and stewardship approaches in EO-related data governance are better developed for repositories and datasets than for federated EO processing platforms that combine archives, external providers, tasking, and value-added analytics into operational services.

**Why this emerged from the landscape review:**

- CoreTrustSeal and similar frameworks focus on trustworthy repositories, licensing, stewardship, and access controls.
- Quality-monitoring approaches such as WIGOS point to the need for timeliness, reliability, and fitness-for-purpose.
- But there is still limited policy guidance on how trust should be demonstrated for federated EO service environments where multiple actors, assets, and algorithms interact.

**What is not working:**

- No commonly recognised trust label for federated EO service platforms.
- Unclear accountability when outputs rely on mixed archives, commercial data, automated processing, and multi-actor orchestration.
- Quality, provenance, and reproducibility expectations are not consistently translated into service-platform governance.

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**Root causes:**

- Data governance and platform governance have evolved separately.
- Certification models have not caught up with EO service federation.
- Procurement and policy communities often lack common criteria for trusted EO infrastructures.

**Affected stakeholders:** Public procurers; Emergency and environmental authorities; Private EO customers; Platform operators; Researchers using complex service chains.

**Why it matters:** Without trusted governance models, uptake into operational and public-service contexts remains slower, riskier, and more dependent on bilateral confidence than on shared policy frameworks.

**LEONSEGS relevance:** Because LEONSEGS combines multiple providers, archive access, automated orchestration, and advanced service generation, it illustrates the need for platform-level trust and quality frameworks beyond repository-only models.

**Linked recommendations:**

- R4. Promote Certification Schemes for Trustworthy EO Processing Platforms
- R9. Facilitate Cross-Border Access to EO Archives via Federated Platforms

**Policy Problem 4: Policy frameworks lag behind public–private tasking and advanced EO service chains**

**Policy problem:** As EO service delivery becomes more dynamic, federated infrastructures increasingly need to combine existing archives, new acquisitions, commercial assets, and downstream processing. Current policy frameworks do not provide enough clarity on how public and private actors should interact in these service chains, especially for complex tasking and operational use.

**Why this emerged from the landscape review:**

- Copernicus and related EU frameworks support data access and service provision, but mixed public–private orchestration remains only partially addressed.
- GEO and UN-SPIDER illustrate the importance of coordination and access in operational contexts, especially when timely data is needed for risk reduction and response.
- The Landsat/SELIP logic of continuity, interoperability, and partnership is relevant here: policy must anticipate hybrid ecosystems rather than only single-programme pipelines.

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**What is not working:**

- Limited clarity on using commercial tasking through federated European infrastructures.
- Archive access, acquisition planning, and service delivery are still often governed separately.
- Public buyers may face uncertainty around legal, procurement, and operational models.

**Root causes:**

- Institutional assumptions that public EO use will flow mainly from publicly organized programmes.
- Limited policy experimentation with hybrid service architectures.
- Unclear operational governance for mixed-source service chains.

**Affected stakeholders:** Commercial satellite operators; Public authorities; Civil protection and environmental bodies; EO service integrators; SMEs trying to enter public-value markets.

**Why it matters:** If Europe cannot operationalise hybrid public-private EO chains, then service responsiveness, market uptake, and strategic autonomy all suffer.

**LEONSEGS relevance:** LEONSEGS explicitly aims to federate operators that want to externalise ground-segment infrastructure and providers with their own assets, while enabling smart processing, archive use, and tasking according to end-user constraints.

**Linked recommendations:**

- R5. Enable Policy Frameworks for Public-Private EO Tasking
- R8. Align EO Infrastructure Policy with Disaster Risk Reduction Frameworks

**Policy Problem 5: Responsible-use and uptake frameworks are not keeping pace with advanced EO services**

**Policy problem:** Policy attention to EO ethics, data responsibility, and operational uptake has not fully kept pace with platforms that can combine heterogeneous EO data, task commercial assets, generate advanced products, and support decision-making at scale, especially when VHR data and automated processing are involved.

**Why this emerged from the landscape review:**Dissemination Level: **PUBLIC**

- Existing EO policy narratives strongly support public value, open access, and service uptake.
- Yet the move toward more seamless, automated, market-facing platforms raises questions about:
  - Proportionality,
  - Ethical use of high-resolution data,
  - Responsible deployment in public services,
  - And practical uptake pathways beyond pilots.
  - Industry and public-space sustainability discussions also reinforce the value of norms and self-regulation where formal regulation is still evolving.

#### What is not working:

- Ethical guidance for VHR-enabled service chains is scattered.
- Uptake into public services often remains ad hoc and pilot-based.
- There are limited “safe spaces” to test governance and responsibility models for new EO infrastructures.

#### Root causes:

- Governance is not evolving at the same speed as technological integration.
- Policy communities still treat technical demonstration and policy implementation as separate phases.
- Lack of structured experimentation instruments for EO governance.

**Affected stakeholders:** Public administrations; Regulators; EO service providers; Citizens and communities affected by EO-enabled decisions; Researchers and innovators.

**Why it matters:** Without a responsible-use and uptake framework, technically capable systems may face hesitation from public authorities, fragmented adoption, and reputational risks.

**LEONSEGS relevance:** LEONSEGS is exactly the kind of enabling platform that turns dispersed EO assets into seamless services. That creates an opportunity to shape responsible deployment rules early rather than after the market hardens.

#### Linked recommendations:

- R6. Support Ethical and Responsible Use of VHR Data in Federated Systems
- R10. Establish Pilot Policy Sandboxes for Federated EO Infrastructures

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## 7. ACTIONABLE POLICY RECOMMENDATIONS

### R1. Recognise Federated EO Ground Segments as a Policy Object

- **Policy problem 1:** *Fragmented governance for federated EO ground segments*
- **Why:** Existing policy frameworks recognize EO data, EO services, and spatial-data infrastructures, but they do not clearly identify the federated, multi-mission ground-segment layer required to coordinate heterogeneous space actors.
- **LEONSEGS Link:** LEONSEGS demonstrates this new infrastructure category in practical, live operations.

### R2. Extend Copernicus SRIA to Include Federated Infrastructure Models

- **Policy problem 1:** *Fragmented governance for federated EO ground segments*
- **Why:** Copernicus' long-term evolution increasingly depends on scalable data use, agile access methods, and wider commercial ecosystem integration. Shared ground infrastructure models must be integrated into this forward strategy.
- **LEONSEGS Link:** LEONSEGS serves as an operational example of how distributed Earth Observation capacities can be coordinated and integrated.

### R3. Develop Interoperability Profiles for Federated EO Services

- **Policy problem 2:** *Interoperability exists, but not yet at the level needed for service federation*
- **Why:** While INSPIRE and existing standards support basic data sharing, shared satellite services need clearer technical profiles for tasking, workflow exchange, archive access, and multi-provider product generation.
- **LEONSEGS Link:** Harmonized interfaces are central to the LEONSEGS multi-mission ground segment architecture.

### R4. Promote Certification Schemes for Trustworthy EO Processing Platforms

- **Policy problem 3:** *Trust, quality, and accountability frameworks do not yet fit federated EO platforms*
- **Why:** Traditional repository trust models are useful for data storage, but they are incomplete for federated platforms that deliver real-time operational processing services.
- **LEONSEGS Link:** LEONSEGS helps define what a reliable, secure, and "trustworthy federated EO infrastructure" means in practice.

### R5. Enable Policy Frameworks for Public–Private EO Tasking

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- **Policy problem 4:** *Policy frameworks lag behind public–private tasking and advanced EO service chains*
- **Why:** Europe needs clearer procurement and operational rules to safely use commercial satellite assets through federated infrastructures in public–service contexts.
- **LEONSEGS Link:** The project explicitly supports both commercial New Space startups and established operators under a shared service logic.

## R6. Support Ethical and Responsible Use of VHR Data in Federated Systems

- **Policy problem 5:** *Responsible–use and uptake frameworks are not keeping pace with advanced EO services*
- **Why:** As high–resolution imagery and advanced satellite services become part of daily public operations, explicit and practical ethical guardrails must be defined.
- **LEONSEGS Link:** The project's policy research isolates ethical VHR usage as a key priority, making it a central focus for our platform model.

## R7. Incentivise Adoption of Open and Harmonised Interfaces

- **Policy problem 2:** *Interoperability exists, but not yet at the level needed for service federation*
- **Why:** Technical sharing across platforms will remain patchy unless it is backed by clear incentives in research funding, public procurement, and program alignment.
- **LEONSEGS Link:** The project is built entirely on standard, harmonized interfaces as a core condition for system federation.

## R8. Align EO Infrastructure Policy with Disaster Risk Reduction Frameworks

- **Policy problem 4:** *Policy frameworks lag behind public–private tasking and advanced EO service chains*
- **Why:** Global coordination frameworks (such as GEO and UN–SPIDER) show that the value of satellite data depends on quick access, coordination, and readiness across different actors.
- **LEONSEGS Link:** Shared networks can provide faster, multi–satellite data delivery during environmental crises and resilience operations.

## R9. Facilitate Cross–Border Access to EO Archives via Federated Platforms

- **Policy problem 3:** *Trust, quality, and accountability frameworks do not yet fit federated EO platforms*

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- **Why:** Sharing and reusing data across borders is a key European policy goal, but accessing distributed archives through current platforms remains too fragmented.
- **LEONSEGS Link:** Integrating distributed archives without centralizing all files is a core part of the project’s design.

### R10. Establish Pilot Policy Sandboxes for Federated EO Infrastructures

- **Policy problem 5:** *Responsible-use and uptake frameworks are not keeping pace with advanced EO services*
- **Why:** Europe needs safe, controlled test environments to evaluate governance, security, purchasing, and responsible-use rules before locked-in laws are written.
- **LEONSEGS Link:** LEONSEGS already functions as a real-world testbed, making it a perfect model to help design these policy sandboxes.

Policy problem	Mapped Policy Recommendations
<b>Problem card 1:</b> <i>Fragmented governance for federated EO ground segments</i>	<b>R1:</b> Recognise Federated EO Ground Segments as a Policy Object  <b>R2:</b> Extend Copernicus SRIA to Include Federated Infrastructure Models
<b>Problem card 2:</b> <i>Interoperability exists, but not yet at the level needed for service federation</i>	<b>R3:</b> Develop Interoperability Profiles for Federated EO Services  <b>R7:</b> Incentivise Adoption of Open and Harmonised Interfaces
<b>Problem card 3:</b> <i>Trust, quality, and accountability frameworks do not yet fit federated EO platforms</i>	<b>R4:</b> Promote Certification Schemes for Trustworthy EO Processing Platforms

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	<b>R9:</b> Facilitate Cross-Border Access to EO Archives via Federated Platforms
<b>Problem card 4:</b> <i>Policy frameworks lag behind public-private tasking and advanced EO service chains</i>	<b>R5:</b> Enable Policy Frameworks for Public-Private EO Tasking  <b>R8:</b> Align EO Infrastructure Policy with Disaster Risk Reduction Frameworks
<b>Problem card 5:</b> <i>Responsible-use and uptake frameworks are not keeping pace with advanced EO services</i>	<b>R6:</b> Support Ethical and Responsible Use of VHR Data in Federated Systems  <b>R10:</b> Establish Pilot Policy Sandboxes for Federated EO Infrastructures

Table 1 Overview of policy problems linked with recommendations

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## 8. STRATEGIC ROADMAPS AND IMPLEMENTATION TIMELINE

Based on the inputs collected through a survey, conducted among internal consortium members and opened for external participants, the following trends and conclusions have been identified to map the 10 policy recommendations according to their impact and feasibility. Each recommendation was scored on a scale from 1 (lowest) to 5 (highest). These scores map each recommendation within an Impact/Feasibility matrix, where Impact measures the potential to resolve policy bottlenecks and Feasibility evaluates the practical ease and implementation readiness. This analysis prioritizes actions by differentiating between high-impact "quick wins" and long-term strategic policy goals.

Feasibility	Impact	Recommendation
2	3.5	R10. Establish Pilot Policy Sandboxes for Federated EO Infrastructures
2.25	3.75	R2. Extend Copernicus SRIA to Include Federated Infrastructure Models
2.5	4.25	R4. Promote Certification Schemes for Trustworthy EO Processing Platforms
3	4.25	R5. Enable Policy Frameworks for Public–Private EO Tasking
3	4	R6. Support Ethical and Responsible Use of VHR Data in Federated Systems
3.25	5	R1. Recognise Federated EO Ground Segments as a Policy Object
3.25	4.25	R3. Develop Interoperability Profiles for Federated EO Services
3.25	4	R8. Align EO Infrastructure Policy with Disaster Risk Reduction Frameworks
3.25	4	R9. Facilitate Cross–Border Access to EO Archives via Federated Platforms
3.5	4.75	R7. Incentivize Adoption of Open and Harmonized Interfaces

Table 2 Impact/Feasibility scoring of 10 recommendations

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Policy Recommendations: Impact vs Feasibility Matrix

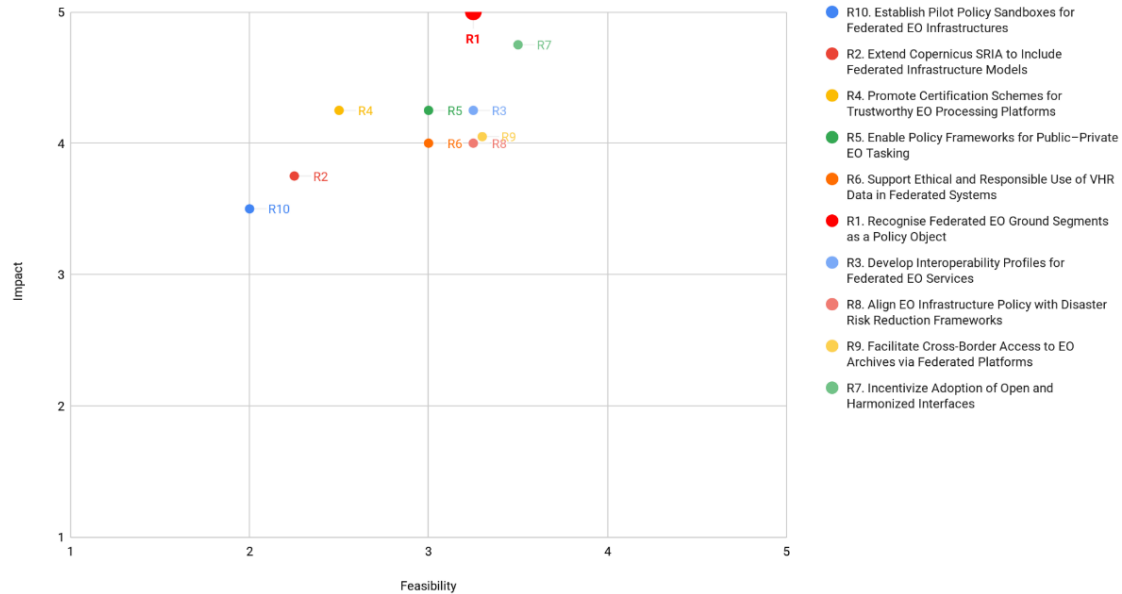


Figure 2 Impact/Feasibility matrix

**Foundational Priority (High Impact):**

- Recommendation R1 (Recognise Federated EO Ground Segments as a Policy Object) emerged as the most impactful action (Score: 5.0). While its feasibility is moderate (3.25), it is considered a critical baseline for coordinating heterogeneous space actors.
- Recommendation R7 (Incentivize Adoption of Open and Harmonized Interfaces) is a strategic "quick win," boasting a high impact (4.75) and the highest feasibility score (3.50) in the dataset, making it a primary candidate for immediate implementation.

**Operational and Technical Alignment:**

- A cluster of recommendations including R3 (Interoperability Profiles), R5 (Public–Private Tasking), R8 (Disaster Risk Reduction), and R9 (Cross–Border Access) all show balanced scores (Impact: 4.0–4.25; Feasibility: 3.0–3.25). These are viewed as highly actionable policies that provide consistent value across the federated Earth Observation (EO) ecosystem.
- Recommendation R4 (Certification Schemes) is noted for its high impact (4.25) but lower feasibility (2.50), reflecting the technical and administrative complexity of establishing trust models for real-time processing platforms.

**Long–Term Strategic Challenges:**

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- Recommendation R10 (Pilot Policy Sandboxes) and R2 (Copernicus SRIA Extension) were rated with the lowest feasibility (2.0 and 2.25, respectively). Despite their importance, we anticipate significant regulatory or structural barriers to their adoption.

The findings highlight a strong consensus on the need to formalize federated ground segments within European policy. These findings suggest that while technical interoperability (R3, R7) is feasible and impactful, the overarching policy success will depend on addressing the governance and legal recognition (R1) of federated infrastructures.

Furthermore, an additional crucial input was made highlighting a critical gap in the current framework. Specifically, it was noted that a **key missing aspect is the definition of a common governance framework for federated EO infrastructures, covering service orchestration, data ownership, access rights, liability, and collaboration mechanisms** among stakeholders. Additionally, **cybersecurity and operational resilience** requirements should be further addressed to ensure trusted and scalable cross-border EO services.

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## 9. CONCLUSIONS

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Europe has successfully made satellite data easier to access, but we now face a major ground infrastructure gap. Moving forward with climate tracking, environmental monitoring, and emergency response requires us to step beyond simple file-sharing. To bridge this gap, Europe must establish a common governance framework for federated EO infrastructures, ensuring clear rules for service orchestration, data ownership, access rights, liability, and stakeholder collaboration. Furthermore, addressing cybersecurity and operational resilience is essential to guarantee the delivery of trusted, scalable cross-border EO services.

By officially recognizing shared ground networks, defining standard public-private tasking rules, creating clear platform trust labels, and launching policy sandboxes, European decision-makers can protect our space independence and help our commercial market grow. LEONSEGS provides the technology; implementing these matching policy recommendations is the next crucial step.

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