FiERCE
MAKING SPACE FOR GREEN SOLUTIONS

D1.1 State-of-play, success factors and requirements for space-enabled green entrepreneurship

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Executive Summary

FIERCE is a 36-month Coordination and Support Action funded by the European Health and Digital Executive Agency (HaDEA) under the Horizon Europe Programme for Research and Innovation (2021-2027). With a mission to accelerate Europe's green and digital transition, FIERCE will mobilize 2.5 million EUR in financial support for 70 SMEs, start-ups and scale-ups to fuel the development, demonstration and commercialization of green space-enabled solutions. On top of that, FIERCE will support 140 SMEs with specialised technical and business advisory to design business solutions and engage in process innovation using downstream space data in areas such as circularity, raw materials, environmental monitoring and corporate sustainability. In parallel, FIERCE will enable a series of local entrepreneurship initiatives driven by innovation intermediaries and business support networks aimed at creating even more opportunities for space-enabled green innovation through synergies with regional industrial, research and market actors.

This deliverable, *"State-of-play, success factors and requirements for space-enabled green entrepreneurship"*, provides an in-depth assessment of how downstream space data and technologies—such as Earth Observation (EO), GNSS, and satellite communications—can support small and medium-sized enterprises (SMEs) in advancing green business models and contributing to Europe's sustainability objectives. The analysis aims to identify both the current landscape and the specific needs of SMEs in adopting these technologies to foster innovation, improve resource efficiency, and align with key European policies such as the Green Deal and the Corporate Sustainability Reporting Directive (CSRD).

The study follows a mixed-methods approach, combining structured desk research, an online survey of over 500 SMEs across Europe, and qualitative insights from SME case studies. This methodology ensured a comprehensive understanding of technological trends, sector-specific applications, policy frameworks, and real-world challenges faced by SMEs. The research examined three priority domains: Circular Economy, Raw Materials, and Environmental Monitoring & Corporate Sustainability, providing a cross-sectoral and cross-country perspective on the role of space-enabled services.

Key findings indicate that while the potential of downstream space data is widely acknowledged, particularly in sectors like agriculture, renewable energy, and environmental risk monitoring—actual adoption remains limited, especially among SMEs outside the traditional space ecosystem. Only 7% of surveyed SMEs currently use space-based solutions, despite over 60% expressing interest. Major barriers include low awareness, limited technical capacity, lack of sector-specific services, and insufficient connections between SMEs and technology providers. Regional disparities were also observed, with higher adoption rates in Western and Northern Europe compared to Southern and Eastern regions.

The 27 selected successful case studies highlighted that SMEs effectively leveraging space data tend to combine these technologies with complementary innovations such as AI, Internet of Things (IoT), or blockchain, underscoring the importance of interdisciplinary approaches and tailored support.

Based on these insights, this deliverable formulates key recommendations for the design of FIERCE services, including but not limited to:

- Development of targeted capacity-building and onboarding programs for SMEs.
- Advisory and matchmaking services linking SMEs with space data providers and experts.

- Simplified access to data and ready-to-use digital tools through the FIERCE Toolbox.
- Demonstration projects and pilots showcasing tangible benefits across sectors and regions.
- Community building and knowledge exchange to foster cross-sector collaboration and innovation.

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List of Terms and Definitions

Table 1. Terms and Definitions

Term	Definition
EO (Earth Observation)	The collection of data about the Earth's physical, chemical, and biological systems via satellite or airborne sensors, used for environmental monitoring, agriculture, urban planning, and more.
GNSS (Global Navigation Satellite System)	A satellite system that provides geolocation and time information to a GNSS receiver anywhere on Earth. Includes systems like Galileo (EU), GPS (US), GLONASS (Russia), and BeiDou (China).
EGNOS (European Geostationary Navigation Overlay Service)	A regional satellite-based augmentation system (SBAS) that improves the accuracy and reliability of GNSS signals over Europe.
SME (Small and Medium-sized Enterprise)	Businesses with fewer than 250 employees and an annual turnover not exceeding €50 million, often targeted for innovation and sustainability support within EU programs.
CSRD (Corporate Sustainability Reporting Directive)	An EU regulation requiring large companies and listed SMEs to disclose environmental, social, and governance (ESG) impacts in their annual reporting.
InSAR (Interferometric Synthetic Aperture Radar)	A radar technique using satellite data to detect ground deformation, widely used in mining, infrastructure monitoring, and natural hazard assessment.
Circular Economy (CE)	An economic system aimed at eliminating waste and the continual use of resources through reuse, repair, recycling, and sustainable design.
EUSPA (EU Agency for the Space Programme)	The EU agency managing Galileo, EGNOS, and Copernicus data and services, supporting downstream market uptake and green applications.

Copernicus	The EU's Earth Observation programme, providing open access to satellite data through its Sentinel missions, supporting applications in climate, environment, agriculture, and disaster response.
Downstream Space Data	Space-derived data and services applied on Earth for practical purposes, including EO imagery, GNSS positioning, and satellite communications.
ESA (European Space Agency)	An intergovernmental organization coordinating space activities in Europe, including EO missions and downstream data innovation.
CASSINI	An EU initiative providing support (e.g. hackathons, accelerators, funding) to startups and SMEs in the space sector to promote innovation and green transformation.

1. Introduction

1.1 Background and scope of the Deliverable

This deliverable, D1.1 "State-of-play, success factors and requirements for space-enabled green entrepreneurship," provides a comprehensive analysis of how downstream space data and services contribute to fostering green entrepreneurship and sustainable business models.

The primary objective of this deliverable is to examine and present the current landscape, the challenges, and opportunities associated with the use of downstream space data and services. The Deliverable specifically examines the use of Earth Observation (EO) data, as well as satellite-enabled applications and solutions for promoting sustainability, environmental monitoring, resource efficiency, and circular economy principles among small and medium-sized enterprises (SMEs).

The key objectives of this deliverable are:

- identifying the latest advancement and technologies in the use of space data and services for green transformation across various industrial sectors[1], like agriculture, renewable energy, tourism, construction and others.
- examining European space policies and strategies, including those from ESA and EUSPA, which support the EU Green Deal
- presenting acceleration and entrepreneurship initiatives which aim to boost the technical and business capacity of SMEs with the space sector.
- analyzing awareness, capacity and perceived barriers of SMEs in utilising space-based data and services for green entrepreneurship.
- showcasing successful case studies of SMEs leveraging space data and technologies in their operation and services.
- identifying the challenges and obstacles faced by SMEs in adopting space-based solutions for sustainability.

The insights gathered from the FIERCE project will inform strategic actions, policy recommendations, and support mechanisms, helping SMEs integrate space technologies into their business models and enhance their role in the green transition. The findings of the deliverable will serve as a foundation for the project's key actions, including the development of the Advisory Services, the Digital Toolbox, the Transformation Projects, and Networking Activities, ensuring SMEs have the necessary tools, knowledge, and support to integrate space technologies into their business models and contribute to the green transition.

[1] European Union. Classification of the industrial ecosystems. Retrieved from https://single-market-economy.ec.europa.eu/industry/strategy_en

1.2 Structure of the deliverable

This deliverable is structured into eight chapters, following a research approach that combines *desk analysis, case studies, and survey-based evidence* to provide an overview of the state-of-play, success factors, and requirements for space-enabled green entrepreneurship. The structure is designed to reflect the development of FIERCE support actions and services.

Chapters 1 and 2 introduce the background, objectives, and methodological framework applied under Task 1.1. Chapter 3 provides an in-depth analysis of downstream space data and technologies, outlining the types of space-enabled solutions that can support key green sectors such as the circular economy, raw materials, and environmental monitoring. This chapter highlights how EO, GNSS, and satellite communications can be leveraged across different use cases to foster innovation and sustainability.

Chapter 4 explores the European policy landscape, focusing on the strategic role of ESA and EUSPA in advancing the Green Deal objectives and enabling SMEs to access and benefit from space-based services. This includes an overview of funding instruments, acceleration initiatives, and support mechanisms relevant to the downstream space ecosystem.

Chapter 5 presents a series of SME case studies identified by the FIERCE consortium, showcasing examples of successful integration of space data into green solutions. The chapter highlights key success factors, barriers encountered, and lessons learned from these experiences.

Chapter 6 builds on the insights from a broad online survey conducted with over 500 SMEs across Europe. The survey assesses SME awareness, adoption levels, and perceived barriers related to the use of downstream space data and technologies, providing quantitative insights that complement the case study findings.

Finally, chapter 7 synthesizes the evidence gathered across the previous chapters, cross-referencing findings by sector, technology, and geographical region. This analysis offers a consolidated view of the current landscape and identifies actionable insights and priority areas for FIERCE services.

2. Methodological approach

2.1 Selection of the desk research type

The desk research performed in this deliverable is a combination of literature review, policy mapping, and market analysis. It draws upon academic research articles, policy documents from European institutions (with particular references to ESA, EUSPA, and the European Commission), market reports, industry publications, and recent relevant Horizon Europe project outcomes and EU Green Deal-related strategies and sector-specific studies.

The review focuses on identifying the current landscape of downstream space technologies, existing business models, emerging use cases in green entrepreneurship, and key enablers and barriers for SMEs. Special attention was given to the integration of space data with sustainability-oriented solutions across sectors like circular economy, raw materials, renewable energy, and environmental monitoring, aiming to understand the field where FIERCE plans to provide its services.

The desk research was conducted by DREVEN, EIT-RM and NOVASPACE.

2.2 Case study analysis

The case study analysis focuses on SMEs across Europe that actively leverage downstream space data and services in their operations, product development, or service delivery. The selection process was guided by the following criteria:

-Relevance of the SME's activities to the green transition.

-Demonstrated use of Earth Observation, GNSS, or other downstream space technologies.

-Geographic and sectoral diversity to ensure a representative sample across the EU.

The identification of SMEs for the case studies was carried out through the active involvement of all project partners including their respective networks, stakeholder communities, and direct outreach. This inclusive approach ensured both diversity and relevance in the selection of SMEs, reflecting the realities of space-enabled innovation across different sectors and regions and also provided the project with an opportunity to further connect with its target industries and stakeholders and use the network of case studies generated as a multiplier in the FIERCE future activities.

Semi-structured interviews were conducted with the selected SMEs, following a commonly developed interview guide (DREVEN) agreed upon by all partners. The interviews were performed jointly by the consortium members, with each partner engaging the SMEs within their national and regional ecosystems. Prior to each interview, informed consent was obtained from the participating SMEs, ensuring compliance with ethical standards and data protection regulations (GDPR). All interviews were documented with full respect to the preferences of the interviewees.

2.3 Online Survey design

To complement the qualitative insights from desk research and case studies, an online survey was designed and deployed to a broad pool of SMEs across Europe. The survey aimed to collect quantitative data on:

- awareness and understanding of downstream space data and services.
- current adoption rates and use cases of space-enabled solutions.
- perceived barriers to adoption (technical, financial, knowledge-related).
- interest in advisory services, capacity building, and potential areas of support through the FIERCE project.

The survey was designed and implemented by Q-PLAN, with an agreed upon methodology collaboratively by the project partners, ensuring that questions reflected the specific objectives of the deliverable and aligned with the broader goals of the FIERCE project. The questionnaire combined closed-ended questions for quantitative analysis, Likert-scale assessments to measure perceptions and readiness levels, and optional open-ended fields to allow respondents to elaborate on challenges, needs, or expectations.

The data collection was conducted through **Prolific**, an established online research platform known for providing access to high-quality, pre-screened participant pools. This choice ensured a structured and reliable sampling approach, enabling the targeting of SME respondents that matched the profile relevant to the study. The use of Prolific allowed for effective control over sample demographics and sectoral representation, while facilitating broad geographic coverage across the EU.

More than 500 SMEs participated in the survey, providing valuable insights that enrich the overall analysis and help shape the design of the project's upcoming support mechanisms.

3. Downstream space data and technologies in green entrepreneurship

3.1 Overview of Downstream space technologies

3.1.1 Downstream space ecosystem and economy

Downstream space refers to the sector that leverages space-derived systems, data, and information to create applications, products, and services for use on Earth. From navigation and Earth observation to emissions monitoring and satellite communications, it underpins many important aspects of modern life. Downstream space technologies, as the fastest-growing segment of the space industry, play a pivotal role in driving global innovation and economic growth, offering abundant opportunities for individuals, businesses and agencies. This sector transforms raw space-derived data into practical solutions and applications, supporting various industries such as agriculture, urban planning, disaster management, logistics, and other.

The downstream sector contributes significantly to the global space economy, with commercial space products and services. Over the last 10 years, Europe's space workforce has rapidly grown by 66% and United States' by 18%[2], highlighting the importance of the space sector. Key applications include navigation services, satellite communications, and Earth observation, which support industries such as precision agriculture, environmental monitoring, and disaster management.

The downstream space sector consists of diverse industries, including telecommunications, Earth observation, and navigation, each catering to different markets with unique solutions. Public demand is crucial for growth, often supported through government contracts and programs that encourage innovation and market expansion. This sector benefits from synergies with other industries, like digital technologies, but faces challenges such as fragmented markets and global competition. These challenges call for a strategic focus on integrating space-derived capabilities with broader digital systems and fostering collaboration across various industries (Moranta, 2022)[3].

Thus, Satellite-based services are increasingly transforming various industrial sectors, leveraging the capabilities of Earth Observation (EO), satellite navigation, and satellite communications technologies. **EO data-driven services** are widely adopted in sectors such as agriculture, forestry, energy, infrastructure, and environmental management. These services enable advanced applications like weather forecasting, solar irradiance prediction, vegetation and pollution monitoring,

[2] Space Foundation. (2024, October 22). The Space Report 2024 Q3. Retrieved from: https://www.spacefoundation.org/2024/10/22/the-space-report-2024-q3/

[3] Moranta, J. (2022, March). The Space Downstream Sector in Europe: Market Trends and Challenges. French Institute of International Relations (IFRI). Retrieved from: https://www.ifri.org/sites/default/files/migrated_files/documents/atoms/files/moranta_space_downstream_sector_2022_3.pdf

damage assessments after natural disasters, and construction evaluations, offering valuable insights and operational efficiency. **Satellite navigation technologies** have become indispensable in transportation, logistics, and health services, where precise geolocation and real-time positioning optimize workflows and enhance safety (Paravano et al.,2024)[4]. Meanwhile, **satellite communications** are critical in education and communication sectors, providing reliable internet access to remote regions where terrestrial infrastructure is lacking, bridging connectivity gaps and supporting global information exchange. An overview in Figure 1 by Paravano et al., 2024 illustrates the distribution of space-based services across the different industrial sectors, highlighting significant use in Agriculture and transport.

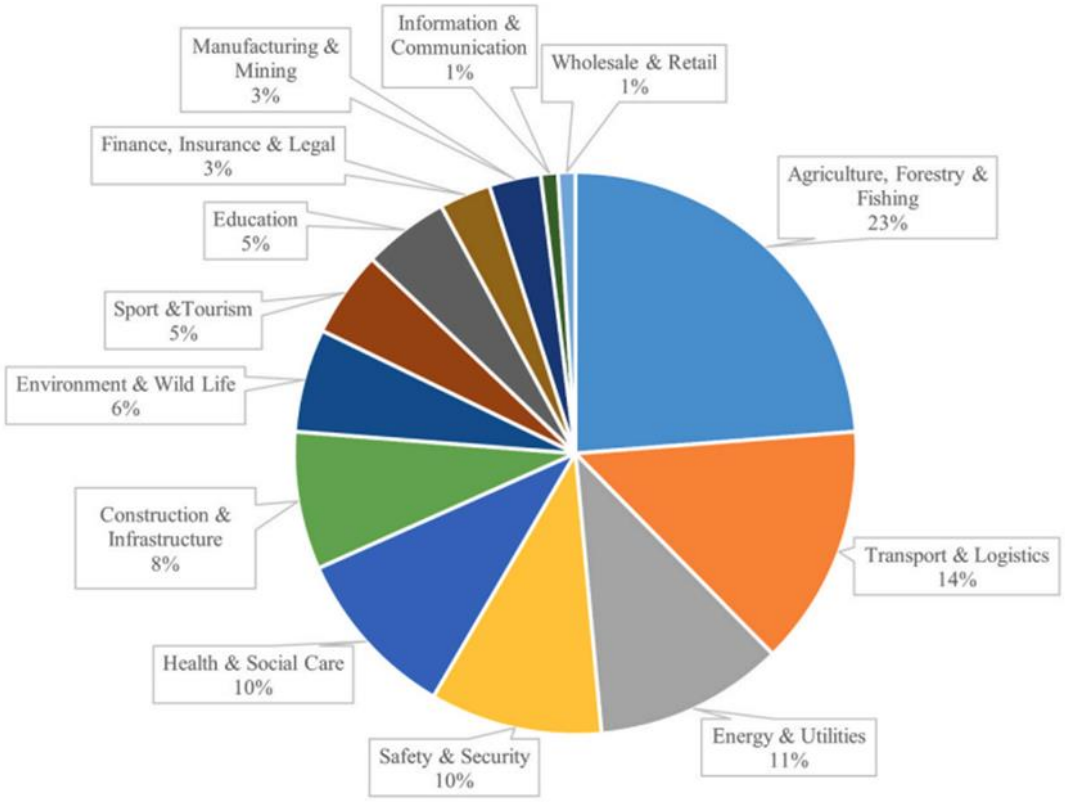

Figure 1: Use of Downstream space services in industrial sectors (Source: Paravano et al., 2024)

Global satellite systems provide a diverse range of data products and services, enabling precise monitoring of Earth's environment and resources (Table 2). These include **multispectral and hyperspectral imagery**, which support land cover classification, vegetation analysis, and mineral exploration; **thermal infrared data**, used for detecting heat emissions, wildfire monitoring, and urban heat island assessments; and **synthetic aperture radar (SAR) imagery**, which can penetrate cloud cover to track land deformation, deforestation, and ice dynamics. **LiDAR (Light Detection and**

[4] Paravano, A., Patrizi, M., Razzano, E., Locatelli, G., Feliciani, F., & Trucco, P. (2024). The impact of the new space economy on sustainability: An overview. Acta Astronautica, 222, 162-173. https://doi.org/10.1016/j.actaastro.2024.05.046

Ranging) is another key satellite-based data product which uses laser pulses to generate high-resolution 3D elevation models, essential for terrain mapping, forestry analysis, and flood risk assessment. Additionally, **real-time weather and atmospheric data** collected by satellites play a crucial role in climate modelling, air quality assessments, and disaster forecasting.

Table 2: Satellite systems, data and their applications

Satellite Product	Description	Example Applications
Multispectral & Hyperspectral Imagery	Optical imaging at multiple wavelengths for detailed surface analysis.	Land use mapping, vegetation monitoring, mineral exploration.
Thermal Infrared Data	Measures heat emissions from Earth's surface.	Wildfire detection, urban heat mapping, water temperature monitoring.
Synthetic Aperture Radar (SAR)	Radar imaging that penetrates clouds and operates day & night.	Land deformation, flood monitoring, deforestation tracking.
LiDAR	Laser-based remote sensing for high-resolution 3D mapping.	Forest structure analysis, urban planning, flood risk modeling.
Altimetry Data	Uses radar to measure sea level, ice thickness, and wave heights.	Climate change monitoring, ocean circulation studies.
Atmospheric Composition Data	Monitors gases like CO_2, CH_4, and ozone in the atmosphere.	Air pollution tracking, greenhouse gas monitoring.

Several international space programs operate Earth observation satellites that deliver these critical datasets. NASA's **Landsat** program[5] which operates from 1970s, provides continuous multispectral and thermal imagery for environmental and land-use analysis. NOAA's **GOES** (Geostationary Operational Environmental Satellites)[6] supply real-time meteorological data for weather forecasting and disaster monitoring. ESA's **Sentinel**[7] satellites, part of the Copernicus program, offer high-resolution optical, radar, and atmospheric data for monitoring land, oceans, and climate change. Additionally, commercial satellite constellations, such as Planet, Maxar, and ICEYE, provide high-frequency, high-resolution optical and SAR imagery, enabling near real-time monitoring of environmental and human activities.

[5] Landsat program and missions. Retrieved on 18/02/2025 from: https://landsat.gsfc.nasa.gov/
[6] National Environmental Satellite, Data, and Information Service. Retrieved on 18/02/2025 from: https://www.nesdis.noaa.gov/
[7] ESA: The Sentinel Missions. Retrieved on 18/02/2025 from: https://www.esa.int/Applications/Observing_the_Earth/Copernicus/The_Sentinel_missions

It is evident that Earth Observation satellite data have become critical for monitoring environmental changes and supporting sustainable development. The growing importance of EO data in land cover analysis, climate change studies, and resource management is evident and expanding rapidly. Satellites like Landsat, MODIS, and Sentinel lead in application breadth and scientific impact, with Sentinel projected to dominate future trends due to its rapid growth in influence (Zhao et al, 2022)[8].

3.1.2 ESA and the Copernicus programme

The European Union Agency for the Space Programme (EUSPA) is responsible for the implementation of the European space programme and provide open space data and services for governments, citizens and businesses through three major components Copernicus, GNSS-EGNOS and GovaSatCom.

The European Space Agency (ESA) has developed the **Downstream Gateway**, an initiative which aims to facilitate the transformation of space-derived data into practical applications, products, and services. This platform provides a single interface for businesses and stakeholders to access ESA's expertise, fostering the integration of space technologies and data into various sectors, including transport, education, urban planning and others.

The activities of the Downstream Gateway include:

- Supporting over €200 million worth of innovative services across 500 businesses.
- Strengthening the connection between ESA programmes and new business sectors to enable wider adoption of space data.
- Encouraging development in areas like smart cities through initiatives such as the "Space for Urban Innovation: Smart Cities" Call for Ideas.

This effort underscores the critical role of downstream space technologies in modern economies, emphasizing their application in creating sustainable, data-driven, and resilient solutions for societal and economic benefits.

Copernicus is the European Union's Earth Observation (EO) program (EU Copernicus programme)[9], offering satellite data and information freely and openly to users. The Sentinel satellite series includes various missions delivering global coverage of radar, multispectral imaging, atmospheric chemistry, and altimetry data.

It is the flagship initiative of the European Union, providing an extensive suite of downstream space data and services, enabling informed decision-making across a wide range of sectors. Copernicus integrates data from satellite observations and in-situ measurements.

The **Copernicus Programme** offers six thematic services, each providing valuable Earth observation data and information:

[8] Zhao, Q., Yu, L., Du, Z., Peng, D., Hao, P., Zhang, Y., & Gong, P. (2022). An Overview of the Applications of Earth Observation Satellite Data: Impacts and Future Trends. *Remote Sensing*, *14*(8), 1863. https://doi.org/10.3390/rs14081863

[9] European Union. (2025). Copernicus programme 2025. Retrieved from: https://www.copernicus.eu/en/copernicus-services

1. **Atmosphere Monitoring Service (CAMS)**: Delivers continuous data on atmospheric composition, supporting air quality monitoring and forecasting.
2. **Marine Environment Monitoring Service (CMEMS)**: Provides information on the state of oceans and marine ecosystems, aiding in marine resource management and maritime safety.
3. **Land Monitoring Service (CLMS)**: Offers data on land use and land cover, supporting urban planning, agriculture, and forestry management.
4. **Climate Change Service (C3S)**: Supplies climate data and projections, assisting in climate change adaptation and mitigation strategies.
5. **Emergency Management Service (CEMS)**: Provides geospatial information for disaster management, aiding in preparedness, response, and recovery activities.
6. **Security Service**: Supports EU policies by providing information in response to security challenges, including border surveillance and maritime monitoring.

This comprehensive approach ensures timely, reliable, and accurate information for addressing environmental challenges and supporting sustainable development. For instance, **Copernicus Land Monitoring services** enable precision agriculture by providing detailed insights into crop health, soil conditions, and water management, fostering resource-efficient farming practices.

Similarly, its **Marine Environment Monitoring Service** supports ocean conservation, offering critical data on sea surface temperatures, currents, and pollution levels, thereby aiding in sustainable fisheries management and maritime safety. The programme's **Emergency Management Service** is targeting disaster response and recovery, providing real-time maps for assessing the impact of floods, earthquakes, and wildfires.

Moreover, Copernicus underpins the EU's climate action initiatives, with its **Climate Change Service (C3S)** delivering robust datasets on temperature trends, greenhouse gas concentrations, and climate projections, helping policy-makers design effective mitigation strategies. These services have been pivotal for both public and private sectors, from urban planning and natural resource management to insurance and logistics. Copernicus freely provides its data and products, and empowers governments, researchers, as well as SMEs ensuring broad accessibility and fostering innovation.

3.1.3 GNSS and EGNOS

A **Global Navigation Satellite System (GNSS)**[10] refers to a network of satellites that broadcast signals to Earth, enabling GNSS receivers to calculate precise location and timing information. The European GNSS (E-GNSS) framework combines the satellite data provided by the **Galileo constellation** with additional augmentation services offered by **EGNOS**. The **European Geostationary Navigation Overlay Service (EGNOS)** serves as Europe's regional satellite-based augmentation system (SBAS). It enhances the accuracy and dependability of GPS signals within Europe by addressing ionospheric distortions and providing real-time integrity information. This capability is particularly important for applications requiring high precision, such as aviation, where it supports safety-critical tasks like precision landings.

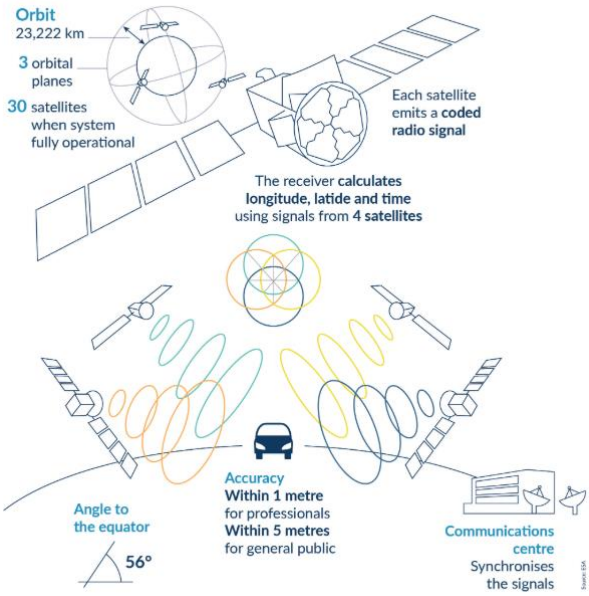

Figure 2: The Galileo navigation system (Source: https://egnos.gsc-europa.eu/european-gnss/what-gnss)

GNSS and EGNOS play pivotal roles in reducing environmental footprints across industries. By optimizing routes and operations, they help lower fuel consumption and CO_2 emissions in road, rail, maritime, and aviation sectors. For instance, EGNOS enables aircraft to take more direct routes and perform fuel-efficient landings. It also reduces fuel consumption and emissions through Performance-Based Navigation (PBN), which optimizes flight paths (ESA, 2022) [11]. Moreover, in renewable energy development, these systems identify optimal sites for wind turbines and solar farms based on geospatial data (EUSPA, 2023) [12] Aligned with the European Green Deal, GNSS and EGNOS support sustainable transformation in key sectors such as mobility, energy, and agriculture. They enable smart mobility solutions, including autonomous vehicle navigation, urban traffic management, and route optimization. In agriculture, GNSS facilitates precision farming, which reduces resource use and environmental impact while increasing yields (EUSPA, 2023).

Galileo currently provides three core services (EUSPA, 2023)[12]:

[10] European Global Navigation systems. Retrieved 12 Jaunary 2025 from: https://egnos.gsc-europa.eu/european-gnss/what-gnss

[11] European Space Agency (n.d.) Galileo and EGNOS Retrieved 12 January 2025 from https://www.esa.int/Applications/Satellite_navigation/Galileo_and_EGNOS

[12] European Union Agency for the Space Programme (EUSPA) 2023. EU Space for Green Transformation: A New Tool for Companies to Monitor Their Sustainability Targets. Retrieved from https://www.euspa.europa.eu/sites/default/files/eu_space_for_green_transformation_a_new_tool_for_companies_to_monitor_their_sustainability_targets_2023_issue_1.pdf

- the Open Service (**OS**), a free service for mass-market applications offering positioning, navigation, and timing;
- the Search and Rescue (**SAR**) service, which is Europe's contribution to the global COSPAS-SARSAT distress beacon locating system and has been operational since 2016;
- the Public Regulated Service **(PRS**), an encrypted, highly robust service reserved for authorized security and governmental users within EU Member States.

Additionally, Galileo is preparing to introduce other significant services, including the Galileo Open Service Navigation Message Authentication (**OSNMA**), a free service with authentication capabilities, and the High Accuracy Service (**HAS**), which will provide enhanced signals, encryption, and advanced features for commercial users.

Multi-GNSS technologies, encompassing systems like GPS, Galileo, BeiDou, and GLONASS, are transforming downstream space applications by enabling precise positioning, geohazard monitoring, and environmental sensing. Innovations with GNSS can facilitate the measurement of soil moisture, snow thickness, and sea levels, while integrated techniques enhance structural health monitoring and disaster management. Continuous advancements in performance and hybridization of GNSS systems underscore their critical role in supporting diverse Earth observation and infrastructure applications (Jin et al, 2022)[13].

3.1.4 GOVSATCOM

The **Governmental Satellite Communications (GOVSATCOM)**[14] program aims to provide secure, reliable, and cost-effective satellite communication services to governmental institutions and citizens. It addresses the need for robust communication infrastructure in critical domains such as defense, civil protection, border management, and disaster response. By pooling and sharing existing capabilities across EU Member States, GOVSATCOM ensures efficient use of resources while enhancing European autonomy in strategic communications.

[13] Jin, S., Wang, Q., & Dardanelli, G. (2022). A Review on Multi-GNSS for Earth Observation and Emerging Applications. *Remote Sensing*, *14*(16), 3930. https://doi.org/10.3390/rs14163930

[14] European Union Agency for the Space Programme (EUSPA). GOVSATCOM (n.d.) Retrieved 8 December 2024 from: https://www.euspa.europa.eu/eu-space-programme/secure-satcom/govsatcom

The European Union Agency for the Space Programme (EUSPA) has been tasked with preparatory activities, including the development, coordination, and management of a network of prospective EU GOVSATCOM users. This effort aims to establish a robust user base to inform the GOVSATCOM mission. Under the ENTRUSTED Horizon Europe project led by EUSPA, the consortium assessed and build a comprehensive roadmap for the advancement of innovative GOVSATCOM user technologies.

Figure 3: GOVSATCOM system capacities and services. (Source: https://defence-industry-space.ec.europa.eu/works.pdf)

The services of the program will take place through the **GOVSATCOM Hubs which** connect users with providers, enhancing available resources and securing access, even in unpredictable situations[15]. The **GOVSATCOM Hubs** are components of the Governmental Satellite Communications (GOVSATCOM) program, acting as secure nodes that link authorized governmental users with satellite communication service providers. The hubs manage and allocate communication resources, ensuring services such as emergency response, civil protection, and military operations. The hubs integrate capacities from both governmental and commercial satellite providers, offering a flexible system that adapts to dynamic user needs. They also support interoperability, creating a unified network that leverages diverse satellite communication resources. As the GOVSATCOM program evolves, the hubs are expected to incorporate advanced technologies and serve a growing user base, enhancing Europe's strategic autonomy in secure satellite communications. Figure3 highlights the reliable communication capabilities, the data and services the system can support and integrate.

[15] European Commission. Satellite Communications (n.d.) Retrieved from: https://defence-industry-space.ec.europa.eu/eu-space/govsatcom-satellite-communications_en

3.2 Use of Downstream space data and technologies by SMEs

3.2.1 Services and applications for Circular Economy

Circular economy (CE) represents a transformative economic model aimed at maintaining the value of materials, components, and products for as long as possible while minimizing waste and reducing the use of primary raw materials. Unlike the traditional linear economy, which follows a "take-make-dispose" pattern, the CE model is founded on principles of sharing, reuse, repair, and recycling, promoting sustainable resource management.

The concept of a circular economy is deeply embedded within the framework of European environmental policy. Specifically, the **7th European Action Plan (2013-2020)**[16] introduced circular economy principles, emphasizing the importance of sustainable growth through efficient resource use and reduced environmental impact. The European Commission's first **Circular Economy Action Plan (CEAP 2015)**[17] further strengthened these principles by setting ambitious targets for waste reduction, recycling, and landfill minimization, alongside fostering eco-innovation and resource efficiency.

In 2019, the European Green Deal[18] outlined a vision for a resource-efficient, competitive economy with net-zero greenhouse gas (GHG) emissions by 2050. This was followed in 2020 by a **new Circular Economy Action Plan (CEAP 2020)**[19], which emphasized sustainable product design, circular value chains, and an enhanced EU market for secondary raw materials. Downstream space data can play an important role for efficient supply chains, improving logistics operations, and optimizing energy use in manufacturing processes, further contributing to UN Sustainable Development Goals (SDG12: Responsible Consumption and Production) The application of CE principles spans across various domains, including resource efficiency, value chain tracking, waste management, energy sustainability and manufacturing. Below, we explore how downstream space can facilitate and integrate in these CE domains.

1. Earth Observation Applications for Resource Management and circular supply chains

Downstream space data can significantly contribute to achieving UN Sustainable Development Goals, and specifically SDG 12 (Responsible consumption and production) by enhancing the efficiency of

[16] European Union. Regulation (EU) No 1303/2013 General Union Environment Action Programme to 2020. Retreived February 24, 2025. https://eur-lex.europa.eu/legal-content/EN/TXT/

[17] Commission of the European Communities. (2015). COM (2015) 614 final. Closing the loop – An EU action plan for the Circular Economy. Brussels, 2.12.2015. Retrieved from: https://www.eea.europa.eu/policy-documents/com-2015-0614-final.

[18] European Commission. (2019). The European Green Deal (COM/2019/640 final). Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN

[19] European Commission. (2020). A new Circular Economy Action Plan for a cleaner and more competitive Europe (COM/2020/98 final). Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:98:FIN

supply chains, improving logistics operations, and optimizing energy use in manufacturing processes (UNOOSA, 2018)[20]. Earth Observation (EO) and remote sensing data provide valuable information for policymakers to optimize resource utilization and implement circular economy principles in several domains. By leveraging high-resolution satellite imagery, EO supports various applications such as waste management optimization, water resource management, urban planning, and circular supply chains. This chapter explores EO applications in different aspects of the circular economy like water resources and waste management, urban planning and resources management.

Water Resource Management

EO technologies considerably enhance water resource management by providing real-time hydrological estimates, monitoring water availability, and assessing environmental changes. The BWI subscription-based service has indicated such potential by integrating EO data from multiple satellite sensors, including radars, altimeters, and radiometers, to digitize river basins through virtual stations. These virtual stations provide real-time forecasts of river flow and water levels, helping authorities and businesses optimize water use, predict floods or droughts, and improve climate resilience. By enabling precise water management, EO contributes to the circularity by promoting the efficient use of water resources, minimizing waste, and ensuring sustainable water distribution. Similarly, Landsat thermal-infrared EO satellite data can demonstrate how evapotranspiration mapping aids in agricultural water use monitoring, drought assessment, and water rights enforcement, offering sustainable water management (Anderson et al., 2012)[21]. Additionally, the GEOEssential Horizon project leverages EO data from sources like Copernicus and GEOSS to generate environmental indicators that support sustainability efforts, enabling policymakers to make data-driven decisions on climate action, biodiversity conservation, and water resource management. Furthermore, studies on groundwater recharge estimation and potential recharge mapping in Ghana (Dekongmenn et al., 2022)[22] show how EO data from satellites such as Landsat, Sentinel-1, Sentinel-2, and MODIS contribute to understanding environmental changes and human impacts on water availability. This can facilitate better water resource management and ensure the sustainable reuse and allocation of water within the circular economy framework.

EO and Urban Planning

Another important role of EO and space data is to support sustainable urban development and planning by enabling real-time monitoring, land use land cover analysis, and infrastructure development. Research on EO-based urban planning and management indicators (Chrysoulakis et

[20] United Nations Office for Outer Space Affairs. (2018). *European Global Navigation Satellite System and Copernicus: Supporting the Sustainable Development Goals – Building Blocks Towards the 2030 Agenda*. United Nations Office at Vienna.(https://www.unoosa.org/res/oosadoc/data/documents/2018/stspace/stspace71_0_html/st_space_71E.pdf)

[21] Anderson, M. C., Allen, R. G., Morse, A., & Kustas, W. P. (2012). Use of Landsat thermal imagery in monitoring evapotranspiration and managing water resources. Remote Sensing of Environment, 122, 50–65.

[22] Dekongmen, B. W., Anornu, G. K., Kabo-Bah, A. T., Larbi, I., Sunkari, E. D., Dile, Y. T., Agyare, A., & Gyamfi, C. (2022). Groundwater recharge estimation and potential recharge mapping in the Afram Plains of Ghana using SWAT and remote sensing techniques. Groundwater for Sustainable Development, 17, 100741.

al., 2014)[23] highlights how satellite data provide cost-effective, timely, and accurate environmental assessments. These types of data and indicators support sustainable land use, transportation network optimization, as well as resource efficiency. Tracking of air and water quality, and climate adaptation measures, EO technologies can help urban planners design resilient urban systems, reducing pollution and improving infrastructure development. This integration into urban planning aligns with the circular economy by promoting resource efficiency, minimizing construction waste, and contribute to the extension of existing infrastructure's lifespan. Another study from Rajaratnam et al., 2023[24] on building stock mining point how GIS and remote sensing techniques improve circular economy strategies by providing precise geo-located data, enhancing building stock estimations, and facilitating the identification of spatial and temporal patterns. Such applications improve decision-making for recycling, waste management, and resource recovery, enabling more effective urban sustainability initiatives and ensuring the expanded and adaptive reuse of urban spaces.

Waste Management

Waste management can also be reinforced by EO. Space-based monitoring helps identify and track waste disposal and accumulation, enabling SMEs to trace collection routes and identify potential resources for recovery and recycling. For example, the ESA WEOS project uses EO services and assists local authorities in mapping waste containers, monitoring waste sorting and disposal areas, and evaluating the environmental impact of illegal waste treatment sites. The project also uses satellite data to track waste ship dismantling and detect illegal disposal. The site waste monitoring provides insights to allocate resources efficiently and combat environmental hazards. Similarly the Goldeneye project exploits and brings together remote sensing and positioning technologies like GNSS to promote sustainable and cost efficient mining operations. In this respect, EO technologies contribute to the circular economy by enabling the identification of waste streams that can be repurposed or reintegrated into production cycles. This can reduce environmental pollution and enhance the efficiency of recycling initiatives. By detecting illegal dump sites and tracking waste flows, EO data efficiently support recycling and waste reduction efforts. Additionally, areas for material recovery can be easily identified through satellite images, helping close the loop in resource use and reduce landfill reliance. These monitoring activities can encourage the shift towards sustainable waste practices, which are part of a sustainable circular economy (Vambol et al., 2019)[25].

Renewable energy

Earth Observation data and satellite-based analytics provide powerful tools for identifying optimal locations for renewable power plants, monitoring environmental conditions, and assessing resource

[23] Chrysoulakis, N., Feigenwinter, C., Triantakonstantis, D., Penyevskiy, I., Tal, A., Parlow, E., Fleishman, G., Düzgün, Ş., Esch, T., & Marconcini, M. (2014). A conceptual list of indicators for urban planning and management based on Earth observation. *ISPRS International Journal of Geo-Information, 3*(3), 980–1002.

[24] Rajaratnam, D., Stewart, R. A., Liu, T., & Vieira, A. S. (2023). Building stock mining for a circular economy: A systematic review on application of GIS and remote sensing. *Resources, Conservation & Recycling Advances, 18*, 200144.

[25] Vambol, S., Vambol, V., Sundararajan, M., & Ansari, I. (2019). The nature and detection of unauthorized waste dump sites using remote sensing. *Ecological Questions, 30* (3), 43–55.

availability in real time. The Green Transition Information Factory[26] platform provides valuable information from EO data, like energy information, to support decision-makers in efficient planning and assessment and monitoring the effectiveness of policies. By integrating geospatial satellite data with weather forecasts and climate services, such as the Copernicus Climate Change Service (C3S), renewable energy production can be optimized through long-term climate analysis, demand forecasting, and supply efficiency enhancements (Dubus et al., 2023)[27]. The C3S Energy service, utilizing ERA5 climate reanalysis and ENTSO-E energy data, offers valuable insights into historical and projected climate effects on wind, solar, and hydropower generation. This information empowers policymakers and industry leaders to make data-driven decisions, fostering a more resilient and sustainable energy sector (Dubus et al., 2023). Furthermore, the integration of EO data enhances operational efficiency, minimizes resource wastage, and supports the shift toward sustainable energy systems. Circular economy principles, benefit from such technologies which contribute to a more sustainable energy transition and improve resource management and minimize environmental impacts (Argentiero et al., 2020)[28].

2. GNSS and EGNOS for Circular Logistics

GNSS technology can increase the efficiency of circular economy and logistics by providing real-time status of asset tracking products and materials. GNSS supports circular business models such as the product-as-a-service[29], where ownership and traceability of resources are recovered and re-presented in production cycles. Circular logistics provides adequate benefits not only in asset tracking but also in root optimization, leading to increase in recovery rate, reduction in emissions and cost saving. Research supports the increasing importance of GNSS technology in monitoring supply chains, enabling circular trade models and aligning with global sustainability objectives. For example the EUSPA project, RESPONDENT, leverages Galileo technology to improve energy efficiency from renewable energy infrastructure, by timing and synchronization services to enhance grid monitoring and optimize power balancing.

Jin et al (2022)[30] and their research in multi-GNSS depict the importance of these systems in high-precision tracking and monitoring, emphasizing their role in road, rail, maritime navigation, and aviation. The study of Elanshboury et al. (2022)[31] analyses ultra-windband (UWB) technology for

[26] European Space Agency. Green Transition Information Factory. Retrieved 14/01/2025 from: https://gtif.esa.int/

[27] Dubus, L., Saint-Drenan, Y.-M., Troccoli, A., De Felice, M., Moreau, Y., Ho-Tran, L., Goodess, C., Amaro e Silva, R., & Sanger, L. (2023). *C3S Energy: A climate service for the provision of power supply and demand indicators for Europe based on the ERA5 reanalysis and ENTSO-E data*. *Meteorological Applications, 30*(5), e2145. https://doi.org/10.1002/met.2145

[28] Argentiero, M., & Falcone, P. M. (2020). The role of Earth observation satellites in maximizing renewable energy production: Case studies analysis for renewable power plants. Sustainability, 12(5), 2062.

[29] Product-as-a-Service (PaaS). Circularity. Retrieved February 24, 2025. https://circularity.com/en/circularguide/paas-product-as-a-service/ /

[30] Jin, S., Wang, Q., & Dardanelli, G. (2022). A review on multi-GNSS for Earth observation and emerging applications. Remote Sensing, 14(16), 3930. https://doi.org/10.3390/rs14163930

[31] Elsanhoury, M., Mäkelä, P., Koljonen, J., Välisuo, P., Shamsuzzoha, A., Mantere, T., ElMusrati, M., & Kuusniemi, H. (2022). Precision positioning for smart logistics using ultra-wideband technology-based indoor navigation: A review. IEEE Access, 10, 44413-44443. https://doi.org/10.1109/ACCESS.2022.3169267

indoor asset tracking and highlights the importance of global navigation systems GNSS to improve tracking and navigation in outdoor environments. The complementarity between these two systems can significantly enhance the complete tracking of assets in circular logistics and smart supply chains. Tagarakis et al. (2021)[32] developed an IOT-based traceability system called AgroTRACE, which integrates GNSS for agricultural-logistics and fresh produce supply chains. Their research suggests that GNSS-competent tracking systems improve the traceability of perishable goods and reduce wastage, which is an important ingredient of circular food supply chains. In the same context, similar technology for geo-traceability of fresh mangoes in Sri Lanca was used in a complex and dynamic agricultural supply chain (Samarasinghe et al., 2024)[33]. The study demonstrated that real-time tracking can optimize logistics, reduce delivery times and resources, improve food safety and ultimately prevent post-harvest losses. Different supply chain sectors, such as industry and technology also exhibit the importance of GNSS tracking to ensure sustainable life-cycle management and reduce damage in material flow. Sorooshian et al. (2024)[34] in their study highlight how navigation system enhance battery recovery processes within the electric vehicle industry by optimizing end-of-life battery logistics, thereby increasing the efficiency of material loops in the circular economy.

The integration of downstream space data in circular logistics plays a vital role in reducing emissions, improving efficiency, and ensuring cost-effective resource recovery. The use of GNSS data, in combination with space technologies and IoT-based systems, allows for real-time optimization of transport routes, ensuring that circular economy supply chains minimize unnecessary mileage, fuel consumption, and environmental impact. The MobiWise project highlights the significance of intelligent routing solutions in urban mobility, where traffic distribution can lead to measurable reductions in CO_2 and NO_x emissions. The project's study from Aguiar et al, 2022[35] demonstrated that optimizing vehicle routing for sustainability objectives, using IoT and GNSS-based tracking could result in a 2.1% reduction in hourly emissions, leading to an annual saving of 400 tons of CO_2 and 1.2 tons of NO_x in a European city. The study by Alves et al. (2021)[36] suggests that route optimization using space technologies can significantly reduce the environmental footprint of transportation within the textile and clothing industry. The study discusses the need for digital traceability within circular

[32] Tagarakis, A. C., Benos, L., Kateris, D., Tsotsolas, N., & Bochtis, D. (2021). Bridging the gaps in traceability systems for fresh produce supply chains: Overview and development of an integrated IoT-based system. Applied Sciences, 11 *(*16), 7596. https://doi.org/10.3390/app11167596

[33] Samarasinghe, Y. M. P., Dissanayake, C. A. K., & Herath, M. M. (2024). *Application of Global Navigation Satellite System (GNSS) Based Mobile Tracking to Improve the Geo-Traceability of the Mango Supply Chain: A Case Study. Journal of Agricultural Sciences – Sri Lanka, 19*(1), 107-117. https://doi.org/10.4038/jas.v19i1.9702

[34] Sorooshian, S., Karimi, F., & Khiavi, S. F. (2024). Link between Sustainable Circular Supply Chain and IoT in Electric Vehicle Battery Manufacturing. Business Strategy and the Environment. https://onlinelibrary.wiley.com/doi/abs/10.1002/bse.3905

[35] Aguiar, A., Fernandes, P., Guerreiro, A. P., Tomás, R., Agnelo, J., Santos, J. L., Araújo, F., Coelho, M. C., Fonseca, C. M., d'Orey, P. M., Luís, M., & Sargento, S. (2022). MobiWise: Eco-routing decision support leveraging the Internet of Things. *Sustainable Cities and Society, 87*, 104180. https://doi.org/10.1016/j.scs.2022.104180

[36] Alves, L., Ferreira Cruz, E., Lopes, S. I., Faria, P. M., & Rosado da Cruz, A. M. (2022). Towards circular economy in the textiles and clothing value chain through blockchain technology and IoT: A review. Waste Management & Research, 40(1), 3-23.https://doi.org/10.1177/0734242X211052858

supply chains, particularly in textiles, where blockchain and IoT technologies can be used to enhance material lifecycle tracking and improve logistics efficiency.

3.2.2 Services and applications for Raw Materials

According to the **European commission**, raw materials are crucial to Europe's economy and reliable and unhindered access to certain raw materials is a growing concern within the EU and across the globe. The supply of many critical raw materials is highly concentrated with the EU mainly being reliant on international markets. For example, China provides 100 % of the EU's supply of heavy rare earth elements (REE), Turkey provides 99% of the EU's supply of boron, and South Africa provides 71% of the EU's needs for platinum and an even higher share of the platinum group metals iridium, rhodium, and ruthenium (European Commission)[37]. The risks associated with the concentration of production are in many cases compounded by low substitution and low recycling rates.

The **Critical Raw Materials Act** (CRM Act), announced in 2022, is the EU's response to the risks of supply disruptions for critical raw materials and the structural vulnerabilities in supply chains. Its goal is to ensure secure and sustainable access to these resources, supporting the EU's climate and digital transition, industrial competitiveness, and the proper functioning of the single market.

The CRM Act is part of the Green Deal Industrial Plan and, together with the Net Zero Industry Act, aims to boost EU manufacturing of net-zero technologies, ensuring a secure, sustainable, and competitive supply chain for clean energy. Space data, such as Earth Observation and Global navigation satellite system data, can play a crucial role in supporting the raw material industry in optimizing their workflows in various stages of the mining lifecycle from mineral exploration to decommissioning.

Earth Observation applications for raw materials

The European Commission has financed several projects leveraging EO technologies for various applications in the mining sector. Notable projects include::

EO-MINERS which brings into play EO-based methods and tools to facilitate and improve interaction between the mineral extractive industry and society, promoting sustainable development and improving social acceptance. EO-MINERS aimed at integrating new and existing EO tools to improve best practice in mining activities and to reduce environmental and societal impacts by:

- introducing innovative remote sensing tools to the mining industry,
- providing accuracy and quality measures for remote sensing products,
- demonstrating the application of EO in different case studies,
- fostering the dialogue between mining industry and environmental organizations based on EO-derived information

[37] European Commission. Critical raw materials. Accessed March 17, 2025. https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en

The MINEYE project which overall ambition is to increase access to critical and strategic minerals and metals in Europe while also considering environmental and social impacts, by providing the mining industry with proven and validated solutions for the uptake of EO data and technology. The challenge of reducing the environmental impacts of mining will be achieved by developing new EO methods and tools for the entire mining value chain. Therefore, MINEYE aims to develop innovative and competitive technologies for the mineral exploration, operational, closure, and post-closure stages. Furthermore the MULTIMINER project uunlocks the potential of Earth Observation technologies, including Copernicus, through the development of downstream products and services for the whole mining life cycle. The project explores new Earth Observation (EO)-based technologies for discovering **critical raw materials (CRM)**, aiming to enhance the likelihood of identifying new sources within the EU and support the EU's strategic autonomy in the raw materials sector. For this MultiMiner uses multi-source and multi-scale earth observation and novel machine learning methods for mineral exploration and mine site monitoring.

1. EO for mine exploration

EO data provide valuable insights for mineral exploration. Satellite imagery and derived products enable the mapping of host rocks and regional structures, aiding in the localization of mineral deposits. Advanced analysis of hyperspectral and multispectral data offers crucial information on the surface Key differences between hyperspectral and multispectral technologies include:

- Number of spectral bands: Multispectral satellites typically capture 5–10 bands, including RGB (red, green, and blue) and some infrared bands. Hyperspectral satellites, however, detect thousands of individual spectral bands, enabling more precise material differentiation.
- Spectral resolution: Hyperspectral sensors have narrower bands, providing finer discrimination of surface materials.

According to Entone Bedini et al. (2017)[38], Hyperspectral remote sensing has been successfully applied in identifying various ore deposit types, including:

- Kimberlites (host rocks for diamonds)
- Carbonatites (host rocks for rare earth elements)
- Porphyry and epithermal gold/silver deposits
- Skarn and volcanic-hosted massive sulfide (VHMS) deposits
- Orogenic and Carlin-type gold deposits
- Iron oxide–copper–gold (IOCG) deposits
- SEDEX Pb-Zn-Ag deposits.

[38] Bedini, E..(2017). *The use of hyperspectral remote sensing for mineral exploration: a review*. https://www.researchgate.net/publication/363465665_The_use_of_hyperspectral_remote_sensing_for_mineral_exploration_a_review

2. EO for mine operation

EO data has become essential for the operational phase of mining. By integrating satellite EO data with in-situ monitoring, mining operations can significantly enhance safety, risk management, and production efficiency, reducing both economic losses and environmental impacts. Satellite Synthetic Aperture Radar (SAR) data, for instance, are widely used to monitor surface deformation caused by mining activities, both in open-pit and underground contexts. Interferometric SAR (InSAR) enables millimetre-to-centimetre accuracy in detecting ground displacement, offering:

- Continuous, wide-area monitoring
- High-frequency revisit cycles, depending on the satellite's acquisition parameters.

A key case study was documented by Tommaso Carlà et al., 2018[39]: regarding a copper open-pit mine slope failure on November 17, 2016. Satellite InSAR data from the Sentinel-1 mission detected accelerating slope movement in the months leading up to the collapse, demonstrating its potential as a predictive tool for mining safety. The study highlighted that while ground-based radar identified instability in the pit's upper benches, satellite InSAR revealed that most of the displacement occurred on a larger natural slope above the mine crest—an area not visible to ground-based radar.

3. EO for mine closure

Earth Observation (EO) data can play a crucial role in supporting the closure phase of a mine site, particularly in monitoring the revegetation process and the stability of decommissioned site assets. **Revegetation** has an important role in reversing degradation processes in areas that have been subject to mining activities. Plants help to protect the soil from erosion through the development of the root systems, which stabilizes the soil and reduces its compaction. Moreover, plant aboveground biomass protects the soil from the action of rain and wind, increases soil organic matter, and forms micro-reliefs that reduce surface runoff, favouring the infiltration of water into the soil (Silvia E. Navarro-Ramos et al., 2022)[40].

A study conducted by Sam Gordon et al. (2023)[41] was focused on the usage of Remote sensing techniques for a long-term monitoring of vegetation recovery at post-closure mine sites in Canada. The Normalized Difference Vegetation Index (NDVI) analysis, Landsat image classification, post-classification change detection, and Regrowth Index (RI) analysis were conducted to assess the speed and extent of landscape and vegetation recovery at the target mine sites. A significant vegetation recovery was quantified for the mine sites that have experienced active reclamation activities. The quantified mine site reclamation behaviour and the relevant sustainable practices would provide important guidance for evidence-based sustainable resource management around the world.

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[39] Carlà T et al. (2018). *Integration of ground-based radar and satellite InSAR data for the analysis of an unexpected slope failure in an open-pit mine.* https://www.sciencedirect.com/science/article/pii/S0013795217312826
[40] Navarro-Ramos S et al. (2022). Active revegetation after mining: what is the contribution of peer-reviewed studies. https://www.sciencedirect.com/science/article/pii/S2405844022004674
[41] Gordon S et al. (2023). Remote Sensing-Based Revegetation Assessment at Post-Closure Mine Sites in Canada. https://www.mdpi.com/2071-1050/15/14/11287

According to Karen A. Hudson-Edwards et al. (2024)[42] mining generates 13 billion tonnes per year of potentially toxic wet slurry waste, called tailings, commonly deposited in tailings storage facilities (TSF). Since 1915, 257 TSF failures have occurred, releasing a total of ~250 million m^3 of tailings, destroying areas up to ~5,000 km^2, killing an estimated 2,650 people and impacting ~317,000 people through displacement, property damage, and risks to livelihoods and health. On 25th January 2019 a catastrophic failure occurred on tailings Dam-I at the Córrego do Feijão iron ore mine (Brumadinho, Brazil, resulting in 270 fatalities and the release of 12 million cubic meters of tailings. Metal contaminants from the tailings were found in river sediments, with concentrations highest near the spill site. A study by Fabia Gama et al. (2020)[43], demonstrated that early warning signs of instability at Córrego do Feijão Dam could have been detected using InSAR technology with Sentinel-1 data.

Satellite InSAR technology has become an essential tool for **monitoring surface displacement** on TSF dam walls, which require continued surveillance even after mine closure. In this framework, the European Environmental Agency (EEA) initiated the first European Ground Motion Service (EGMS), and with it the start of continental-scale monitoring of European ground deformations. EGMS is part of the Copernicus Land Monitoring Service (CLMS). The first delivery took place in May 2022. This product represents the bleeding edge of space-based remote sensing technology, using InSAR data derived from Sentinel-1 to detect and measure ground movements across Europe with millimeter precision. The product is updated annually and can be used for a variety of applications; city, regional, or state authorities can use it to monitor the structural integrities of dams, bridges, railways, and buildings (Copernicus)[44].

The displacement monitoring market is a dynamic and rapidly growing sector, driven by the increasing number of new satellite constellations being launched. Sentinel-1 and Sentinel-2 data, part of the Copernicus mission, are freely available, which has facilitated the emergence of numerous startups and SMEs in the industry. Below are reported some of those:

- Nhazca, Rome, Italy. Specializes in displacement monitoring applied to natural hazard and infrastructures using EO data.
- Geoapp, Florence, Italy. Provides consultancy services to the mining sector, focusing on EO-based technologies for geotechnical risk assessment.
- Geofem, Nicosia, Cyprus: Experts in displacement monitoring using EO data, applied to both the mining and civil engineering sectors.
- DATelite, Hungary: Expert in displacement monitoring using EO data, applied to both the mining and civil engineering sectors.

[42] Karen A. Hudson-Edwards et al. (2024). Tailings storage facilities, failures and disaster risk. https://www.nature.com/articles/s43017-024-00576-4

[43] Gama F. et al. (2020). Deformations Prior to the Brumadinho Dam Collapse Revealed by Sentinel-1 InSAR Data Using SBAS and PSI Techniques. https://www.researchgate.net/publication/346817814_Deformations_Prior_to_the_Brumadinho_Dam_Collapse_Revealed_by_Sentinel-1_InSAR_Data_Using_SBAS_and_PSI_Techniques

[44] Copernicus. European Ground Motion Service. Accessed March 23, 2025. https://land.copernicus.eu/en/products/european-ground-motion-service?tab=documentation

GNSS applications for raw materials

Global Navigation Satellite System (GNSS) technology plays a crucial role in modern mining operations, offering high-precision positioning, navigation, and monitoring capabilities. GNSS-based solutions enhance safety and efficiency.

GNSS for mine operation

In active mining operations, GNSS is widely used for fleet management, precision drilling, and surveying. GNSS-enabled equipment allows mining companies to optimize excavation processes, reduce material waste, and improve worker safety. One key application is GNSS-based autonomous haul truck systems, which use real-time satellite positioning to guide self-driving trucks in open-pit mines. These systems, implemented in major mining improve fuel efficiency, reduce human error, and enhance overall productivity by enabling precise route planning and collision avoidance.

GNSS for mine closure

After a mine ceases operations, GNSS technology plays a crucial role in monitoring land stability and supporting environmental rehabilitation efforts. GNSS-based ground stations can detect subtle shifts in terrain, ensuring the integrity of tailings dams and mitigating long-term environmental hazards. GNSS can be effectively combined with InSAR technology, as each compensates for the limitations of the other. For example, a study conducted by Qiuxiang Tao et al. (2025) [45] highlights how precise leveling and GNSS measurements are widely used for monitoring surface deformation in coal mining today. However, these methods face several challenges, such as large workload, long operational cycles, low spatiotemporal resolution, and the inability of levelling measurements to monitor horizontal deformations, which imposes significant limitations. In recent years, the development of Interferometric Synthetic Aperture Radar (InSAR) has greatly addressed these shortcomings with its high efficiency, low cost, high precision, and wide coverage, providing a new method for surface deformation monitoring. Nevertheless, InSAR still has unavoidable limitations, such as only measuring line-of-sight deformations and distortion in areas with large deformation magnitudes.

3.2.3 Services and applications for Environmental monitoring and corporate sustainability

Downstream space data – information from satellites and particularly EO imagery and GNSS - has become a powerful tool for environmental monitoring and corporate sustainability. In Europe, programs such as Copernicus (for EO) and Galileo/EGNOS (for navigation) make vast datasets freely available, enabling businesses to track environmental indicators, optimize resource use, and reduce their ecological footprint. Companies are increasingly leveraging these space-derived insights to align profitability with sustainability goals, whether it's monitoring forests and emissions or improving

[45] Tao Q et al. (2025). A method for monitoring three dimensional surface deformation in mining areas combining SBAS-InSAR, GNSS and probability integral method. https://www.nature.com/articles/s41598-025-87087-4

operational efficiency. A World Economic Forum analysis[46] highlights that EO technology can advance sustainability and deliver economic benefits across industries. In short, best practices now integrate satellite data with on-the-ground information and analytics to drive informed decision-making in service of the planet and business performance.

A recent global review of EO-enabled corporate environmental strategies highlights that, despite the growing availability of EO data, its uptake in corporate sustainability reporting and environmental monitoring remains limited and uneven across sectors[47]. The study underscores the need for better alignment between EO capabilities and corporate ESG disclosure frameworks, especially regarding supply chain traceability, emissions monitoring, and biodiversity assessments, all areas strongly supported by Europe's Copernicus and Galileo programs.

Best practices for environmental monitoring and sustainability applications now commonly integrate multi-source data: high-resolution EO imagery, GNSS positioning, and IoT sensors. For instance, combining Sentinel satellite data with ground sensors allows farmers to irrigate precisely, optimizing water use and avoiding waste. In logistics and transport, GNSS-enabled route optimization systems have shown significant benefits, including measurable reductions in emissions.

Best practices and recent insights include – but are not limited to:

- **Integrating multi-source data:** Successful applications combine high-resolution satellite imagery, GNSS positioning, and IoT sensors to create actionable insights. For example, integrating Sentinel satellite data with ground sensors allows farmers to irrigate more precisely, avoiding waste. NASA's SMAP mission can detect crop water stress from space, and when combined with soil sensors, farmers optimized irrigation, cutting water costs by up to *25%*. Similarly, **route optimization** systems that fuse GNSS tracking and IoT logistics data have shown substantial benefits. A recent European study (MobiWise project) demonstrated that intelligent routing using GNSS reduces urban transport emissions ~2%, saving ~400 tons CO_2 and 1.2 tons NO_x. These findings underscore the importance of using space data in tandem with AI and local data to target efficiency gains and emission reductions.
- **Open data and platforms:** Europe's open-data policy is a cornerstone – the Copernicus program offers free datasets (imagery, climate, atmosphere, land use, etc.) that SMEs can readily use. Best practices involve tapping into these platforms (e.g. the Copernicus Climate Data Store, Land Monitoring services) and cloud hubs (DIAS platforms) for on-demand analytics. The new **EU Green Deal Data Space** initiative and platforms like the ESA's *Green Transition Information Factory* are emerging to integrate satellite data with climate and energy models, helping policymakers and businesses plan sustainably. Through these tools, companies avoid heavy upfront costs and can focus on value-added analysis. The **EU Space**

[46] World Economic Forum (2025), 5 uses of Earth observation data that are good for business and the planet, Retrieved from: https://www.weforum.org/stories/2025/01/5-uses-earth-observation-satellite-data-for-business-and-planet/#:~:text=,and%20implement%20Earth%20observation%20technologies

[47] Paravano, A., Patrizi, M., Razzano, E., Locatelli, G., Feliciani, F., & Trucco, P. (2024). The impact of the new space economy on sustainability: an overview. Acta Astronautica, 222, 162-173.

for Green Transformation report (EUSPA 2023) itself serves as a practical guide, showcasing how firms can incorporate EU space data into their.

- **Capacity and partnerships:** Another best practice is partnering with expert organizations or startups specialized in geospatial analytics. European SMEs in the downstream space sector have proliferated – from agritech firms using EO for precision farming to consultancies offering "geospatial ESG" services that link satellite observations (e.g. deforestation, methane) to specific corporate assets[48]. Such collaborations help corporates interpret satellite data correctly and integrate it into their sustainability reporting and decision processes. The result is more credible, transparent monitoring and faster innovation cycles.

Downstream space data is already driving concrete sustainability solutions for both SMEs and large corporates, especially in Europe:

- **Deforestation-Free Supply Chains:** Industries reliant on commodities like palm oil, cocoa, or timber use satellite imaging to ensure raw materials aren't sourced from illegal deforestation. **Nestlé**, for instance, monitors 100% of its palm oil supply areas via the Starling satellite service (Airbus & TFT), which uses radar imagery to flag forest cover changes in near-real time (source). This helps companies comply with strict regulations like the new EU Deforestation Regulation and meet "zero deforestation" pledges[46]. It's good for business – avoiding legal risks and protecting brand value – and good for the planet by preserving biodiversity and carbon sinks. Other firms leverage Global Forest Watch (a platform using EU and NASA satellite data) to gain similar visibility into supplier lands.

- **Precision Agriculture & Water Management:** European agri-tech SMEs are using EO data to make farming more sustainable. For example, Greek startup **AgroApps** and others combine Sentinel-2 imagery with weather and GNSS data to guide farmers on optimal irrigation and input use, boosting yields while conserving water. Satellite-derived soil moisture and crop vigor maps ensure that water and fertilizers are applied only when and where needed. This data-driven approach has been shown to improve water efficiency significantly (as noted, up to 25% cost savings in trials)[46]. It also reduces runoff of chemicals, benefiting nearby ecosystems. Precision agriculture powered by space data is now a growing practice across Europe's farms, supported by EU initiatives and paying dividends in both cost and environmental impact.

- **Renewable Energy Planning and Monitoring:** Space data is crucial in the renewable energy sector. **Copernicus** satellites provide solar irradiance maps and wind resource assessments, allowing engineers to **optimize site selection** for solar farms and wind turbines euspa.europa.eueuspa.europa.eu. A recent analysis found that using EO data can improve clean energy investment planning by ~33% – by identifying the sunniest or windiest sites and minimizing project risks. Once facilities are built, satellites and GNSS enable smarter maintenance: high-precision Galileo positioning guides drones to inspect solar panels and

[48] Maucher, C. ESA (2023), Using Earth Observation Data for Environmental, Social and Governance Schemes. Retrieved from: Earth Observation Data for Environmental, Social, Governance Schemes

wind blades, detecting issues (like hot spots or cracks) early (source: euspa.europa.eu). This reduces the need for manual checks in remote areas and keeps renewable plants running efficiently. In one example, **GNSS-enabled** drones already help locate underperforming solar panels, and with Galileo's new High Accuracy Service, such operations will become even more effective. The cumulative impact, as EU space officials note, is substantial – from higher clean energy output to lower maintenance emissions.

- **Climate Risk Assessment and Biodiversity Monitoring:** Satellite data is increasingly used to **map physical climate risks** (floods, heatwaves, wildfires) for corporate facilities and cities. Urban planners in Europe overlay thermal imagery to find heat islands and radar-based flood maps to pinpoint vulnerable zones[46], informing climate-resilient infrastructure investments. Likewise, companies with global assets utilize EO data to gauge risks – for instance, a manufacturing firm might use Sentinel-1 radar data to monitor flood-prone areas near its factories or supply routes. On the biodiversity front, startups like **Space4Good (NL)** or **Kanop (FR)** work with businesses and NGOs to track forest carbon stocks and habitat health via satellite, enabling participation in carbon markets and conservation finance. These applications help corporates anticipate and mitigate environmental risks, fulfilling the recommendations of frameworks like TCFD (Task Force on Climate-related Financial Disclosures) with tangible data.

- **Emissions Monitoring and Air Quality:** Space-based sensors now detect greenhouse gas emissions and air pollutants at facility and city scales. The EU's Sentinel-5P satellite maps pollutants (NO_2, SO_2) and will soon be joined by dedicated CO_2-monitoring missions. Notably, emerging satellite constellations spot methane leaks from oil & gas operations worldwide. This has **caught the attention of regulators and investors** – multiple satellites (public and private) now form a "system of systems" to identify major methane plumes (link: reuters.com reuters.com). In 2022–23, a satellite survey by the Oil & Gas Climate Initiative led operators to fix leaks that would have emitted ~1 million tons CO_2-equivalent per year (link:reuters.com). European policy is also pushing this: the EU's Methane Strategy calls for using Copernicus to detect super-emitters and new regulations will require companies to monitor and repair leaks. Satellites thus act as an independent eye, ensuring transparency. Groups like CDP (Carbon Disclosure Project) welcome this trend, noting that orbital measurements provide **"timely information that may otherwise be left out of disclosures"** (link:reuters.com). In practice, energy companies are beginning to subscribe to services (e.g. GHGSat or MethaneSAT data) to find and curb their emissions faster, aligning with climate pledges.

From a policy perspective, a supportive policy environment in Europe underpins these developments, promoting the use of space data for sustainability through both **regulatory requirements and voluntary initiatives**. The European Green Deal (2019) explicitly recognizes space systems as enablers for climate action: an analysis found that over *52%* of Green Deal policy documents reference space technologies, especially Copernicus, the **EU Methane Emissions Strategy** (2020) plans to deploy Copernicus data to identify methane leaks and guide international efforts, the **Zero Pollution Action Plan** (2021) delivers air quality data to citizens via Copernicus services; and the **EU Forest Strategy** (2021) calls for an integrated forest monitoring system using Copernicus imagery and Galileo positioning to combat illegal logging. Likewise, the **EU Solar Energy Strategy** (2022) highlights using satellite data to find optimal sites for solar installations. These policies not only set sustainability targets but actively encourage leveraging Europe's space infrastructure to meet them.

On the corporate front, Europe's **Corporate Sustainability Reporting Directive (CSRD)** (effective 2024) requires thousands of companies to disclose detailed environmental impacts and risks. Space data offers a credible means to meet such requirements – for instance, by providing objective evidence of land-use change, carbon emissions, or climate hazards affecting operations. The EUSPA "Green Transformation" report showcases how businesses can align with CSRD and other EU environmental rules through satellite monitoring. It also reveals a gap: despite the potential, only about *7%* of European companies are currently using space data for environmental purposes. This finding has spurred action to increase awareness and uptake of satellite solutions. Programs like **ESA's Business Incubation Centers (BICs)** and the EU's **CASSINI** initiative (Competitive Space Start-ups for Innovation) provide funding and support to startups developing space-enabled green applications. These efforts aim to bridge the knowledge gap and scale up innovative services, so more SMEs and corporates can harness space data in their sustainability journeys.

In addition to regulation, **voluntary frameworks** are leveraging space data. The European Space Agency and partners launched the **Space Climate Observatory (SCO)** as a collaborative platform for using EO in climate resilience projects. Financial institutions and investors are developing "geospatial ESG" standards – combining asset location data with EO indicators (e.g. forest loss, water availability) to assess companies' environmental performance gda.esa.int. This is influencing sustainable finance: investors increasingly expect that companies utilize the best available data (including satellite evidence) to support their ESG claimsreuters.com. All these governance trends – from mandatory reporting to voluntary disclosure and investor pressure – create a conducive environment in which downstream space data is not just a novelty but a **necessity** for credible sustainability management.

4. Strategies of European space associations supporting Green transition

4.1 Introduction

The European Space Agency (ESA) and the European Union Agency for the Space Programme (EUSPA) have developed comprehensive strategies to align their space activities with the objectives of the **European Green Deal**. Their efforts are directed at leveraging space technologies, including Earth observation, satellite navigation, and connectivity solutions, to support climate action, economic sustainability, and environmental monitoring. By fostering innovation and investment in green technologies, ESA and EUSPA contribute to the EU's goal of achieving climate neutrality by 2050.

The EU has significantly invested in the development of innovation ecosystems promoting knowledge diffusion, technological development, industrial collaboration, specialised business support and respective investments at regional, national and international/cross-border level. However, only a few business support organisations from these networks are explicitly focused on space entrepreneurship (e.g. clusters), with a view to supporting SMEs to unlock the potential of downstream space data application and services. ESA Business Incubation Centres (BICs) and the EU CASSINI initiative have started working towards this direction.

4.2 The role of the EU Space Programme in EU Policies

The EU Green Deal aims to make Europe the first climate-neutral continent by 2050, setting an ambitious roadmap for sustainable growth, resource efficiency, and environmental protection. A report from the European Economic and Social Committee (EESC) analysed that space technologies, particularly the EU Space Programme, play a significant role in supporting the EU Green Deal, with **52% of the 31 Green Deal policies referencing space technologies as can be seen in** Figure 4.

Among these, Copernicus is the most frequently cited, mentioned in twelve policies, while Galileo is referenced in two. Some EU Green Deal policies, like the EU Solar Energy Strategy of 2022, are trying to create synergies between space technologies and green transition technologies (e.g., solar panels where the use of satellite data can help identify optimal locations for solar farms).

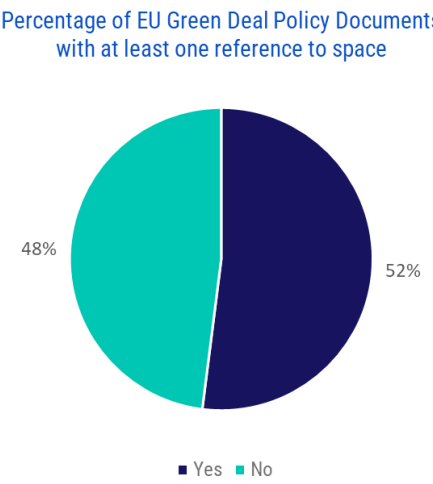

Figure 4: Percentage of EU Green Deal Policy Documents with at least one reference to space (Source: EESC)

The report from the European Economic and Social Committee (EESC) listed the following **key examples of Green Deal policies** that mention space[49]:

- **Industrial Strategy for Europe (2020)**: Highlights space as essential for sustainable mobility, industrial competitiveness, and innovation, emphasizing the need for secure raw material supply chains.
- **Offshore Renewable Energy Strategy (2020)**: Calls for leveraging Copernicus and EMODnet to assess environmental impacts and optimize offshore energy development.
- **Methane Emissions Strategy (2020)**: Plans to use Copernicus for global methane monitoring, including detecting super emitters and supporting international collaboration.
- **Zero Pollution Action Plan (2021)**: Aims to provide citizens with accessible pollution data via tools like the Air Quality Index App, powered by Copernicus.
- **EU Forest Strategy (2021)**: Proposes an integrated forest monitoring framework using Copernicus and Galileo to combat illegal logging and improve forest management.
- **Climate Adaptation Strategy (2021)**: Recommends Copernicus data for decision-making and resilience planning, particularly through platforms like Climate-ADAPT.
- **Solar Energy Strategy (2022)**: Highlights synergies between space and terrestrial solar technologies to drive innovation.
- **Farm to Fork Strategy (2022):** Emphasizes Earth observation for monitoring sustainable food systems and reducing environmental impacts in agriculture and fisheries.

Through initiatives such as the **Energy Performance of Buildings Directive**, EU Space aids in reducing carbon emissions from buildings (one of the largest contributors to greenhouse gas emissions) by using **Copernicus** data to monitor emissions and help urban planners target renovations. Space technologies also support corporate sustainability efforts by offering **Earth Observation** data, which businesses use to report on their environmental impacts and make informed decisions on sustainability practices. Furthermore, **Galileo and Copernicus** assist in preventing

[49] European Economic and Social Committee (EESC). (2023). EU space policy and the involvement of civil society. Retrieved from https://www.eesc.europa.eu/sites/default/files/files/qe-04-23-899-en-n.pdf

illegal logging and improving the traceability of timber, contributing to forest conservation efforts. As a further example, airlines also benefit from **EGNOS** for fuel-efficient flight paths, helping to reduce emissions under international carbon offset schemes.

The **European Green Deal's objectives** span across 10 key action areas, which are near term opportunities for companies in several industrial sectors[50]. These 10 areas can be seen in **Figure 2.**

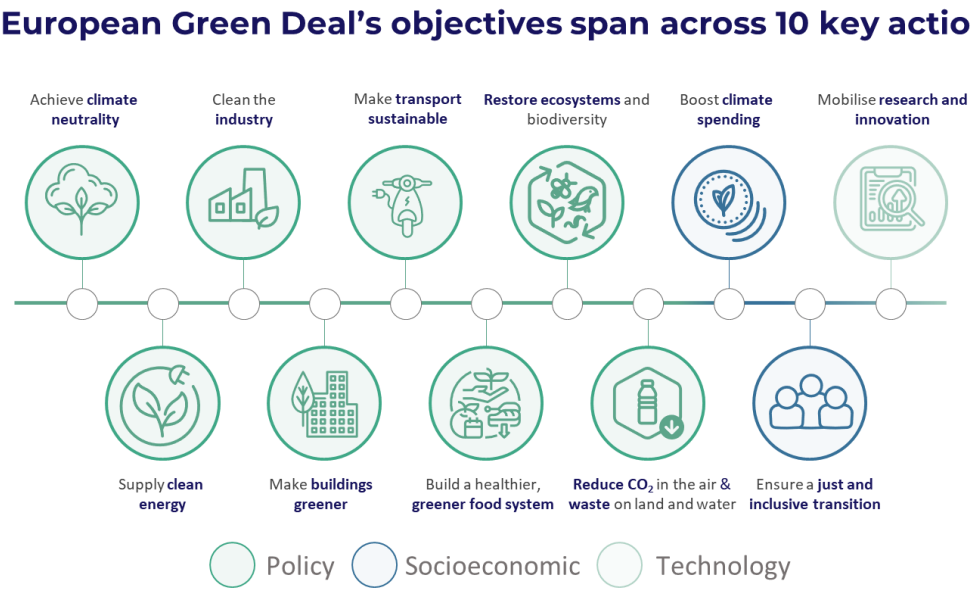

Figure 5: The European Green Deal's objectives span across 10 key actions areas. (Source: EUSPA (2023) EU Space for Green Transformation)

For the period of 2008-2030, PwC has estimated that the EU Space Programme will create a quantifiable impact across multiple areas as seen in **Figure 6**:

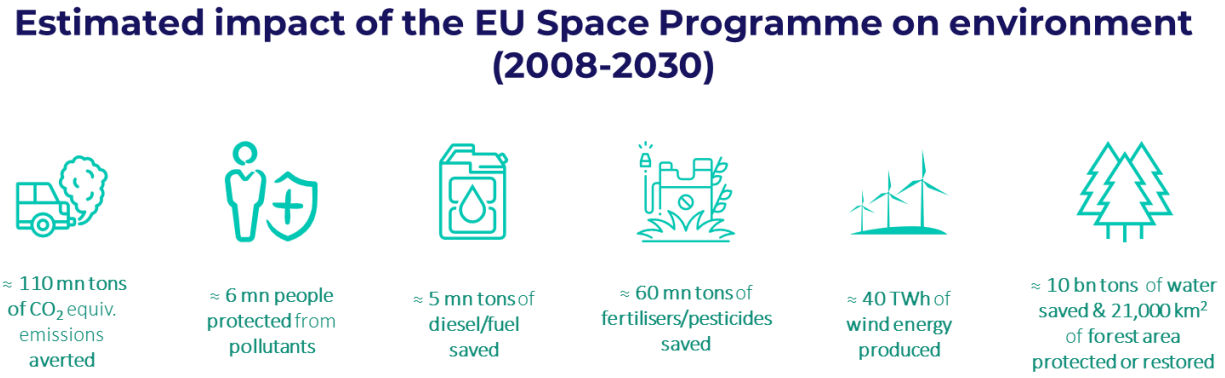

Figure 6: Analysis of the Environmental Impact of the EU Space Programme 2020 (Source: PwC, EUSPA Report)

[50] EUSPA (2023) EU Space for Green Transformation. Retrieved from: https://www.euspa.europa.eu/sites/default/files/eu_space_for_green_transformation_a_new_tool_for_companies_to_monitor_their_sustainability_targets_2023_issue_1.pdf

In alignment with the Green Deal's broader objectives, ESA and EUSPA have cultivated a robust ecosystem of initiatives designed to foster entrepreneurship, innovation, and industrial competitiveness, especially within the startup and SME sectors. These initiatives, further presented in the next paragraph, are specifically geared toward transforming strategic objectives into actionable, market-ready solutions. In addition, the activities of ESA and EUSPA around the Green Deal go beyond the application of downstream space data and services in 'green' use cases or the commercialisation of these use cases. They also **expand into activities to reduce the carbon footprint and make operations more sustainable, even within the operations of the agencies.**

4.3 EUSPA Strategies for the Green Deal

The EU Space Programme has improved the accessibility and usability of services, particularly for small and medium-sized enterprises (SMEs), by reducing costs, mitigating technology risks, and aligning with market demand, offering new opportunities to integrate space data into business models.[51] To help companies utilise this data as a means of driving their own sustainability journeys, EUSPA published the "EU Space for the Green Transformation" report, demonstrating the potential of EU Space Data adoption. This practical guide introduces the Green Deal and its implications for companies, offering guidance on making sustainable solutions financially viable and navigating the market for space-based success.

The report showcases real-world applications and best practices, demonstrating how businesses use space data to drive sustainability, align with EU environmental policies, and meet requirements like the Corporate Sustainability Reporting Directive (CSRD). Despite the clear potential for space data in the green transition, the report highlights that only 7% of European companies are currently using space data for environmental purposes.[52]

To address this, EUSPA focuses on market development and linking space services to user needs, with initiatives like the CASSINI program, launched in 2021 with the European Commission aiming to support space-driven solutions for environmental and societal challenges.

4.3.1 CASSINI

The **Competitive Space Start-ups for Innovation initiative (CASSINI)** includes a €1 billion EU seeds fund; as well as hackathons, business accelerators, and matchmaking services that bring together innovators, investors, and industry stakeholders. CASSINI challenges and collaborations help identify high-potential projects that can receive funding under this initiative. Through these CASSINI "arms", CASSINI **facilitates the scaling of green technologies and supports the growth of startups** focused on areas like energy efficiency, climate adaptation, and sustainable agriculture.

[51] How EU Space supports Europe's environmental policies (2023). Retrieved from: https://egnos.gsc-europa.eu/news-events/news/how-eu-space-supports-europes-environmental-policies

[52] EUSPA (2023) EU Space for Green Transformation. Retrieved from: https://www.euspa.europa.eu/sites/default/files/eu_space_for_green_transformation_a_new_tool_for_companies_to_monitor_their_sustainability_targets_2023_issue_1.pdf

Figure 7, illustrates that CASSINI start-ups are distributed across the whole of Europe. The program is expected to generate **over €2 billion in funding for space-driven green innovations by 2027** and aligns with the EU's Green Deal Innovation Fund, which aims to provide **€10 billion in financing for green technologies by 2030.**

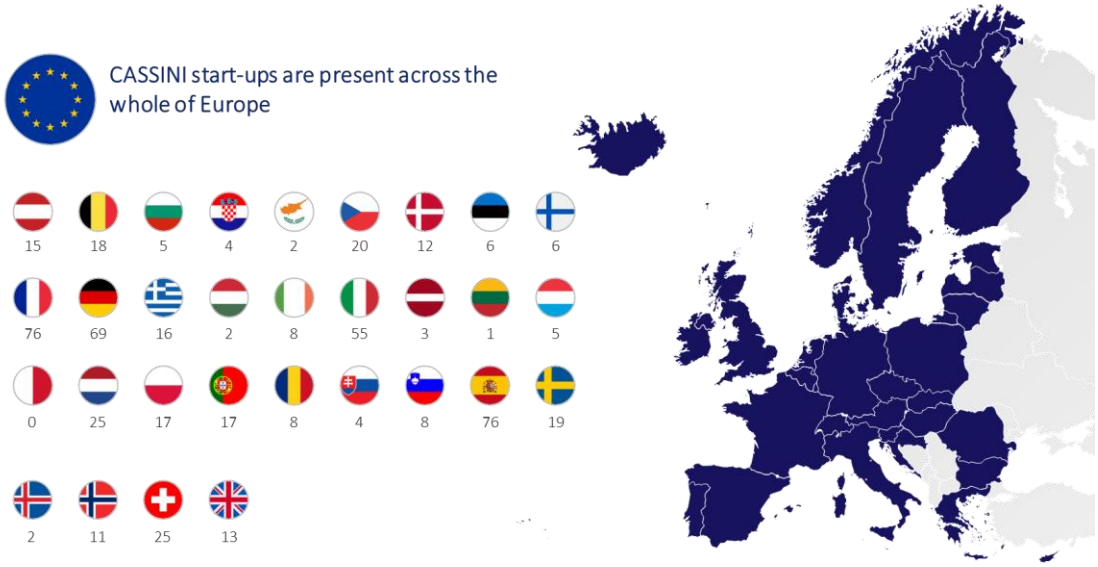

Figure 7: CASSINI has been successful at giving rise to multiple start-ups across the whole of Europe

Through hackathons, business accelerators, open challenges and matchmaking services, CASSINI aims at bringing together innovators, investors, and industry stakeholders; as well as educating the public sphere about the potential of space technologies. As of 2025, CASSINI has mobilized **over €500 million** in investment for startups focused on space-based green technologies.

A. CASSINI Hackathons & Mentoring

The CASSINI hackathons are **online competitions** targeting high social impact business opportunities that make use of EU Space data They are **held twice a year since 2021** on variable themes addressing the EU sustainability & digitalisation goals.

For instance, the **7th CASSINI Hackathon**, focused on **green transition challenges**. It had 456 active participants across 10 locations and led to the submission of 91 projects, with winning teams receiving financial awards and expert mentorship to further develop their innovations. The first-place winner of the 7th CASSINI Hackathon was **TerraMetallum**, which applies satellite data to detect and mitigate soil contamination. The second-place winner, **WasteNoTime**, develops a model that detects landfills by using satellite imagery and citizens' input. The third-place winner, **CrOptimize**, provides optimal crop recommendation and agroclimatic zoning based on satellite and climate data powered by AI.[53] The local organisers offered a combined prize pool of **€27.000,** which included cash prizes

[53] Retrieved from https://www.cassini.eu/hackathons/7th-cassini-hackathon-winners

totaling €9,000 for the top three teams, as well as 100 hours of mentoring, signifying the unique positioning that the CASSINI Hackathons have in the EU Space Ecosystem.

B. CASSINI Challenges

The **CASSINI Challenges** are a series of online innovation competitions launched by the European Commission to promote the use of EU space technologies, including Galileo, EGNOS, and Copernicus, aiming to showcase clear market uptake. These challenges encourage startups, entrepreneurs, and researchers to develop innovative solutions using satellite data for various sectors such as climate change, security, mobility, and smart cities. Participants compete for funding, mentorship, and networking opportunities to accelerate their ideas into viable products and services that support Europe's space economy and technological leadership. The topics for 2024 had a €1.15 Mn prize pool and 3 technology readiness tracks (Idea, Prototype, Product), addressing commercial, societal and environmental challenges.[54]

C. CASSINI Matchmaking

The CASSINI Matchmaking are dedicated events for introducing start-ups, scaleup companies and SMEs to investors and corporates. Startups receive pitch training and specialised mentoring to help them secure funding and partnerships. There are **over 10 CASSINI Matchmaking events per year** and they are present at large EU Entrepreneurship events such as Slush, Space Tech Expo Bremen, IAC Milan and HIGHTECH Venture Days.[55] Success stories include Arkanda Space (Spain), Orbital Matter (Poland) and 10LINES (Estonia). €1.1 billion of total combined funding has backed over 200 CASSINI start-ups participating in matchmaking events.[56]

D. CASSINI Business Accelerator

Beyond hackathons and challenges, the **CASSINI Business Accelerator** supports high-potential startups by **offering coaching, training & events** to boost their commercial evolution. It is tailored to **space companies in growth stage** that have a product on the market. Some successful startups are already part of the CASSINI Business Accelerator like Ecosmic (Italy), EarthPulse.ai (Spain), Constellr (Germany), Endurosat (Bulgaria) and Latitude (France). These startups were among the 21 companies selected for the second batch of the CASSINI Business Accelerator.[57]

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[54] Retrieved from https://www.copernicus.eu/en/news/news/observer-cassini-challenges-2024-space-data-entrepreneurs-compete-eu115-million-prize

[55] Retrieved from https://www.cassini.eu/matchmaking/

[56] European Commision (2024) EU Space Programme Performance. Retrieved from https://commission.europa.eu/strategy-and-policy/eu-budget/performance-and-reporting/programme-performance-statements/eu-space-programme-performance_en

[57] Retrieved from: https://www.cassini.eu/accelerator/startups

In September 2024, the second batch of the CASSINI Business Accelerator closed, generating 127 sales deals, generating €24.4 million in total value. Private funding amounted to €117 million from equity-based funding and €20 million from other sources of private funding during the 6-month duration of the second batch.[58]

As of December 2024, for the total of the first three batches of the CASSINI Business Accelerator, the programme has achieved a total 456 sales deals with a cumulative €62.2 million in total value, from which €20.5 million is exclusively from new customer deals.[59]

E. CASSINI Investor Network

The CASSINI Investor network is a customized toolset for Venture Capital (VC) and fund managers. It provides exclusive deal flow information and early access to investment opportunities, with targeted introductions, networking opportunities, access to technical reports and specialized guidance. A consolidated network of over 40 investors like PromusVentures, Vsquared Ventures, Alpine Space Ventures and Primo Space, are actively participating in CASSINI matchmaking actions.[60]

F. EU Space Academy

The EU Space Academy is an online learning platform which aims to be a reference point for entrepreneurs using EU Space Data. It offers lectures and interactive training, to help entrepreneurs access EU space data and build a space application business. It is open and free to all individuals, start-ups and SMEs providing pre-recorded tutorials across various segments. Part of the courses concerns the diverse applications of space data for real-world scenarios, including sustainability and green-focused applications.

4.3.2 EUSPA Horizon Europe Calls

EUSPA also stimulates market development of the EU Space downstream sector by funding projects that promote the use of space-based solutions through its Horizon Europe calls. The European Commission **allocates funding to EUSPA**, which then organizes calls for projects. EUSPA manages Horizon Europe funds for space applications, ensuring they align with EU policy priorities like the Green Deal, digitalization, and security. The Horizon Europe calls managed by EUSPA, concern both non-space calls involving EU space programmes[61] and R&D projects related to space.

Three Horizon Europe calls under Pillar II were closed on February 20, 2024. Specific focus was given on Cluster 4: Digital, Industry, and Space.This alignment ensures that the projects funded are closely linked to advancing digital technologies and industrial innovations that can benefit from space-based

[58] CASSINI Business Accelerator (2024). Retrieved from: https://www.cassini.eu/accelerator/blog/overachieving-best-way
[59] CASSINI Business Accelerator (2024). Retrieved from https://www.cassini.eu/accelerator/blog
[60] CASSINI Investor Network (2025). Retrieved from Investor Network | EU Agency for the Space Programme
[61] EUSPA (2024) Horizon Europe non-space calls involving EU space programmes. Retrieved from: https://www.euspa.europa.eu/sites/default/files/horizon_europe_non-euspa_space_calls_2023-2024.pdf

capabilities. EUSPA has allocated substantial funding to initiatives aimed at addressing key challenges, particularly climate change and sustainability through downstream space applications.

For example, the first Horizon Europe call has provided **€32.6 million to 13 projects** aimed at **promoting the European Green Deal**, in support of Copernicus-based applications, which leverage satellite data for climate monitoring, disaster response, and environmental sustainability.[62]

The second call allocated **€48.1 million** to support a broader range of space-based solutions, with Earth Observation and Copernicus being at the core of the call.[63] The call aimed to stimulate the development of new space-enabled applications with value-added services utilising the EU Space Programme.

The **third EUSPA Horizon Europe Call**, with a total budget of **€34.5 million** targeted five key areas, further exemplified EUSPA's commitment to sustainability objectives:

1. Green and secure post-pandemic transitions
2. Advancing EGNSS in regulated markets
3. Copernicus applications for policy-making and business
4. International space-based downstream application development
5. EU GOVSATCOM for security

These initiatives aim to stimulate technological innovation but also ensure that space services translate into real-world applications. **Table 3**, summarises some examples of successful EUSPA-funded Horizon Projects.

Table 3: Example of successful Horizon projects

Real World Examples of EUSPA Horizon Projects	
SWIFTT project	AI is integrated with Copernicus Earth Observation data for real-time forest risk monitoring, aiding forest management authorities in preventing wildfires, deforestation, and illegal logging. It also provides actionable insights for policymakers to implement sustainable forest management practices.
RESPON-DENT	AI/ML-based forecasting algorithms use Earth observation and weather data to predict solar and wind energy generation, helping grid operators balance supply and demand while reducing fossil fuel reliance. The system uses Galileo-enabled Phasor Measurement Units for precise

[62] EUSPA (2021) EUSPA launches Horizon Europe call to transform the digital economy, increase the Union's resilience and support the Green Deal. Retrieved from: https://www.euspa.europa.eu/pressroom/press-releases/euspa-launches-horizon-europe-call-transform-digital-economy-increase

[63] EUSPA (2022). Retrieved from: https://www.euspa.europa.eu/sites/default/files/content/press_releases/earth_observation_at_the_heart_of_euspas_2nd_call_1.pdf.pdf

	timing in smart grid monitoring, improving power balancing and grid stability.
COMUNIDAD	European GNSS and Copernicus data support agricultural and rural development projects in Chile and Colombia, demonstrating the global applicability of EU space solutions.
BirdWatch project	Satellite imagery and Copernicus data monitor avian biodiversity and assess habitat suitability in response to climate change, helping researchers track bird populations and migration patterns. The data supports conservation efforts and the development of strategies to protect vulnerable species and habitats.
Overwatch project	GNSS positioning, Copernicus data, AI, drones, 5G, and AR combine to create an integrated holographic management system for emergency response, recovery, and disaster mitigation. This system provides real-time situational awareness and decision-making through an augmented reality-based user interface.
BUILDSPACE	Digital Twins powered by EU Space data (Copernicus, Galileo, and EGNOS) to support sustainable urban management in cities like Piraeus, Riga, and Ljubljana. It helps city authorities optimize energy efficiency, reduce carbon emissions, and improve urban infrastructure sustainability.

4.3.3 EUSPA Partnerships for Green Transition

EUSPA partners with various organizations across international, European, and national levels to maximize the impact of EU Space data and services. For example, in March 2022, EUSPA signed a Memorandum of Understanding with the United Nations Office for Outer Space Affairs (UNOOSA) to support the United Nations Sustainable Development Goals (SDGs) by leveraging Earth Observation and European GNSS, identifying multiple ways that the EU Space Programme contributes to the SDGs64 The two organisations identified different sustainability challenges and mapped the relevancy and contribution of each EU Space component.[65] This collaboration aligns with the EU Green Deal, recognizing the importance of space-based technologies.

Other examples include a collaboration with the European Fisheries Control Agency (EFCA) to enhance the monitoring and enforcement of fisheries regulations.[66]

In many cases, EUSPA and ESA work together to support the evolution of space-enabled operational services for the twin transition. For example, on 19 April 2024, the European Commission, and ESA,

[64] UNOOSA (2023) Supporting the Sustainable Development Goals. Retrieved from: https://www.unoosa.org/res/oosadoc/data/documents/2018/stspace/stspace71_0_html/st_space_71E.pdf
[65] UNOOSA (2023) EU Space supporting a world of 8 billion people. Retrieved from: https://www.unoosa.org/res/oosadoc/data/documents/2023/stspace/stspace85_0_html/st_space_085E.pdf
[66] EFCA (2022). Retrieved from: https://www.efca.europa.eu/en/content/pressroom/efca-and-euspa-formalise-inter-agency-cooperation-related-maritime-domain

with the support of EUSPA, formalized a Collaboration Arrangement to harness space technologies in addressing critical global challenges, including climate change, digitalization, crisis response, and the protection of critical infrastructure.[67]

EUSPA will support the evolution of space-enabled operational services to foster the green and digital transitions, security, and resilience within the European Union. This partnership emphasizes how multiple central organisations with combined capabilities, promote space data and services as solutions with great potential for decarbonization, climate change mitigation, and adaptation efforts. The collaboration focuses on three primary areas, as seen in **Table 4**:

Table 4: Areas of collaboration EUSPA/ ESA

Collaboration initiative	Description
Space for a Green Future (S4GF)	Utilizing space-based data and technologies to support environmental sustainability and the green transition.
Rapid and Resilient Crisis Response (R3)	Enhancing capabilities to respond swiftly and effectively to crises using space assets.
Protection of Space Assets (PROTECT)	Ensuring the security and resilience of space infrastructure against potential threats.

4.4 ESA Strategies

ESA is a multi-state organisation with 22 members and receives most of its funding from its members. ESA plays a significant role in the research, development, and operation of space technologies, particularly of Earth Observation (EO) missions. The continuation of the Copernicus program and the advancement of EO technologies are among ESA's key priorities. In 2024, there was a big budget increase for Earth Observation making it 30.5% of the total funding, allocating approximately €2.4 billion to ensure EO mission continuity, support environmental monitoring, and align with the EU's environmental and climate goals.[68] ESA also focuses on monitoring greenhouse gas emissions, forest cover, and land-use patterns, helping meet EU obligations under the Paris Agreement and the Fit for 55 targets.[69]

[67] DG DEFIS (2024). Retrieved from: https://defence-industry-space.ec.europa.eu/european-commission-signs-collaboration-arrangement-esa-address-critical-global-challenges-through-2024-04-19_en
[68] ESA (2024) ESA budget by domain 2024. Retrieved from: https://spaceinsider.tech/2025/01/01/esa-sets-preliminary-e7-7-billion-budget-for-2025-amid-evolving-priorities/
[69] ESA(2020). Retrieved from: https://www.esa.int/Applications/Observing_the_Earth/Space_for_our_climate/Providing_the_facts_to_help_Europe_achieve_55

4.4.1 ESA Support Mechanisms to SMEs and Startups

ESA plays a key role in promoting market development through entrepreneurship initiatives, that helps companies build and scale space technologies both in the downstream and the upstream sector. Commercialisation is thus a key strategic priority, by supporting entrepreneurship and investment through various mechanisms, ranging from incubation centres to new procurement schemes.[70] Key examples include the ESA Business Incubation Centers (BIC) network, ESA Business Applications and Space Solutions (BASS), the ESA Φ-lab and the recently opened ESA Business Accelerator of Germany. Note that not all ESA funding and support mechanisms are outlined, and a focus is given on mechanisms that focus on space-enabled green technologies and solutions.

ESA BIC Network

The ESA Business Incubation Centres (BIC) network, Europe's largest for space start-ups, spans 22 countries and supports over 1,800 start-ups by the end of 2024. In 2023, it generated €232+ million in revenue, raised €556+ million in investment, and created more than 5,000 jobs. Sustainability is a key evaluation criterion for new start-ups within the BIC network, encouraging the development of solutions that align with the United Nations Sustainable Development Goals. ESA BICs provide seed funding, technical guidance, and market access, helping to develop space-based applications for renewable energy, precision agriculture, environmental monitoring, and more, contributing to the EU Green Deal objectives.[71]

For instance, **OroraTech**, a German space company, developed a satellite-based wildfire detection system providing real-time data to combat forest fires, with support from ESA BIC Bavaria and the InCubed program.[72]

ESA BASS (Business Applications and Space Solutions)

ESA Business Applications and Space Solutions[73] is a comprehensive suite of programmes that supports the transformation of space technologies and data into commercial products and services, as part of the ARTES 4.04 The initiative provides companies with access to ESA's extensive technical expertise, market insights, and networking opportunities, along with tailored mentoring and funding support. By connecting startups with established industry players and facilitating partnerships, ESA Space Solutions helps drive the growth of the European space economy and encourages the

[70] ESPI (2021) Space Venture Europe. Retrieved from: https://www.espi.or.at/wp-content/uploads/2022/06/ESPI-Report-83-Space-Venture-Europe-2021.pdf
[71] ESA (2025) . Retrieved from: https://commercialisation.esa.int/2025/01/the-esa-bic-network-how-two-decades-of-expertise-crafts-a-gateway-to-space-for-business/
[72] OroraTech(2022). Retrieved from: https://ororatech.com/resources/news-blog/ororatech-receives-incubed-co-funding
[73] ESA BASS. Retrieved from: https://business.esa.int/

development of innovative, market-ready applications in areas such as satellite communications, navigation, and Earth observation..

In 2023, ESA's Business Applications and Space Solutions (BASS) published the "Green Dossier", detailing how space applications support sustainable development. The report highlights over 150 green applications funded since 2010, which have delivered commercial space-based solutions across various sectors, such as energy transition, circular economy, smart cities, sustainable agriculture, and ecosystem protection. The BA programme funds various space-related projects through zero-equity funding between €60.000 and €2 million. The BASS programme has invested over €183 million in more than 300 green initiatives, with around 50% of the projects focused on decarbonization. One of the standout success stories is Kayrros' Methane Watch Demonstration Project, which uses space technology to monitor and mitigate global methane emissions. These efforts support sectors like energy, mobility, and agriculture in accelerating their journey toward carbon neutrality.[74]

ESA Φ-lab

ESA Φ-lab[75] explores AI-driven Earth observation applications, having contributed to over 50 projects in climate monitoring, disaster response, and ecosystem management. To encourage the ESA Φ-lab has a portfolio of challenges that often address sustainability issues, like land cover classification, sustainable agricultural management practices and sea ice mapping. ESA Φ-lab also manages and contributes to several flagship programmes like "AI4EO", "AI for a Green and Sustainable Future", "QC4EO", "InCubed" and "Destination Earth and Digital Twin Earth".

For instance, the InCubed programme, also under the EOP, is a Public-Private Partnership co-funding programme of up to 80% to SMEs, supervised by the ESA Φ-lab that aims to support companies developing innovative and commercially viable solutions that harness Earth Observation data.[76] Other programmes like "Destination Earth and Digital Twin Earth" focus on creating high-fidelity digital replicas of the Earth, integrating real-time EO data with advanced modeling to enhance climate resilience, environmental monitoring, and policy decision-making.

[74] ESA Space Solutions (2023) Green Dossier. Retrieved from: https://business.esa.int/sites/business/files/ESA%20Green%20Dossier%20MASTER_Digital_Final.pdf
[75] European Space Agency. Retrieved from: https://philab.esa.int/
[76] European Space Agency. InCubed is an ESA programme managed by φ-lab (available: https://incubed.phi.esa.int/)

4.4.2 ESA's dedication toward advancing satellite technologies towards the green transition

FutureEO Programme

FutureEO is a programme under the umbrella of the Earth Observation programme[77] focused on the development of EO capabilities[78] over the next decades. It provides a range of tools such as providing a range of tools, such as zero equity funding, support in securing additional private investments and programmatic support. The Earth Explorer research missions are pivotal to FutureEO. These are satellite missions that monitor climate change and study environmental changes such as temperature anomalies and sea-level rise. Some mission examples can be seen in **Figure 8**.[79]

Figure 8: Earth Explorers missions (Source: ESA[80])

FutureEO supports climate action in line with international agreements, particularly the Paris Agreement, and helps bridge knowledge gaps in climate monitoring to provide evidence-based data for decision-makers. Additionally, it aims to enhance sustainable resource management by monitoring land degradation, water stress, deforestation, and ecosystem health, contributing to biodiversity

[77] Future EO Programme. Retrieved from https://www.esa.int/Applications/Observing_the_Earth/FutureEO/Introducing_FutureEO

[78] European Space Agency, Future EO (Retrieved from:: https://indd.adobe.com/view/a3fbcc56-df64-4e68-afc9-1667f7e84eed)

[79] Earth Explorers: ESA's pioneering science missions for Earth. Retrieved from: https://www.esa.int/Applications/Observing_the_Earth/FutureEO/Earth_Explorers_ESA_s_pioneering_science_missions_for_Earth

[80] European Space Agency (2024) Earth Explorers Missions. Retrieved from: https://www.esa.int/Applications/Observing_the_Earth/FutureEO/Earth_Explorers_ESA_s_pioneering_science_missions_for_Earth

conservation and the EU's circular economy objectives. FutureEO also aims to improve early warning systems for natural disasters like wildfires, floods, and droughts, supporting disaster resilience and adaptation efforts.

Space for a Green Future (S4GF) and Green Transition Information Factory (GTIF)

ESA's **"Space for a Green Future" (S4GF) Accelerator** is a co-governed and independent non-profit partnership of Green Transition actors. It aims to integrate satellite-based technologies to improve environmental monitoring and resilience, aligning with the EU's green transition and sustainability goals. It works on collaborative, user-driven, and scalable seed activities to develop space solutions for climate action, helping ESA maximize the impact of its space programs in supporting net-zero objectives by 2050.

The **Green Transition Information Factory**[81] is an online platform that aggregates satellite data to offer actionable insights for businesses, cities, and governments, helping them navigate the challenges of reducing carbon emissions and meeting EU targets. It is a cloud-based tool designed for municipal planners, businesses, and policymakers to track emissions from various sectors and assess carbon footprints.

4.4.3 ESA sustainability as a principle across different operations

ESA Green Agenda and Ecodesign

In 2023, ESA launched the **Green Agenda** to reduce greenhouse gas emissions and integrate sustainability across its projects. The agenda sets ambitious goals to reduce ESA's carbon footprint by 46% by 2030, with a particular focus on sustainable procurement practices, eco-friendly infrastructure, and sustainable mission designs. A baseline assessment revealed that 91% of ESA's GHG emissions came from Scope 3 (indirect) emissions, including the power consumption of external laboratories and the processing of space products. To address this, ESA uses a dual approach, combining organizational GHG assessments with environmental life cycle assessments (E-LCA), targeting significant reductions in emissions and contributing to broader EU climate neutrality goals. In **Figure 9**, it can be seen that ESA's Green Agenda, spans across 5 key areas.[82] ESA also incorporates the **EcoDesign framework** to ensure that life cycle assessments are part of mission planning.[83]

[81] Green Transition Information Factory. Retrieved from: https://gtif.esa.int
[82] European Space Agency (2023). Retrieved from: https://www.esa.int/About_Us/Climate_and_Sustainability/The_ESA_Green_Agenda
[83] European Space Agency. Retrieved from: https://www.esa.int/Space_Safety/Clean_Space/ecodesign

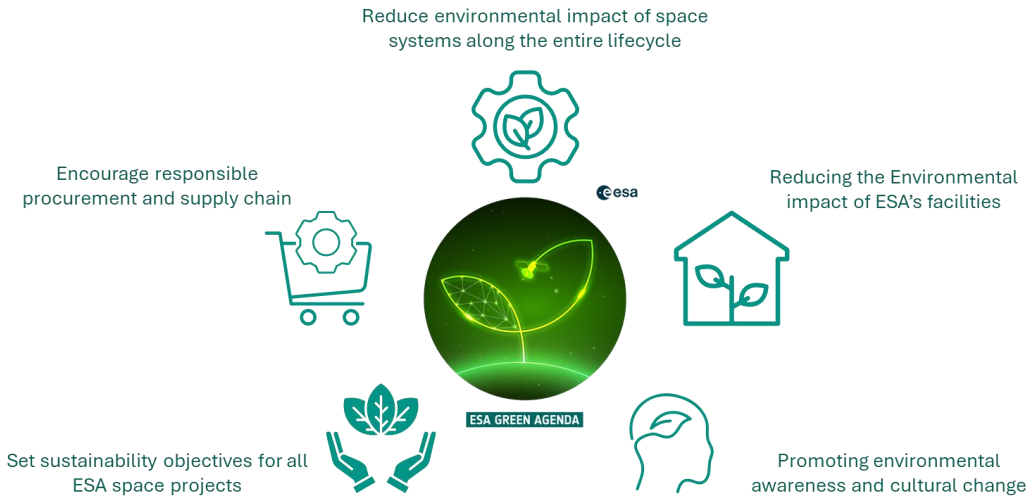

***Figure 9:** ESA's Green Agenda is an essential part of its strategic implementation of the Paris Agreement and the European Green Deal, aiming to reduce its environmental impact and contribute to the sustainable development of society (Source: ESA[84])*

ESA Climate Change Initiative

The **ESA Climate Change Initiative** focuses on generating long-term satellite data records, with 27 research projects as of 2024, tracking critical climate variables like greenhouse gases, sea levels, and land cover. These datasets support climate models, scientific research, and policy decisions aligned with the Paris Agreement and IPCC reports, contributing to global climate monitoring efforts.[85]

ESA Connectivity and Secure Communications (CSC)

ESA's **Civil Security from Space Programme (CSS), part of the ESA Connectivity and Secure Communications (CSC) initiative**, addresses the challenges posed by natural disasters, extreme weather events, and cybercrime. It focuses on developing space-based solutions that support civil security and crisis management, addressing the increasing complexity of risks identified in the **World Economic Forum's 2024 Global Risks Report**[86] and the **IPCC's call to action** against climate-change-related risks.[87]

[84] European Space Agency. Retrieved from: https://www.esa.int/About_Us/Climate_and_Sustainability/The_ESA_Green_Agenda
[85] European Space Agency. Retrieved from: https://www.esa.int/Applications/Observing_the_Earth/Space_for_our_climate/ESA_s_Climate_Change_Initiative
[86] World Economic Forum (2024), The Global Risks Report. Retrieved from: https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2024.pdf
[87] European Space Agency. Retrieved from: https://climate.esa.int/en/Scientific-highlights/Supporting-the-IPCC/

4.5 Existing acceleration initiatives and entrepreneurship opportunities

Beyond opportunities linked to the Green Deal, Europe boasts of a multitude of initiatives to boost entrepreneurship and accelerate the development of promising projects and technologies.

4.5.1 Acceleration Initiatives

There are numerous accessible accelerator programmes across Europe, spanning every region. Many of these initiatives focus on a broad range of technologies, with a growing emphasis on deep tech—including the space sector. However, dedicated space-specific programmes are comparatively rare. They tend to cluster in regions that either boast extensive accelerator networks and robust entrepreneurial ecosystems (e.g. Sweden and Switzerland) or have a long-standing history in space activities (e.g. France, Germany, and the UK).

Figure 10 and **Table 5**, show a distribution of incubators and accelerators throughout Europe, indicating the ones that were deemed most relevant for a selection of European countries. Aerospace "specialists" concentrate around countries with large space industries as expected, but strong incubators and accelerators are present throughout Europe. Space expertise can be found through other means such as partnerships.

Key players in Europe's space startup support landscape are closely linked to established institutional initiatives. For instance, the ESA Business Incubation Centres (ESA BIC) primarily provide incubation support (occasionally extending into acceleration services), while the CASSINI Business Accelerator specifically targets space ventures, offering intensive coaching, mentorship, and access to venture capital.

These initiatives play a crucial role in bridging the funding and expertise gaps that early-stage space ventures face. By offering seed capital, technical support, and valuable industry connections, they help transform innovative ideas into commercially viable solutions. Moreover, the success of these programmes not only attracts further private and public investment but also fosters strategic partnerships between startups, established aerospace companies, and governmental agencies. As Europe's space ecosystem continues to mature, the expansion and refinement of tailored acceleration and incubation services are expected to drive further innovation and help secure Europe's competitive edge in the global space economy. It is worth noting that the lack of a space-specific accelerator programme doesn't necessarily lack expertise in the field but is more of a signifier of lower Venture Capital interest in the area, often simply due to smaller economies and populations. Entrepreneurs in these regions can still receive support through a combination of generic accelerators and space expertise from incubators or institutions.

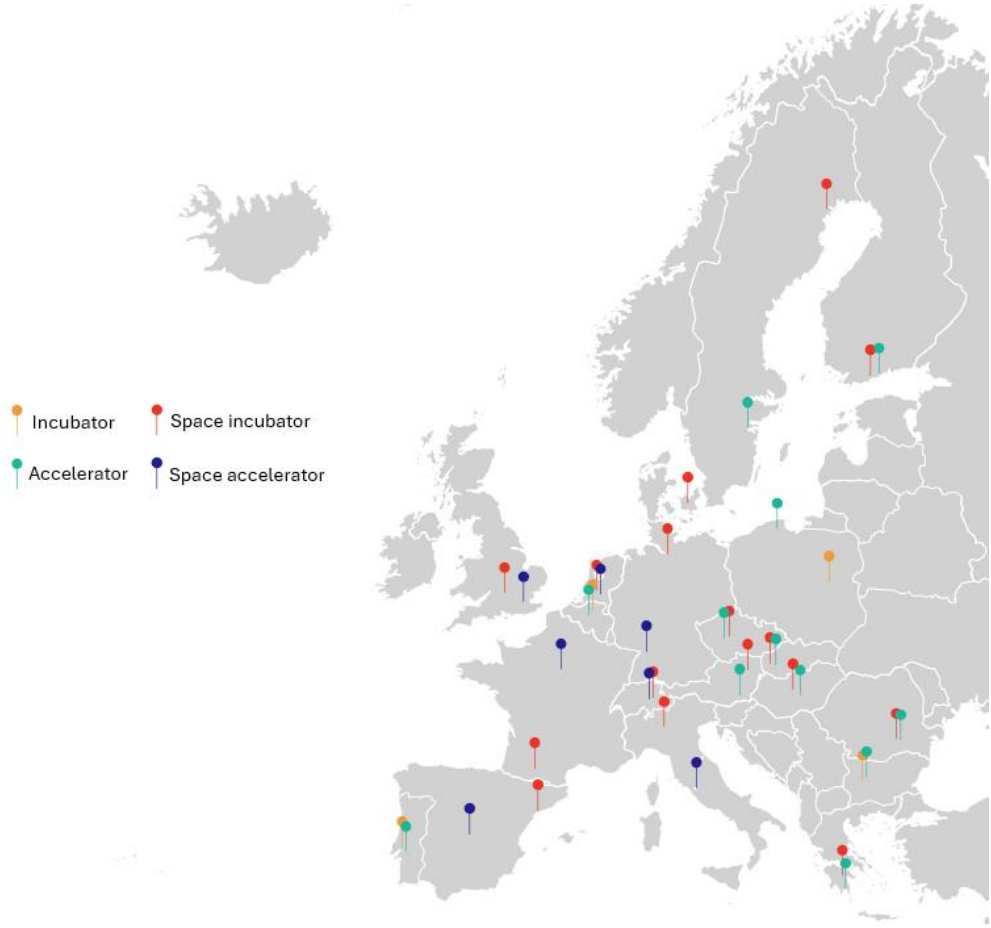

Figure 10: Distribution of incubators and accelerators for a selection of European countries (one of each per selected country)

Table 5: List of relevant accelerator and incubator programmes for space entrepreneurs for a selection of European countries. One of each selected per country (Source: Novaspace analysis)

Country	Local Incubator	Local Accelerator
Germany	**DLR Space Incubator** – Run by the German Aerospace Center, it has supported multiple space-tech ventures.	**Airbus BizLab** – A corporate accelerator that has successfully advanced aerospace innovations, including space projects.
United Kingdom	**Imperial Enterprise Lab** – Based at Imperial College London, this incubator has helped launch high-tech startups (including aerospace ventures).	**Seraphim Space Accelerator** – A dedicated accelerator based in London with a proven track record in scaling space-related startups.
France	**Station F** – Europe's largest startup campus in Paris, which has hosted tech ventures that include space-related projects.	**Space Founders** – A Paris-based accelerator program that has accelerated several independent space-tech startups.
Italy	**PoliHub** – The incubator of Politecnico di Milano that has a strong record in nurturing deep-tech and aerospace innovations.	**Luiss EnLabs** – An accelerator known for fast-tracking high-tech ventures, including those in the aerospace domain.

Spain	**Barcelona Activa** – A regional incubator in Barcelona that has supported various tech startups, some of which have advanced space-related projects.	**SeedRocket Barcelona** – An accelerator in Barcelona that has actively worked with emerging space-tech ventures.
Nether-lands	**SpaceHub** – A deep-tech incubator in Eindhoven that supports cutting-edge projects—including those with space applications.	**YesDelft!**– A well-established accelerator that has helped scale deep-tech startups, including space-oriented projects.
Switzerland	**Incubator @SCHWEIZERHOF** – Located in the Swiss Alps, this incubator is devoted to nurturing space-tech innovation and mentoring startups.	**Kickstart Switzerland** – An accelerator offering early-stage support and resources for technology ventures (with space project experience).
Poland	**Cracow Technology Park** – A real innovation hub in Kraków that has supported various high-tech projects, including those in the space sector.	**Startup Hub Poland** – A functioning accelerator network (found at startuphub.pl) that has worked with emerging space-tech ventures.
Belgium	**Co.Station Brussels** – A coworking and incubation platform in Brussels that has backed diverse tech startups—including space-related projects.	**Start it @KBC** – A well-known Belgian accelerator program that has supported innovative high-tech ventures, some with a space focus.
Sweden	**Ideon Science Park** – Located in Lund, this incubator supports deep-tech startups and has hosted ventures working with satellite data and space tech.	**STING** – A Stockholm-based accelerator that has helped scale several tech startups, including ones in the space domain.
Austria	**INiTS** – A Vienna-based incubator with a strong track record in nurturing innovative tech startups, including those in high-tech aerospace.	**Founder Institute Vienna** – The global accelerator's local chapter, active in helping deep-tech ventures grow in Austria.
Norway	**Forskningsparken Oslo** – A well-established research and business park in Oslo that incubates high-tech ventures, including space-related projects.	**StartupLab Norway** – An accelerator that has supported multiple tech startups in Norway, with experience in scaling deep-tech projects.
Denmark	**Symbion** – A Copenhagen-based incubator that supports innovative tech startups and has been involved with projects in emerging technology sectors.	**Accelerace Denmark** – A renowned Danish accelerator that supports early-stage tech ventures and has experience with space-oriented projects.
Finland	**VTT Ventures** – An incubation arm of the Finnish Technical Research Centre that has supported numerous deep-tech and space-related startups.	**Startup Sauna** – A well-known accelerator from Aalto University in Helsinki that has fast-tracked high-tech ventures including space tech.
Portugal	**Startup Lisboa** – A leading incubator in Lisbon that has backed a wide range of technology startups, some in the space sector.	**Beta-i** – A Lisbon-based accelerator that has actively supported deep-tech ventures, including those with space applications.
Czech Republic	**Impact Hub Prague** – A real incubator and coworking space in Prague that has hosted tech ventures, including projects in the space domain.	**UP21** – An established Prague-based accelerator program that has helped scale several tech startups, some with space-related focus.

Romania	**TechHub Bucharest** – A recognized incubator in Bucharest that supports innovative high-tech startups, including ventures in space-related sectors.	**Startarium** – A functioning accelerator program in Romania that has accelerated various tech startups, with examples in deep-tech fields.
Ireland	**Dogpatch Labs** – A Dublin-based incubator that supports innovative tech startups and has a history of backing ventures using satellite data.	**NDRC Ireland** – The National Digital Research Centre accelerator, which has supported a number of high-tech startups including space projects.
Greece	**Corallia** – An incubator focused on space technologies and innovation, nurturing startups in Greece's space sector.	**Found.ation** – A Greek accelerator program that has helped scale deep-tech ventures and has worked with companies in adjacent space sectors.
Hungary	**Design Terminal Budapest** – A genuine innovation hub in Budapest that has supported multiple high-tech startups, including projects linked to space.	**Momentum Accelerator Hungary** – An existing accelerator program in Budapest that has a track record of scaling tech startups in deep-tech areas.
Cyprus	**Eratosthenes Center of Excellence Space Business Incubation Programme** – Run by the ECoE supported by ESA	
Ireland	**Dogpatch Labs** – Dublin-based incubator known for supporting a range of innovative tech startups, including ventures using satellite data.	**NDRC Ireland** – The National Digital Research Centre accelerator that has fast-tracked several high-tech startups, including space projects.
Croatia	**Zagreb Technology Park** – An innovation hub in Zagreb that supports tech startups and has worked with companies in the deep-tech/space sector	**Founder Institute Croatia:** An extension of the global accelerator, providing a four-month program for aspiring entrepreneurs
Slovenia	**Ljubljana Innovation Centre** – A real incubator in Ljubljana that nurtures innovative tech startups, including those in deep-tech sectors	**ABC Accelerator:** Based in Ljubljana, it offers acceleration programs for startups aiming for global markets.
Malta	**Malta Enterprise Incubator** – A government-backed incubator that has supported various innovative tech startups, including space-related projects.	
Estonia	**Tehnopol** – Based in Tartu, this tech park incubates startups across deep-tech sectors, including those with space-related innovations.	**Startup Wise Guys** – A highly-regarded Estonian accelerator that has supported several deep-tech startups, some leveraging space tech.
Lithuania	**Vilnius Tech Park** – An established incubator supporting Lithuanian startups in the deep-tech sector, including projects with space applications.	
Latvia	**Riga Business Incubator** – A proven innovation centre in Riga that supports tech startups (with examples in deep-tech and space data applications).	**Latvian Startup Association (Startin.LV):** A non-profit organization established to unite the voices of Latvian startups and develop the startup community.
Bulgaria	**Sofia Tech Park** – A well-established incubator in Sofia that has supported various deep-tech startups, including those touching on space tech.	**Sofia Tech Park Accelerator** – Its acceleration program has helped scale high-tech ventures with space-related applications.

4.5.2 Other funding opportunities

Venture Capital Landscape

For companies needing access to finance, a robust ecosystem of venture capital is available to EU-based businesses developing and marketing space technology and digital services powered by space data. Dedicated space-focused funds—such as Primo Space, Promus Ventures, Expansion Ventures, Alpine Space Ventures, and OTB Ventures—specifically target the unique challenges of the space sector. In addition, multi-focused VC funds including Vsquared Ventures, UnternehmerTUM VC, Deep Blue Ventures, 42CAP, Qbic Fund, Radix Capital Partners, Voima Ventures, and HV Capital also invest in innovative space projects as part of their broader technology portfolios. The CASSINI Entrepreneurship Initiative further enhances deal flow by connecting promising space startups with investors through its dedicated Investor Network, ensuring that more companies can secure the necessary risk capital.[88] [89]

European Investment Bank (EIB)

Complementing equity financing, the European Investment Bank (EIB) has introduced new instruments to support the growth of EU space companies. In January 2024, the EIB signed a collaboration agreement with ESA and DG-DEFIS to boost access to debt finance and advisory services for SMEs and startups in the space sector.

The European Investment Bank (EIB) has supported various space projects, including SES's O3b mPOWER satellite network to expand broadband access, investments through the InnovFin Space Equity Pilot in funds like Orbital Ventures and Primo Space, and the Alphasat mission, which enhances mobile broadband services while demonstrating European technology.

In 2021, the EIB made significant investments in the space sector, both directly and indirectly. In July, it committed **€50 million**, backed by the **European Fund for Strategic Investments (EFSI)**, to **Wachstumsfonds Bayern 2**, a Bavarian growth fund that later invested in **OroraTech**, the Munich-based start-up developing nanosatellite-based wildfire early warning systems.[90]

The following month, the EIB provided a **€10 million loan** to the Bulgarian company **EnduroSat** to support nanosatellite development and expand its **Shared Satellite Service**, allowing customers to lease space assets for data collection.[91]

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[88] European institutions join forces to boost the European space sector (2024). Retrieved from: https://www.eib.org/en/press/all/2024-021-european-institutions-join-forces-to-boost-the-european-space-sector

[89] CASSINI Initiative Investor Network. Retrieved from: https://www.cassini.eu/cassini-initiative/investor-network

[90] European Investment Bank (2021). Retrieved from: https://www.eib.org/en/press/all/2021-247-eib-boosts-venture-capital-for-innovative-startups-in-bavaria

[91] European Investment Bank (2021). Retrieved from: https://www.eib.org/en/press/all/2021-291-eib-invests-eur10-million-in-new-space-scaleup-endurosat

Additionally, the EIB granted **€15 million** to the French company **Kayrros**, aiding the advancement of its Earth observation data analytics technology to assess climate-related economic impacts, as part of a **€40 million financing round**.[92]

European Innovation Council (EIC)

Moreover, the EIC Accelerator offers scale-up grants and investments, with a budget of 1B€ offers blended finance. It includes equity investments (up to €15 million) and grants (up to €2.5 million), along with tailored coaching and mentoring opportunities, providing yet another pathway for high-potential space ventures to scale and succeed.[93] Together, these financial instruments and programmes form a comprehensive funding landscape that is critical to driving European leadership in the global space economy.

The European Innovation council also has funding opportunities through EIC Pathfinder with up to €4 million grant to support early stage development of technologies; EIC Transition with up to €2.5 million grants to validate and demonstrate technology and develop market readiness; and STEP Scale Up which are investments of €10 million to €30 million, aiming to bridge the funding gap of high-risk innovations.[94]

[92] European Investment Bank (2021). Retrieved from: https://www.eib.org/en/press/all/2022-138-france-kayrros-specialise-dans-la-tech-climatique-beneficie-d-un-pret-de-15-millions-d-euros-de-la-bei

[93] European Innovation Council. Retrieved from: https://eic.ec.europa.eu/eic-funding-opportunities/eic-accelerator_en

[94] European Innovation Council. Retrieved from: https://eic.ec.europa.eu/index_en

5. Successful case studies of Space-enabled Green Solutions

5.1 Overview of case study implementation

This chapter presents a total of 27 collected case studies through structured interviews with innovative European SMEs which are actively applying space-based data and technologies in their operations. The survey included both startups and more mature SMEs from various industrial sectors. The interviews aim to capture real-world examples of how Earth Observation (EO), satellite communication, navigation, and integrated digital platforms can drive green innovation, sustainability, and digital transformation across various sectors.

The primary objective of this activity was to understand how SMEs are adopting and operationalizing space data, the barriers they face, the success factors enabling uptake, and the lessons learned that can inform future support mechanisms. The findings are going to guide the design of the project's Advisory Services, as well as the targeted support that FIERCE aims to deliver to selected SMEs.

5.2 SME selection criteria, profile, interview design and process

5.2.1 Interview design and process

The objective of the case study interviews was to explore:

- The role of space technologies in the SMEs' products, services, and value chains.
- Success factors that facilitated adoption, including enablers such as access to funding, knowledge, or partnerships.
- Barriers, challenges, and unmet support needs for scaling space-enabled solutions.
- Perspectives on potential support measures that could foster further integration of space data into green business models.

The collected insights provide examples of space-enabled green entrepreneurship and contribute directly to shaping the design of the FIERCE support services and toolbox, by understanding the use cases of the SMEs the project is targeting. In the meantime, hey also highlight both common patterns and sector-specific dynamics that influence the adoption of downstream space technologies.

5.2.2 Selection criteria and SME profile

The case study survey covered a diverse set of SMEs operating across various sectors where downstream space data plays a critical role. Many of the interviewed SMEs have multi-sectoral activities, reflecting the cross-cutting nature of space applications. For instance, an SME might combine EO with AI for both agriculture and environmental monitoring or use satellite communication across urban infrastructure systems and civil protection. Despite this overlap, an attempt has been made to categorize each SME based on its primary market orientation and targeted products and use

cases. The table below presents the dominant industrial ecosystem for each SME as identified through their business model, key products, and client focus.

Table 6: Number of selected SMEs per sector

Industry Sector	SMEs	Count
EO Services / Platform Providers	Totalview, Geosystems Hellas, Terra Spatium, Endurosat, EarthPulse, GHG Monitoring Solutions	6
Agriculture / Smart Farming	Agroapps, Acceligence, Neuropublic, bspoke solutions, Apisense, Baltic Satellite Service, Eofarm, Orbify, SENSORBITE P.S.A.	9
Environmental Monitoring / Water / Climate	Mobile Monitoring, CDXI solutions, Neuralio, Space4good, Caius, Kanop	6
Smart City / Infrastructure	Inteligg, Surviot, Losa/Parkspaceeco,	3
Mining	Geosense	1
Telecom / GovSatCom	Cloudsignals, Circuits Integrated Hellas	2

A summary of the 27 SMEs interviewed during the case study process highlights the core applications of space data integrated into the companies' products or services. It provides a snapshot of what space technologies and products are being leveraged across different industries, from precision agriculture and environmental monitoring to urban infrastructure and telecommunications. This mapping can help identify common use cases, innovation trends and potential areas for future development and support to SMEs from the FIERCE advisory tools.

Table 7: Core application and services of selected SMEs

No	SME Name	Country	Core Applications of Space Data
1	total view	Greece	VHR imagery, custom EO products for marine, telecom, universities
2	geosystems hellas	Greece	Software solutions in EO, GIS, photogrammetry for various sectors
3	terra spatium	Greece	Geospatial solutions, remote sensing, and software development
4	endurosat	Bulgaria	Space infrastructure builder
5	Agroapps	Greece	Precision farming, EO for irrigation, pest and yield monitoring
6	Acceligence	Cyprus	UAV + EO for smart farming and security surveillance
7	Neuropublic	Greece	Web- and Cloud-based integrated information systems and IoT for smart farming and civil protection
8	Bspoke solutions	Greece	XR + AI for precision ag, sustainability traceability, AgriChatbot
9	Apisense	Poland	Sentinel + IoT for bee health and environmental correlation
10	Baltic Satellite Service	Latvia	High-quality monitoring and analysis for forestry, environmental protection, and land management.
11	EOfarm	Greece	IT solutions in agriculture, water monitoring, and air quality assessment
12	Mobile monitoring	Poland	EO + drone + in-situ data for water quality, ports, defense

13	cdxi solutions	Greece	Disaster resilience, water quality monitoring, machine lifecycle intelligence
14	Neuralio	Greece	AI for ESG, biodiversity, land use, carbon credit forecasting
15	Space4good	Netherlands	Forest protection, carbon markets, biodiversity monitoring
16	Caius	Greece	EO for forest mapping, livestock tracking, protecting ecosystems
17	Kanop	France	EO for carbon sequestration, biomass validation and land-use verification
18	inteligg	Greece	EO for building energy efficiency, air quality, CO_2 management
19	Surviot	Hungary	GNSS + radar for tunnels/bridges, SatCom in remote areas
20	losa / parkspaceeco	Poland	EO for parking prediction, SR image models
21	Geosense	Netherlands	geological mapping, mineral exploration, and orebody detection services
22	Cloudsignals	Greece	5G NTN, SatCom, EO for maritime and remote connectivity
23	circuits integrated	Greece	MMIC chips for high-frequency Ka-band SatCom
24	EarthPulse	Spain	Custom EO solutions for various applications, namely for supply chain tracking
25	Orbify	Poland	EO reports on environmental monitoring of businesses
26	GHG Monitoring Solutions	Hungary	Earth observation data is used to detect and mitigate methane emissions in petroleum infrastructure
27	SENSORBITE P.S.A.	Poland	Provides a geospatial platform using AI to turn remote sensing data into actionable, easy-to-understand insights

5.3 Case studies Presentation

Totalview	
Industry/Ecosystem	Digital, Aerospace and Defense
Location	Athens, Greece
Year Established:	2011
totalview	TotalView brings 25+ years of experience in providing very high-resolution satellite imagery and cutting-edge geospatial solutions. The company specializes in satellite image provision, analysis and software development, delivering tailored solutions to a wide array of customers.

Applications of Space Data

TotalView utilizes very high-resolution remote sensing imagery (up to 30cm.) and data from various satellites, including WorldView, Skysat, SPIRE, ICEYE and others. The company retrieves, orders, processes, and delivers satellite images to clients based on their specific needs. Totalview customers, like marine companies, telecommunications providers, universities, government agencies, and others receive raw, unprocessed imagery or enhanced data products with custom processing, and specific index assessment. The company also supports various organizations with tailored geospatial analysis and GIS applications across multiple sectors.

Barriers & Support Requirements

One of the key challenges is maintaining a steady cash flow, as large Earth Observation projects, requires very close monitoring and specific deliverables. Scaling operations and maintaining high-quality services require careful planning and continuous market monitoring to adapt to industry demands. Success also depends on strong management skills, as well as a commitment to cooperation, integrity, and delivering high-quality results. TotalView has become a point of reference for EO data in Greece and Cyprus, with over 80% of its revenue coming from these markets. It emphasizes the importance of client satisfaction, ensuring that delivered EO services provide important solutions and meet the specific needs of the customer.

Success Factors

TotalView's success builts on decades of experience in the Earth Observation sector. Its founder has been active in the remote sensing field since 1993, starting from projects such as the identification of land parcels through EO, for farmer subsidies. This long-standing expertise, combined with the background and experience of TotalView's personnel, has provided deep industry knowledge, a strong foundation for innovation, and the ability to deliver high-quality satellite image processing and geospatial analysis. Today, there is a growing wealth of available satellite datasets and EU financial instruments, which can allow for new opportunities in EO applications and market expansion.

Lessons Learned

TotalView advises that SMEs looking to integrate EO data into their operations, should seek executive guidance and specialized training while planning their budget and resource allocation is very crucial. Understanding the costs and technical requirements early on can help ensure smoother adoption and scalability. With the vast variety of satellite data available, including standardized EO indicators for various sectors, companies must identify the optimal sources for their specific needs. TotalView believes that the EO sector is rapidly expanding, offering new opportunities in Green Entrepreneurship. The company aims to incorporate advanced products, such as hyperspectral imagery, to further enhance its services and remain at the forefront of the industry.

Geosystems Hellas S.A.

Industry/Ecosystem	Digital
Location	Athens – Greece (+ 2 branches in Athens & Heraklion, Crete)
Year Established:	2009
	Geosystems Hellas (GSH) delivers advanced geospatial software solutions, specializing in Earth observation, GIS, remote sensing, photogrammetry, and data management. It actively develops and integrates platforms for Smart Cities, IoT, and Enterprise Solutions, offering tailored solutions for environmental monitoring, urban planning, natural resource management, cultural heritage, security, and disaster risk management.

Applications of Space Data

GSH utilizes European optical and radar data for remote sensing in agri-food, urban well-being, cultural heritage, environmental monitoring, civil protection, security, and defense. It specializes in monitoring infrastructure for Smart Cities and public-private projects while advancing Big Data, Data Fusion, and AI-driven analytics in European and national initiatives. While Copernicus data remains the primary source due to its reliability and accessibility, commercial solutions may sometimes be required to overcome orbital constraints and spatial resolution limitations, particularly for military applications.

Barriers & Support Requirements

Regarding the actual technical integration of space data from Copernicus, it was noted that spatial resolution presents a limitation, as the 10-meter pixel size can be highly restrictive. This constraint affects the level of detail available, particularly for applications requiring high precision. As a result, for certain use cases such as defense, the resolution of Copernicus data alone may not be sufficient to meet specific operational and analytical requirements, necessitating the integration of higher-resolution commercial satellite data.

Success Factors

GSH's success is driven by strategic partnerships, technological expertise, and industry leadership. As the exclusive reseller of Hexagon in Greece and Cyprus, it expands access to advanced geospatial solutions. Executing contracts for the European Space Agency GSH plays a key role in the downstream space sector in Greece and is considered a well-established entity in European level.

Its full integration of Copernicus data, combined with expertise in big data, AI, and machine learning, fuels innovation in European and national projects. With a team of over 30 skilled engineers, GSH delivers cutting-edge solutions across multiple disciplines. Its close connection with EARSC, HASI, and the Si-Cluster, along with the strong public sector collaborations, further strengthens GSH's industry influence.

Lessons Learned

The main lessons learned from their journey so far, that could be useful for new companies in the field:

- Data Synergy is Key – Integrating satellite, IoT, space-based, and ground data enhances accuracy and enables effective downscaling, leading to more precise insights.
- Technologies must be scalable and adaptable to support growth, evolving markets and new applications.
- With the Earth Observation market set to significantly grow by 2030, innovation in the sector offers significant opportunities for new business.

TERRA SPATIUM SA

Industry/Ecosystem	Digital
Location	Athens – Greece
Year Established:	1989
	TERRA SPATIUM SA specializes in geospatial solutions, remote sensing, and software development. It designs and supports advanced geospatial systems, leveraging Earth observation data and cutting-edge technologies. The company provides integrated solutions in mapping, environmental management, agriculture, defence, and border security, while supported the Greek ground segment for the HELIOS-II Earth Observation satellite.

Applications of Space Data

TERRA SPATIUM leverages Earth observation data from optical and radar satellites, including Copernicus (Sentinels), tailored to each service. As an Airbus data reseller, it provides high-resolution imagery from its optical and radar satellites. Its applications include mapping, environmental monitoring, precision agriculture, forestry, coastal erosion monitoring, mining, defence and maritime surveillance. By combining satellite data, drone imagery, and AI-driven analysis, it enhances decision-making and operational efficiency across industries.

Barriers & Support Requirements

TERRA SPATIUM, as many other companies in Greece, faced economic instability during the Greek financial crisis and bailout programs period, impacting revenues and market conditions. A major barrier remains the lack of state funding, (or a co-financing model between the public and private sectors) that could support the uptake of downstream space solutions which are still perceived as a commodity. Unlike one-off projects, remote sensing and monitoring require continuous investment and recurring funding, as they are ongoing processes rather than single-use solutions. The absence of a structured financial framework limits scalability, slowing the integration of remote sensing technologies especially into the public-sector operations.

Success Factors

With over 30 years of experience, TERRA SPATIUM has grown organically through co-financed projects, establishing itself in the geospatial and space technology sector while serving public and private clients. Expanding beyond traditional geospatial services, the company integrates cutting-edge technologies, including patented solutions and innovations in precision beekeeping, enhancing monitoring, sustainability and efficiency in apiculture. Demonstrating its steady and sustainable growth, the company has doubled its staff over the past 1.5 years, reinforcing its commitment to progress. Strengthening its industry presence, TERRA SPATIUM actively participates in ESA co-financed projects and holds memberships in esteemed organisations such as The American Hellenic Chamber of Commerce, EARSC, HASI, Si-Cluster, EUGENIUS, and HASDIG.

Lessons Learned

The main lessons learned are (i) new geospatial businesses in Greece should seek support from ESA BIC Greece and Si-Cluster, for funding, mentorship, and resources (ii) integrating spin-offs and research centres bridges innovation with real-world applications, driving growth and advancement (iii) exploiting the shifting priorities of public institutions due to climate change offers opportunities for adaptable and forward-thinking solutions in the sector.

EnduroSat

Industry/Ecosystem	Space Infrastructure Builder
Location	Sofia, Bulgaria
Year Established:	2015
ENDUROSAT	EnduroSat is a space infrastructure builder, streamlining space missions in LEO and beyond. The company manages every step—from mission design to launch and operations—serving over 350+ customers globally and employing more than 200 space professionals across 6 locations worldwide. The company's track record includes 2,500+ modules in orbit and 60+ satellites delivered to customers.

Applications of Space Data

EnduroSat designs and operates satellites up to 400 kg, providing businesses and researchers with space data which can be used for environmental monitoring, urban planning, and disaster management. Company's comprehensive Space Service handles mission design, launch, and operations, delivering analysis-ready data on demand. Equipped with advanced onboard AI, EnduroSat's satellites offer insights with reduced data latency and transmission volume.

Barriers & Support Requirements

Data users need timely and high-resolution data for addressing societal and environmental challenges. Users face difficulties in accessing high-resolution satellite imagery due to limited access and associated cost, hindering progress in crucial sectors. Space data has traditionally been exclusive to governments and major players due to cost and complexity, a challenge EnduroSat is committed to solve.

Success Factors

EnduroSat satellites are software-flexible, with AI capability in orbit, significantly outmatching the current solutions. The systems are delivered at significantly lower cost without compromising on data accuracy and performance, providing the capability to support the most advanced applications for data processing. With 5-year lifetime, the missions follow an agile development approach allowing for rapid technology iterations and enhancements with each satellite generation. With flexible mission operations, the customers have direct control over the data quality, acquisition and delivery process at significantly shorter timeframes.

Lessons Learned

Space data is essential for understanding and managing our environment. By providing the private sector with affordable access to this data and the tools to develop diverse applications, we can significantly transform humanity.

Agricultural Applications IKE (AGROAPPS)

Industry/Ecosystem	Digital, Agri-Food
Location	Thessaloniki, Greece
Year Established:	2016
AgroApps	Agroapps is specializing in data-driven solutions for precision farming, climate-smart agriculture, and sustainability monitoring. It uses Earth Observation data, AI-driven analytics, and advanced modeling techniques, to deliver customized decision-support tools for farmers, agribusinesses, and policymakers.

Applications of Space Data

AgroApps exploits Earth Observation (EO) data and climate modeling to deliver precision agriculture solutions. It utilizes Sentinel, LandSat, MODIS and private constellations' satellite imagery, as well as numerical weather forecasting to provide real-time information and support on various crop management practices.

The company's applications AgroApps 360 and AgroApps Hydro, integrate weather and satellite data for farm management and irrigation optimization, helping farmers improve yields and reduce water use and resource waste. Specifically, this data are used for crop growth monitoring, for the calculation of the daily soil water balance, irrigation demand and expected yield, for the delineation of management zones for variable applications, and the estimation of possible pest emergence and disease outbreaks. The company's commercial solutions are currently used by more than 12,000 farmers, various agri-food companies and water managing authorities in the Greek Territory.

Barriers & Support Requirements

A significant barrier has been the reluctance of farmers and authorities to adopt smart data-driven farming practices due to significant digital illiteracy and lack of trust in digital applications. Also developing high-accuracy and precision applications required specialized expertise, making it essential to attract skilled professionals in Remote Sensing. AgroApps has participated in many EU-funded projects and established fruitful collaborations with many other companies and institutions in the field. Through its extensive portfolio and R&D projects it has developed advanced capabilities in remote sensing data and applications, allowing to experiment with new technologies and products.

Success Factors

The combination of high skilled personnel, R&D opportunities and strategic collaborations has been key to AgroApps' growth and success. Through building strategic partnerships with major players in the space and technology sectors like SPACE Hellas and business innovation ecosystems, AgroApps has progressed with state of the art digital applications. The involvement in CASINI hackathons and similar initiatives has helped the company test innovations, gain exposure and build strategic collaborations within the European space and agri-tech ecosystems.

Lessons Learned

A key takeaway is that participation in research projects and innovation-driven initiatives provides valuable knowledge and capabilities, allowing companies to experiment with new technologies and refine their products. It is essential though to develop a clear, scalable business model, based on the end-user's and market needs, to seek funding opportunities and invest in partnerships with space agencies and other research institutions.

ACCELIGENCE	
Industry/Ecosystem	Agriculture, Environment, Transport, Security, Defense
Location	Nicosia, Cyprus
Year Established:	2019
ACCELIGENCE	ACCELIGENCE LTD is a technological SME, focusing on the research, design and manufacturing of robotic solutions with emphasis on custom UAVs. The company offers a number of prototypes, capable of being adapted on all business verticals. ACCELIGENCE is targeting mainly the Agriculture, Environment, Transport, Security and Defense Market. The mission of ACCELIGENCE is the commercialization of all significant research results achieved in the company's laboratory and the research project participated/ing.

Applications of Space Data

ACCELIGENCE activities are closely connected with space data, as all company's products/services require the use of navigation data through GNSS technologies. The use of such datasets are mandatory for our autonomous navigation services and to ensure the safe and standardized operation of our products. Space datasets such as satellite communication services or remote imaging are considering as features for our operations as many missions requires them in order:

1) to establish secure communication links in extreme remote areas
2) to validate remote areas before the flight planning.

Considering the above, it is obvious that the impact of space data in our business is very high.

Barriers & Support Requirements

The challenges we are facing in adopting space data (mainly earth observation images) in our business lies more on the limited market needs for this combined (space/UAV) technology exploitation and the luck of expertise (technological maturity). We believe that through continuous research on the features that these technologies/dataset can offer, we will have a rapid expansion of the specific market.

A nice example is the participation of our company in a project named CALLISTO, in which we promoted the combined use of EO images and UAV operation in the area of Agriculture and Security.

Success Factors

As we already mention in the section above the continuous research (and the corresponding funding for research and innovation) helped our company to unlock new services and application in the era of space dataset exploitation.

Lessons Learned

Acceligence considers the following important factors for SMEs:

Data space users are likely to experience increased market share and growth, thanks to the expanded data-sharing capabilities.

Diversification: The ability to access and share various datasets (open, closed, research, etc.) opens doors to new roles and business opportunities within the market.

Innovative Business Models: Users can explore innovative business models, including cross-border and collaborative models tailored to specific use cases.

SMEs can be benefited more from the above thanks to their inherent organizational and technological flexibility

NEUROPUBLIC S.A.	
Industry/Ecosystem	Digital, Agriculture
Location	Piraeus, Greece
Year Established:	2003
NEUROPUBLIC	NEUROPUBLIC specializes in Web- and Cloud-based integrated information systems. It developed Greece's first large-scale IoT infrastructure, deploying thousands of custom wireless sensors on agricultural land. By leveraging Earth Observation data, AI, IoT, and its Code Generator tool, it delivers advanced services in smart farming, civil protection, and environmental monitoring.

Applications of Space Data

NEUROPUBLIC develops telemetric agrometeorological stations, sensors, and data analytics systems while managing a vast network across Greece. It leverages satellite monitoring for smart farming, crop classification, geo-analytics, civil protection, and environmental monitoring, as well as advanced ERP systems that meet the diverse needs of various organizations. Its flagship system, gaiasense, integrates thousands of IoT sensors across agricultural land in Greece and Europe with a satellite data processing platform and a cloud-based application ecosystem. For these purposes, NEUROPUBLIC primarily uses Copernicus satellite data, develops algorithms, and incorporates high-resolution purchased data from private satellites based on specific needs.

Barriers & Support Requirements

As NEUROPUBLIC expands, it faces infrastructure challenges, with vast satellite image volumes requiring continuous storage, high computational power, and efficient data management. This demands high-speed servers with substantial memory capacity, increasing acquisition and maintenance costs. Ensuring reliable data verification also requires a specialized expert ecosystem and advanced validation methods. The high cost of sustaining such a system creates a major entry barrier for new players.

Success Factors

NEUROPUBLIC develops Gaiasense, Europe's first integrated smart farming system, offering advanced yet user-friendly services for all farmers. It combines satellite imagery for crop monitoring and large-scale technology with expert input from agronomists, researchers, and laboratories to support decision-making. Leveraging proprietary technologies and a specialized team—including 34 agronomists—NEUROPUBLIC processes vast Earth Observation data to deliver tailored, market-ready solutions. Supported by the European Space Agency's Business Incubator in Greece, it contributes to major projects like ScaleAgData, DIVINE, Farmtopia, QuantiFarm and PoliRuralPlus while maintaining strong collaborations with the Greek public sector.

Lessons Learned

The main lessons learned from their journey so far, that could be useful for new companies in the field:

- A good idea alone is not enough. A well-structured and realistic business plan, aligned with market needs and readiness, is crucial for successful implementation and scalability.
- Companies should focus on building their own expertise rather than replicating existing solutions. Investing in knowledge, expertise, and technological development is essential for long-term success and competitiveness.

bSpoke Solutions P.C.	
Industry/Ecosystem	Digital, Agriculture
Location	Thessaloniki, Greece
Year Established:	2022
bSpoke solutions	bSpoke Solutions P.C. specializes in developing custom digital solutions for agriculture, leveraging expertise in Artificial Intelligence (AI), Machine Learning (ML), microservices, and IoT-based applications.

Applications of Space Data

With deep experience in data management, predictive analytics, and real-time processing, bSpoke Solutions P.C. has successfully developed and deployed cutting-edge technologies tailored to the needs of the AgriFood sector, manufacturing and other high-impact industries.

Key projects and products integrating EO data, include:

• AgriVision – An XR-powered application enhancing farm management and advisory services for farmers, consultants and AgriFood companies. When using the AgriVision lenses, satellite images and vegetation indices are augmented onto the real field and dynamically adjusted, based on the farmer's location (GPS coordinates), varying at the field's borders compared to its interior.

•EcoTrace – A digital traceability solution supporting sustainable agricultural practices and data-driven decision-making. EcoTrace calculates a number of sustainability indicators related to the farming practices followed to achieve production and establishes traceability from farm to the shelf. The indicators are calculated using, among others, satellite data especially in determining the crop water needs and crop evapotranspiration.

•GreenFit HE – An AI-driven chatbot and decision support tool designed for precision agriculture and farm optimization. The AgriChatbot is fully integrated with Farm Management Information Systems and provides insights to farmers also by analyzing time series of EO images over the farms.

Barriers & Support Requirements

To overcome any barriers, bSpoke's team includes lead software engineers, data scientists, agronomists, remote sensing experts and technical managers, each bringing extensive experience in designing, implementing and delivering innovative digital solutions that drive efficiency, sustainability and automation. bSpoke Solutions maintains active participation in research consortia, technology demonstrations and industry events, underscoring its commitment to fostering innovation and knowledge sharing.

Success Factors

In many of its products bSpoke Solutions P.C. brings sector-specific knowledge combining different experts with strong technical skills. The company's expertise ensures that its applications address the practical challenges faced in various sectors. bSpoke has a sharp focus on sustainability, digital transformation and user-centric design, core principles that define its approach to developing cutting-edge technological solutions. Having extensive experience in ICT and AI technologies, bSpoke Solutions has consistently bridged technological advancements with real-world challenges.

Lessons Learned

bSpoke Solutions P.C. leveraged partnerships, research collaborations, and advanced analytics to integrate EO data effectively, overcoming barriers like limited expertise and funding. Key takeaways include the importance of multidisciplinary teams, seamless integration with existing digital tools, and a focus on real-time, actionable insights to drive efficiency and sustainability.

Apisense

Industry/Ecosystem	Agri-Food
Location	Kraków, Poland
Year Established:	2022
Apisense	Apisense develops AI-driven solutions for real-time diagnosis and monitoring of bee colony health. Their technology combines sensors and advanced analytics to quickly detect diseases and environmental threats within beehives. Targeting beekeepers globally, Apisense aims to support sustainable beekeeping by enabling early interventions, reducing bee mortality, and enhancing productivity, ultimately contributing to ecological balance and agricultural efficiency. http://apisense.ai

Applications of Space Data

In Apisense's flagship BeeSentry project space data (Copernicus Sentinel-1 & 2) was used to identify vegetation types and phenological phases around infected beehives. Satellite imagery complemented IoT sensors placed within hives, allowing detection of pathogens like Varroa or American foulbrood.
Roadmap to access the data: Satellite-derived vegetation data was integrated with AI-based disease detection models. This enabled Apisense to assess environmental factors influencing disease spread, creating an early-warning system for local beekeepers and improving decision-making regarding hive management and interventions.

Barriers & Support Requirements

The BeeSentry product was successfully developed with support from ESA's BASS ARTES program. Funding enabled operational testing, making the solution ready for full-scale deployment and manufacturing. Collaboration with Poland's leading bee research centers—University of Life Sciences in Lublin and Wrocław—and numerous meetings with beekeepers, veterinarians, and producers significantly increased community recognition. Greater adoption would be facilitated by governmental agency support, as systematic implementation and mandatory usage could effectively reduce or even eliminate bee diseases at regional scales.

Success Factors

Key factors in Apisense's successful adoption of space data included ESA funding, strong collaboration with renowned research institutions, and effective community engagement through continuous dialogue with end-users (beekeepers, veterinarians, producers). Additionally, a robust focus on educational outreach helped establish credibility and facilitated acceptance. Innovation, technology integration, and partnerships also significantly contributed, enhancing the solution’s market readiness and demonstrating clear practical value to stakeholders.

Lessons Learned

A key insight from Apisense’s experience is the importance of educational outreach and organic community engagement, including participation in industry conferences and active collaboration with potential end-users. It's valuable to target both business and governmental clients early on. Regarding space data integration, businesses should first experiment using freely available datasets and analytical tools to assess practical benefits. Only when clear added value emerges should commercial datasets be considered. Additionally, investing in partnerships with specialized institutions accelerates expertise-building and adoption.

Baltic Satellite Service	
Industry/Ecosystem	Digital Space, Forestry, Environment
Location	Riga, Latvia
Year Established:	2009
BSS Baltic Satellite Service	BSS specialises in remote sensing and geospatial intelligence, offering tailored Earth Observation (EO) solutions for clients like governmental organizations, farmers, private companies. The company develops and delivers custom platforms, algorithms, and spatial databases, enabling high-quality monitoring and analysis for forestry, environmental protection, and land management.

Applications of Space Data

Baltic Satellite Service utilizes a combination of open-access satellite data, such as Sentinel-1,2 and 3 from the Copernicus programme, and commercial satellite products from providers like Planet and Maxar via Airbus, to deliver tailored remote sensing solutions. The datasets are complemented by aerial photographs, drone imagery, and meteorological sensor data, enabling high-resolution, multi-source analysis across diverse environments. The company has developed advanced geospatial platform GeoHub.net for integrating, processing, and publishing geospatial data using industry-standard protocols (XYZ/TMS, WMS, MVT, S3). It is used for forest, agriculture, utility network, flood, fire and other environment event, habitat and parameter monitoring, provision of cloud-free imagery basemaps, different other geospatial data and web applications, custom tools and ML algorithms to support its end-users from different industries.

Barriers & Support Requirements

In its early stages, Baltic Satellite Service faced challenges in navigating the landscape of existing technologies and identifying the most suitable platforms and data sources for their applications. The integration and management of data from drones, alongside the processing of multi-source datasets such as satellite imagery, aerial photos, and meteorological data, required a high level of technical expertise and specialized training. One of the key requirements for overcoming these barriers has been the ability to build and retain a team of skilled scientists and developers capable of designing custom algorithms and application-specific tools.

Success Factors

BSS has a client-centric approach that enables the company to deliver reliable, purpose-driven solutions across different sectors. Their success comes from a strong background in GIS and geospatial technologies and their involvement in field-based projects and research initiatives supported by ESA, Interreg, Eurostars, and other. Among the company's early achievements were the development of a forest health risk monitoring platform, a biotope monitoring tool and a greenhouse gas emissions monitoring system, both of which included remote sensing data for environmental monitoring and helped position the company as a credible and capable EO service provider.

Lessons Learned

Understanding the specific needs of the customer, with a clear awareness of the technical capacities and limitations of the team and tools is really important for success. A solid business plan defining what product or service is being developed, who it serves, and resources (IT, scientists, software) is needed. Equally critical is understanding the available types of data, how to access and process them efficiently, and which existing platforms and technologies can be leveraged to reduce development time, cost and complexity.

EOFarm	
Industry/Ecosystem	Digital, Agriculture
Location	Preveza, Greece
Year Established:	2017
EOfarm	EOFarm is a spin-off of the National Technical University of Athens (NTUA), providing EO-based services and IT solutions in agriculture, water monitoring, and air quality assessment. The company has conducts monitoring studies for national and European agencies such as Municipalities, the Greek Payment Authority of C.A.P. and ESA, delivering data-driven tools for sustainable resource management. EOFarm serves clients including farmers, agri-tech firms, and public bodies, combining satellite analytics with digital innovation.

Applications of Space Data

EOFarm utilizes a wide range of remote sensing data, including spectral, thermal, and radar imagery from open sources such as USGS, Copernicus, and JAXA, and commercial providers like IKONOS, WorldView, and Planet. These datasets are integrated into custom geospatial applications and IT platforms, enabling high-resolution monitoring of agriculture, water systems, and environmental conditions. The company applies this data in operational and research-driven tools, including contributions to major projects such as the IT support of ESA's exploitation platforms. By combining EO data with advanced analytics, EOFarm delivers scalable, real-time insights to users across both the public and private sectors.

Barriers & Support Requirements

EOFarm identifies technical challenges as the most significant barriers in working with EO data. One key issue is that not all datasets are compatible with OGC (Open Geospatial Consortium) standards, which can hinder data processing, interoperability, and communication across systems. This lack of standardization complicates the development of scalable and open EO applications, especially when integrating data from diverse sources. While funding is not considered a major obstacle for SMEs, the company emphasizes the importance of open standards and system compatibility.

Success Factors

Early in its development, the company participated in the Copernicus Incubation , which provided valuable support in transforming research into market-ready services. Since then, EOFarm has built strong partnerships with universities, ESA, national agencies, and European research projects, reinforcing its role. The company was also recognized for its innovation, earning 2nd place in a regional innovation competition in Epirus. EOFarm considers mentoring, training, and networking essential for new SMEs, especially in a rapidly evolving space-data ecosystem. But it also points out the importance of open data and open source technologies for SMEs to enter the EO sector.

Lessons Learned

EOFarm openly acknowledges that some of its early projects, particularly with public authorities, did not yield profit, but these experiences were crucial learning opportunities. Supporting clients with limited technical background helped the team refine its communication, technical support, and service delivery. The company advises other SMEs to carefully estimate the time and resources required for a project and strongly encourages the use of open-source software and open-access EO data, which can significantly reduce development costs while ensuring flexibility and adaptability in solution design.

Mobile Monitoring Sp z o.o.	
Industry/Ecosystem	Environmental Monitoring, Infrastructure safety
Location	Gdansk, Poland
Year Established:	2022
MOBILE MONITORING	Mobile Monitoring Sp. z o.o. develops an integrated environmental monitoring system that combines satellite data, autonomous water drones, in-situ sensors, and AI. Our solution enables real-time monitoring of water quality, early detection of threats like algae blooms or pollution, and supports infrastructure safety. We target public institutions, ports, environmental agencies, and the defense sector. Our mission is to support sustainable water management and climate resilience by using space-based technologies and automation

Applications of Space Data

We use Earth observation data, mainly from the Copernicus programme, to monitor key water parameters such as chlorophyll levels, surface temperature, turbidity, and salinity. This data supports early detection of environmental risks and enhances situational awareness — especially relevant for applications in environmental monitoring, defense and maritime security. Satellite data is integrated into our platform via API, displayed alongside drone and in-situ measurements, and used for real-time analysis, alerts, and automated reporting. This combined approach allows for large-area monitoring, supporting both civilian and strategic infrastructure protection.

Barriers & Support Requirements

Our main barriers in adopting space data included limited in-house expertise in satellite data processing and the need for additional funding to develop dedicated tools for integration and visualization. Accessing and interpreting EO data required time and specialist support, especially in the early stages. Participation in the ESA BIC incubation programme, technical consultations, and collaboration with academic partners (e.g. University of Gdańsk) helped us overcome these challenges. Further support — particularly in the form of targeted funding and access to EO training — would accelerate adoption in more advanced use cases, including defense, infrastructure protection, and climate risk monitoring.

Success Factors

Key success factors in our adoption of space data included a clear use case (real-time water monitoring), strong internal focus on innovation, and access to expertise through ESA BIC and academic partnerships. Collaboration with institutions like the University of Gdańsk enabled us to validate satellite data and apply it effectively. Support from funding and acceleration programmes also played a role, helping us build custom tools and integrate EO data into a scalable, multi-source monitoring platform.

Lessons Learned

We learned that combining satellite data with other sources (like sensors and drones) creates the most value. Starting with a clear use case and involving end-users early helped us design practical tools. The key is to integrate space data gradually and focus on making it easy to use through automation and clear visualizations.

CDXi solutions	
Industry/Ecosystem	Manufacturing, Environment / Digital and Green AI solutions
Location	Thessaloniki, Greece
Year Established:	2023
	Offering mature solutions already tested at the research level, CDXi Solutions emerged as a spin-off of CERTH ITI, specializing in Quality Assurance using Space (EO) and non-Space data. It develops custom, data-driven, and explainable AI solutions to support the digital and green transition across public and industrial ecosystems. From disaster resilience and water quality monitoring to machine lifecycle intelligence, its cutting-edge AI services drive real impact.

Applications of Space Data

CDXi leverages advanced Multimodal AI Data Fusion combining visual and IoT data to transform space data into actionable insights, primarily utilizing Copernicus satellite data and integrating high-resolution datasets on demand. It develops AI-driven solutions for different domains such as disaster resilience, water quality assessment, industrial diagnostics, and liquid metal inspection, reducing sensor dependency while enhancing environmental monitoring. Moreover, it is actively engaged in the National Microsatellite Program, developing services that utilize satellite imagery.

Barriers & Support Requirements

As a spin-off, CDXi aimed to bridge the gap between research and industry, turning cutting-edge innovation into tangible, real-world solutions. Driven by a vision to make a lasting impact, the company leveraged CERTH's Technology Transfer Structure, branded as "SPIRA," to navigate this journey, developing its first business plan within the program in early 2023. However, transitioning from academia to the market came with its own set of challenges, including bureaucratic barriers and the slower pace of processes involving public sector clients, impacting timelines and efficiency.

Success Factors

CDXi's research-tested solutions paved the way for its development as a spin-off, providing a strong foundation for growth without the need for initial upfront investments. Having set a clear vision and a business strategy from the start, CDXi participated in the European Space Agency Business Incubation Center of Greece and took part in many other competitions for green tech companies. In tandem with strengthening its foothold in the domestic market, CDXi is now steadily expanding into Europe, solidifying its position in the industry.

Lessons Learned

The main lessons learned from their journey so far are (i) a strong business plan and a well-defined strategy are essential from the get-go. Having a clear strategy is crucial, and more importantly, to be involved and engaged in its implementation on your own, so as to truly understand the positioning of the company and the market, (ii) establishing strong partnerships early on with experienced professionals and key industry players is invaluable. Learning from those who have been in the field for years can provide critical insights and accelerate growth. Finally, CDXi stressed out the importance of a collaboration with a skilled accountant and a reliable lawyer to efficiently navigate the bureaucratic and financial challenges that manifest early on.

Neuralio Artificial Intelligence	
Industry/Ecosystem	Digital
Location	Thessaloniki, Greece (HQ)
Year Established:	2022
neuralio ARTIFICIAL INTELLIGENCE	Neuralio AI specializes in delivering cutting-edge artificial intelligence solutions tailored for the environmental sector. The company leverages Earth Observation data and AI to offer comprehensive services in sustainable land use planning, climate and weather forecasting, land suitability evaluation, environmental footprint monitoring and agent-based simulations.

Applications of Space Data

Neuralio utilizes satellite monitoring (mostly EO), climate information, agent-based modelling and spatial suitability, to offer (i) land use planning (ii) crop suitability (iii) green bonds and carbon credits and (iv) nature related financial risks. In parallel, Neuralio uses satellite imagery and life cycle assessment analysis to offer (i) territorial LCA analysis (ii) sustainability metrics, (iii) biodiversity and ecosystem health analysis and (iv) ESG monitoring and assessment. The satellite data it mostly uses for these purposes are Copernicus EO data (land surface monitoring, climate projections), NASA & ESA satellite imagery (historical and real-time analysis) and Geostationary satellite data (e.g. Meteoset).

Barriers & Support Requirements

Ever since its foundation, Neuralio AI relies on its in-house expertise for the adoption, integration and analysis of the downstream space data. Even though this has proven very effective it comes with high costs to attract and retain highly qualified personnel.

Regarding the actual technical integration of space data from EUSPA, it was pointed out that the integration of satellite data of Copernicus for example is a quite straightforward and user-friendly process, especially in their data-agnostic integration pipelines.

Success Factors

First of all, Neuralio understood very quickly that with regards to downstream space data analysis, the value lies not in the data itself but in how you make sense out of them for the particular needs of the client. This is why the company pays a lot of attention in creating “fit for purpose” actionable forecasts and analyses. As they highlighted “it does not add value to a local farmer to provide imagery of their land fields, they visit them at least 2 times a day”.

On top of that, working with highly specialized AI/ML & EO experts is critical to stay ahead of competitors as well as targeting high-growth markets such as ESG finance market, climate fintech and green bonds.

Neuralio is supported by the European Space Agency’s Business Incubator in Greece and is part of major projects such as AI4Copernicus, KYKLOS 4.0 and BD4NRG.

Lessons Learned

The main lessons learned from their journey so far, that could be useful for new companies in the field:

- Impact comes from actionable forecasts and innovation—not just raw data; building agnostic, adaptable data pipelines is essential for scalable success.
- Seeking expert advice accelerates progress—if you want to move fast and stay ahead in the market, expertise saves considerable time; otherwise, significant time and personnel investment is needed.

Space4Good

Industry/Ecosystem	Nature and Forestry; Agriculture and Food; Green Finance and ESG; Climate and Humanitarian Aid
Location	The Hague, Netherlands
Year Established:	2017
	Space4Good is a geospatial analytics company using satellite and local data to deliver actionable environmental insights. Evolving from a grassroots team of scientists into a social enterprise, it positions remote sensing as a key tool for sustainability.

Applications of Space Data

Space4Good uses satellite Earth observation data combined with local data to deliver accurate, actionable insights for partners on the ground. Initially focused on free sources like Sentinel and Landsat to support non-profit clients, the team later integrated local data collection to improve model accuracy and share results across similar ecoregions. Their flexible approach tailors data access to client needs—from raw data to processed insights, reports, or GIS platforms. Recently, they launched "Forester," an automated tool providing deforestation alerts, predictions, and direct communication with forest rangers to help protect forests.

Barriers & Support Requirements

In its early days, Space4Good focused on providing GIS and remote sensing support to small conservation groups and activists, but limited expertise and funding often made long-term adoption difficult. Contributions were typically short-term, tied to NGO grant cycles. To ensure greater impact, Space4Good shifted toward supporting organisations with existing geospatial activities, helping them enhance their analytics and modelling. They also began working with commercial clients facing environmental and economic challenges, especially in carbon markets, where their focus on high-accuracy, locally informed models—developed with, not instead of, local stakeholders—was particularly valued.

Success Factors

From the start, Space4Good built a strong team of remote sensing and environmental science experts, positioning itself as a geospatial analytics company focused on actionable insights for deforestation, reforestation, carbon, and biodiversity. A key success factor was narrowing its focus to environmental and vegetation monitoring, building deep sector expertise. With its local modelling approach, emphasis on accuracy, and social enterprise status, Space4Good established long-term partnerships—even with organisations hesitant to engage purely commercial providers. Their collaborative, inclusive work style and smoother integration with clients familiar with geospatial technologies further contributed to successful outcomes.

Lessons Learned

"I think you will be more likely to be successful if you fall in love with the problem and focus on solving it—regardless of the technology you use." Success lies in being mission-driven, not tool-driven. For product-focused businesses, this means deep client integration and a clear, unique value proposition. Service companies should prioritise specialisation. In remote sensing, real differentiation comes not from the data itself, but from transforming it into meaningful, actionable insights.

Caius

Industry/Ecosystem	Digital
Location	Ioannina and Athens, Greece
Year Established:	2022
	Caius is an AI startup using satellite and geomorphological data to map forests, digitize areas, protect ecosystems, and promote sustainability, ecotourism, and rural development with its innovative technology.

Applications of Space Data

Caius is using Earth Observation and GNSS data to fuel two key products, Caius Paths and Caius Pasku. Caius Paths is an AI-enabled road discovery, validation and real-time navigation system in vast rural areas. By utilizing satellite data, the system maps the accessibility of remote areas for tourism, transportation and safety alike. Caius Pasku targets free-range livestock farmers, enabling the scanning of surrounding rural areas for suitable pasture and the identification of the best trails for their livestock. Using state-of-the-art neural networks, powered by Galileo and Copernicus data, users receive accurate updates on grazing areas and herding routes within them. Other than Copernicus, Caius also uses paid satellite data for increased resolution (0,5~1m), depending on the needs of the particular use case.

Barriers & Support Requirements

The downstream space sector is an emerging market in Greece and there are not many -or even any- "established" products for trail discovery and navigation. Even though this also poses as an opportunity it was very hard in the beginning to actually convince large scale customers (regional/ municipal authorities mostly) for the value of capturing the whole outlook of a rural area in terms of time/ maintenance cost reduction, exploitation opportunities, etc. The company had to go door-to-door with specific case studies just to validate the proof of concept. Another barrier for downstream space companies of such kind derives from the delays that are associated with working B2G, enabling Caius to also pursue B2B customer relations (e.g. with big topographic companies as subcontractors).

Success Factors

Caius started as a group of friends who, through their diverse expertise, saw that they could create innovative products using scientific data and Artificial Intelligence learning models. At the same time, they were actively involved in hiking and exploring nature, so with the Region of Epirus as their base, their first product was born, initially as a research project, to explore with an intelligent tool the trails that exist in the nearby forests. Sharing a common enthusiasm for hiking was a significant success factor as it kept them motivated and inspired for creative brainstorming and continuous evolvement. Caius has received business/ financial support by ESA BIC Greece and has been awarded in several competitions such as the Venture Impact Awards, Global Startup Awards, etc.

Lessons Learned

Key lessons highlight the importance of designing products to be scalable internationally from the start, with markets like Italy showing strong demand for downstream space services. Validating product-market fit requires both time to understand the target market and sufficient feedback from potential users to ensure real demand. Most importantly, success comes from confirming actual business interest early on—first ask, then build.

Kanop

Industry/Ecosystem	Space Data Analytics – Environment
Location	Paris, France
Year Established:	2021
kanop	Satellite imagery and advanced remote sensing technologies to transform raw space data into actionable insights in carbon finance and nature-based projects

Applications of Space Data

By analyzing time-series satellite imagery, KANOP provides clients with insights into environmental impact, helping them make data-driven decisions. Initially focused on carbon finance, the company has expanded its scope to broader environmental monitoring, biomass assessments, land-use verification, and carbon sequestration validation.
Roadmap to access the data: KANOP integrates publicly available satellite data, primarily from Sentinel-1 and Sentinel-2, using Google Earth Engine. They emphasize the use of Synthetic Aperture Radar (SAR) and advanced techniques to extract insights.

Barriers & Support Requirements

Main challenges: 1. Scalability Issues: Differences in satellite data availability across regions made it difficult to standardize solutions. 2. User Adoption Challenges: Their initial SaaS model failed to gain traction, as end users struggled to interpret raw satellite data without additional contextual insights. 3. Cost Constraints: High-resolution imagery from commercial providers proved too expensive for widespread use.
Support mechanisms: 1. Incubation & Acceleration Programs: They participated in initiatives like CentraleSupélec, Google Accelerator, and ESA BIC Nord France, which provided technical guidance and business development support. 2.Funding & Grants: The company secured financial support from programs such as the EUSPA Cassini Challenge and the French government, which helped sustain their research and development efforts. 3. Strategic Partnerships: Collaborations with research institutions (ONERA, Telecom Paris) provided expertise in SAR and remote sensing.

Success Factors

Their success was shaped by several key strategies. A market-driven shift from a SaaS model to a full-service solution allowed them to better align their offerings with client needs. Continued investment in SAR data processing and time-series analysis enhanced the accuracy and relevance of their insights. Strategic collaborations with leading research institutions and consultancies further strengthened both their technical and commercial capabilities. Additionally, the development of a user-friendly API and data access platform significantly improved usability and boosted customer adoption.

Lessons Learned

KANOP learned that simply offering raw satellite data is not enough—clients need clear, actionable insights to support their decisions. Their strong focus on SAR expertise and continuous R&D, backed by research partnerships, positioned them as a leader in environmental monitoring.

Inteligg

Industry/Ecosystem	Monitoring and optimising industrial emissions
Location	Athens, Greece
Year Established:	2018
	Energy savings and minimizing CO2 emissions, compatible with infrastructure in buildings, suitable for the public and private sectors in commercial, residential buildings, offices, schools, hotels, sports centers, and hospitals.

Applications of Space Data

Inteligg utilizes Earth observation and satellite data to develop sustainable energy, environmental monitoring, and smart city solutions, enhancing resource efficiency and decision-making. By integrating space data into its projects, Inteligg analyzes satellite-derived insights for energy optimization, indoor air quality assessment, and environmental impact studies, supporting data-driven sustainability innovations while making use of Gen AI/ML.

Barriers & Support Requirements

Inteligg faces challenges such as limited access to funding and the need for advanced technological infrastructure to fully leverage space data for sustainability solutions. To overcome these barriers, the company has engaged in research collaborations, participated in EU-funded projects, and partnered with industry and academic institutions to enhance expertise and access to cutting-edge space-based technologies.

Success Factors

Inteligg's success in adopting space data is driven by its strong focus on innovation, expertise in energy and environmental solutions, and participation in EU-funded projects. Additionally, strategic partnerships with research institutions and industry stakeholders have enabled the company to access advanced space-based technologies and integrate them into sustainable development initiatives.

Lessons Learned

Inteligg's experience highlights the importance of leveraging research collaborations and funding programs to access and integrate space data effectively into sustainability solutions. A key best practice is to combine space-based insights with innovative technologies in energy and environmental management, ensuring data-driven decision-making for smarter, more sustainable solutions.

SURVIOT	
Industry/Ecosystem	Construction, Infrastructure monitoring
Location	Hungary
Year Established:	2022

SURVIOT emerged from a company specializing in GIS (Geospatial Information System) integration and development services . Now, they provide advanced monitoring solutions for bridges, buildings, and tunnels, utilizing automated sensors that function like a “smartwatch” for the built environment. With the integration of GNSS-based movement tracking, radar satellite data, and satellite communication, SURVIOT guarantees the precise acquisition, analysis, and reporting of data to support the long-term safety and stability of infrastructure.

Applications of Space Data

SURVIOT utilizes space data in three primary applications. Initially, they employed the GNSS to monitor ground movements, detecting slow surface movements with millimeter-level precision. Secondly, they use satellite data from Sentinel-1 to improve movement detection, achieving sub-millimeter accuracy – in close cooperation with another downstream space SME. Lastly, the company developed satellite-based communication systems to ensure data transmission from sensors in areas without terrestrial network coverage. Collaborating with a specialized team met at ESA Incubation Program, they created proprietary hardware and software solutions for better integration of data, significantly expanded their service offerings and contributed to better monitoring and decision-making for infrastructure projects supporting long-term structural integrity assessments.

Barriers & Support Requirements

SURVIOT struggled to secure market-driven investment, as their field-based hardware solutions were less appealing to investors focused on trendier technologies. Grants like the ESA Business Incubation Centre and EU Interreg projects became key funding sources, though the administrative burden was challenging for the team. Despite this, the ESA program proved valuable in providing mentoring and connecting them with collaborative partners.

Success Factors

Participation in the ESA Business Incubation program offered SURVIOT valuable mentorship, networking, and financial support, particularly within Hungary’s space SME landscape. Strategic partnerships and the development of custom GNSS monitoring hardware helped expand and enhance their service offering beyond software. Focusing on local projects and challenges also proved key to refining their products and building credibility in the infrastructure monitoring sector.

Lessons Learned

SURVIOT highlighted the importance of staying focused on their core mission and being selective with opportunities, recognizing that not all leads are worth pursuing. Building trusted partnerships and finding mentors who truly understand both the technology and the market proved far more valuable than engaging with organisations whose main goal is simply to sell their own services. They stressed the need to distinguish between genuine collaboration and sales-driven pitches. Another key lesson was the importance of educating potential clients about the benefits of space data, as overcoming initial scepticism often requires ongoing advocacy and clear communication. Maintaining focus and resisting the pressure to chase every opportunity or respond to every initial interest was also essential. They emphasized that normalizing rejection—being willing to say no and comfortable with hearing no—is part of the process, and that finding the right clients and supporters takes time and persistence.

LOSA (ParkSpaceEco)

Industry/Ecosystem	Smart City
Location	Kielce, Poland
Year Established:	2021

PARK SPACE ECO

ParkSpaceEco provides predicting parking occupancy using geolocation data and historical transactions. Targeting urban areas and municipalities, ParkSpaceEco significantly optimizes city parking management by enabling efficient resource allocation, reducing congestion, and cutting emissions. Its mission is to create smarter, more sustainable urban environments through innovative use of satellite data, machine learning, and advanced analytics.

Applications of Space Data

ParkSpaceEco leverages Earth observation data, particularly satellite imagery, for automated mapping and identification of on-street parking spaces. Satellite-based super-resolution techniques enhance image quality, enabling accurate object detection and segmentation of parking infrastructure. This approach streamlines urban parking management, supports infrastructure planning decisions, and allows cities to optimize parking resources efficiently. Integration of satellite-derived insights directly into the system's predictive models provides municipalities with robust data-driven tools for real-time occupancy forecasting and strategic decision-making.

Barriers & Support Requirements

ParkSpaceEco faced major challenges due to the lack of detailed spatial data on street parking, prompting them to develop their own solution using Very High Resolution (VHR) satellite imagery. To lower acquisition costs, they created super-resolution models for object detection, enabling accurate and cost-effective parking mapping. Another hurdle was raising awareness among city authorities about "search traffic"—the congestion and emissions caused by drivers looking for parking, often overlooked in urban planning. Greater awareness, external funding, strategic partnerships, and easier access to satellite data are key to scaling ParkSpaceEco’s solution with municipalities.

Success Factors

ParkSpaceEco achieved 95% accuracy in parking occupancy prediction, validated during a pilot deployment in Wrocław, Poland. The solution doesn't require costly infrastructure such as sensors or cameras. Instead, it utilizes transaction data from mobile apps and parking meters, combined with precise geolocation of on-street parking spaces. This streamlined approach ensures affordability, scalability, and ease of implementation worldwide.

Lessons Learned

The greatest challenge identified by LOSA was educating public administration on the value of advanced geospatial solutions. Effective implementation requires proactive educational efforts and continuous engagement, including presentations at industry conferences and workshops. Demonstrating practical benefits and providing clear examples through pilot projects significantly facilitates acceptance. Public authorities’ awareness and understanding of innovative solutions are essential prerequisites for successful adoption and long-term integration of space-derived data into public sector operations.

GEOSENSE	
Industry/Ecosystem	Digital, Raw Material Industry
Location	Lemelerveld, Netherlands
Year Established:	1996
	Geosense is a specialized geospatial company offering geological mapping, mineral exploration, and orebody detection services to support mining site selection and operational planning. Geosense delivers high-precision data products tailored to the needs of the mining and exploration industry. It has clients worldwide mainly mining and exploration companies, as well as government agencies with products like geological surveys.

Applications of Space Data

Geosense uses spectral and hyperspectral data, including datasets from ASTER, Sentinel, WorldView and others. Also, Digital Elevation Models (DEMs) to support geospatial analysis. The company has collaborated with providers like SpecTIR (USA) to access high-quality airborne hyperspectral imagery. These data sources are essential for identifying structural deformations, such as magma movement, fault lines, and mineral-rich zones, enabling more precise site assessments. Geosense combines these datasets with advanced GIS and remote sensing tools, including ENVI, QGIS, TNT maps, and custom-developed processing workflows and software add-ons, ensuring a high level of data accuracy, efficiency, and analytical depth in their deliverables for mining and exploration clients.

Barriers & Support Requirements

Access to space data and analytical tools has improved significantly, thanks to a wide range of public and commercial data providers, but this abundance of information presents a major challenge. For small companies, it is time consuming and resource intensive to know which datasets are most suitable for specific applications, how to efficiently retrieve them, and how to integrate them effectively into their operational workflows. Although tools and platforms have become more accessible, tailoring them to specific geological applications still demands significant expertise and custom development.

Success Factors

Geosense's success stems from its extensive experience in the raw materials and mining sector, offering tailored remote sensing services that meet the specific needs of clients in exploration and geology. Its strength lies in customized data analysis and tool development, ensuring precision and relevance in each project. Geosense is actively engaged in networks such as the Geological Remote Sensing Group (UK) and the Society of Economic Geologists (SEG), and frequently participates in major conferences, enhancing its visibility and industry connections.

Lessons Learned

Investing in expertise is critical for success for SMEs in the EO sector. While some EO data processing can be automated, the manual steps of interpretation and analysis remain essential for ensuring accuracy—especially in complex fields like geological mapping and mineral detection. Accurate results require trained and experienced personnel who understand both the data and the application context. Geosense's experience shows that building internal capabilities in remote sensing, GIS, and geoscientific analysis is key to delivering high-quality, reliable services.

CLOUDSIGNALS

Industry/Ecosystem	Digital, Aerospace and Defense
Location	Athens,Greece
Year Established:	2020
cloud signals	Cloud Signals specializes in downstream and midstream space applications. In commercial terms it provides high-performance satellite communications backhaul GEO/LEO solutions, ensuring seamless connectivity.

Applications of Space Data

Cloud Signals leverages all kinds of space technological assets including satellite communication, navigation, and Earth Observation data to enhance maritime connectivity and mobility in general, remote area internet access, and environmental monitoring. The company uses GOVSATCOM technologies and other secure satellite communication systems to provide reliable connectivity for ships and offshore operations. It offers navigation and communication solutions, ensuring continuous satellite-based tracking, real-time data exchange, and optimized route planning for vessels. Cloud Signals has developed a product bundle that connects the core network and the Radio Access Network (RAN) of mobile and non-terrestrial networks, offering 5G services for ubiquitous coverage and broadcast services. Additionally, it has deployed satellite internet in remote locations, such as schools in Karlovasi, Samos island in Greece. The company also contributes to Axis 3: Agriculture Monitoring Service of the Hellenic Space Programme and ESA, using Earth Observation data for precision agriculture, environmental monitoring, and resource management.

Barriers & Support Requirements

One of the main challenges is funding, as deploying satellite communication networks and integrating advanced navigation systems requires significant investment. Expanding services to new markets also demands continuous innovation and financial resources to remain competitive. Another key challenge has been building strategic partnerships and gaining market access in the satellite communications sector. Cloud Signals leverages its broad connections and synergies with multiple companies and bodies like OTE, SPACE Hellas, EURESCOM, GOMSPACE, HELLASAT and ESA BIC to name a few. Additionally, participation in EU projects like the "Space-based innovation and digitalization for the school of tomorrow" (SCOTSS) project has helped Cloud Signals expand its business network, as well as its social impact.

Success Factors

A key enabler of Cloud Signals' success is its highly skilled personnel, who brings expertise in satellite communications, 5G networks, as well as Earth Observation and Space Navigation technologies. Participation in R&D projects has also been instrumental, enabling Cloud Signals to stay up to date with space-based innovation. Furthermore, support and participation in ESA programs, including ESA BIC and collaborations with HELLASAT, has provided both technical guidance and market access opportunities, strengthening Cloud Signals' position in the satellite communications sector.

Lessons Learned

An important factor for Space SMEs is to attain specialized expertise and continuous training. Given that Greece’s space ecosystem is still emerging, there are many opportunities for SMEs, but success depends on having both innovative and feasible ideas backed by strong technical knowledge. For future SMEs entering the space sector, it is essential to develop a clear, scalable business model and actively engage in R&D and funding opportunities.

Circuits Integrated Hellas	
Industry/Ecosystem	Semiconductor Antenna for Optimized Data transfer
Location	Kifisia, Greece
Year Established:	2018
CIRCUITS INTEGRATED	Designs, manufactures and distributes the next generation proprietary Monolithic Microwave Integrated Circuit (MMIC) for SatCom

Applications of Space Data

Moving to the Ka-band optimizes Earth Observation (EO) missions by significantly increasing data transmission capacity and efficiency. The higher frequency enables greater bandwidth, allowing satellites to transmit larger volumes of high-resolution imagery and sensor data to ground stations faster and with lower latency. This is critical for applications such as climate monitoring, disaster response, and defense intelligence, where real-time data access improves decision-making. Additionally, Ka-band's narrower beamwidth enhances data security and reduces interference, making it ideal for high-precision EO applications. With CIH's technology supporting high-frequency operations, EO satellites can leverage improved data transfer rates, enhanced spectral efficiency, and more reliable communications, ensuring seamless integration with next-generation space networks and AI-driven analytics for faster, more actionable insights

Barriers & Support Requirements

Key barriers include the high capital intensity of R&D, limited access to specialized manufacturing infrastructure for hybrid III-V/silicon technologies, and stringent regulatory requirements for space-grade components. Support is needed through public-private partnerships, targeted funding schemes, and access to testbeds and demonstration platforms to accelerate technology validation and de-risk market entry.

Success Factors

Success relies on a strong value proposition, strategic partnerships, and early market validation. Reducing size, weight, power, and cost in satellite systems boosts both efficiency and commercial appeal. Ka-band technology enables faster, more secure data transfer, ideal for EO and inter-satellite links. Scalable manufacturing of hybrid III-V/silicon components and alliances with network and satellite providers are key for adoption. Pilot programs and demos will validate performance, while alignment with industry needs ensures smooth integration into future satellite networks.

Lessons Learned

Developing advanced semiconductor technology requires more than innovation; it demands a strong industry ecosystem and robust manufacturing partnerships. A key lesson has been the complexity of integrating III-V materials with silicon, which presents technical and cost challenges due to the limited manufacturing infrastructure. The importance of early industry engagement has also been emphasized, as securing strategic industry collaborations is vital for validation and adoption. Market entry requires navigating regulatory hurdles, demonstrating commercial viability, and proving superior performance over existing solutions. Additionally, funding remains a crucial challenge, as the high R&D costs necessitate significant capital investment and long-term financial backing. Ultimately, Kythrion's success will be driven by a clear commercialization strategy, industry alignment, and first-mover advantages in high-growth sectors such as satellite communications utilizing advanced semiconductors

EarthPulse	
Industry/Ecosystem	Space Data Analytics
Location	Barcelona, Spain
Year Established:	2020
earthpulse!	Earth Pulse provides flexible Earth Observation analytics services using satellite data — primarily from Sentinel missions. Clients can choose between: **Ready-made analytics packages** (recurring services), **A SaaS platform** to process and analyze their own data in-house.

Applications of Space Data

Earth Pulse leverages Earth Observation data from Sentinel satellites (Copernicus programme), alongside other open geospatial datasets, to provide value-added analytics across sectors such as supply chain, insurance, and humanitarian aid. Their solutions support monitoring of land use, environmental conditions, supply chain risks, and ESG-related metrics—enabling better operational decisions, reporting, and risk assessment. While EO data forms the core of their offering, Earth Pulse tailors the granularity and format of insights to match each client's technical capacity, ensuring accessibility and usability across diverse user needs.

Barriers & Support Requirements

Earth Pulse faced several key challenges in its growth journey. A major barrier was the client knowledge gap, as many potential users lacked understanding of how Earth Observation data could support their operations. Scaling from pilot projects to long-term operational services also proved difficult, as did standing out in a crowded EO market with many similar offerings. Limited access to growth funding further constrained their ability to fully develop and scale their SaaS platform. Early support came through grants from ESA and Spanish programs, along with strategic consultancy partnerships involved in leading EU initiatives, which were crucial in funding development and building credibility.

Success Factors

Flexible product design allowed Earth Pulse to make EO data accessible to both experts and non-experts, while strong technical expertise in Sentinel and geospatial analytics ensured high-quality insights. Early development was supported by public funding from ESA and Spanish programs, which played a key role in bringing their solutions to market.

Lessons Learned

Key lessons include the importance of building flexible products that cater to both expert and non-expert users, and leveraging partnerships—such as with consultancies—to help bridge the client knowledge gap. Crucially, success comes from integrating space data directly into real business workflows, going beyond visuals to deliver actionable value.

ORBIFY	
Industry/Ecosystem	Agri-food, Energy-renewables, Retail
Location	Kraków, Poland
Year Established:	2021
orbify	Orbify began with carbon offset projects and expanded into biodiversity and sustainability analytics. They help clients assess supply chain impact and ensure EUDR compliance using Earth Observation data.

Applications of Space Data

Orbify primarily uses Copernicus (Sentinel) data, complemented by other EO and in-situ sources, to support biomass analysis, EUDR deforestation compliance, biodiversity monitoring, carbon offset validation, and illegal ship activity detection. Their proprietary cloud engine integrates geospatial data with advanced machine learning to deliver tailored insights via live dashboards, providing actionable intelligence, compliance tools, and automated recommendations.

Barriers & Support Requirements

Orbify faced key challenges around platform usability, ensuring easy access for non-experts while maintaining technical depth, and standing out from existing solutions. A major focus was on building intuitive interfaces without compromising analytical quality. Support came through the CASSINI Business Accelerator (first batch) and two projects funded by the EUREKA programme. They were not part of the ESA BIC, as Poland was not participating at the time.

Success Factors

Orbify's success has been driven by its advanced technical capabilities, strong internal research team, and agility in responding to market feedback. By applying cutting-edge AI methods and focusing on practical usability, they quickly moved from concept to market-ready tools. Participation in high-profile accelerator programs and a collaborative approach with clients and regulators further strengthened their credibility and market reach.

Lessons Learned

Orbify learned that starting too broad delayed value delivery, while focusing on specific verticals early on significantly increased impact and business alignment. They also found that platform usability is key to driving adoption and ensuring client engagement.

GHG Monitoring Solutions

Industry/Ecosystem	Energy and Space sector
Location	Budapest, Hungary
Year Established:	2022
	Providing solutions for detecting and mitigating methane leakages in the petroleum sector-related infrastructure. Using Earth observation data, they provide applicable solutions in the field to detect and mitigate methane emissions in the petroleum sector, which is a valuable service for various actors in this sector, on the development side.

Applications of Space Data

The business idea came from the issues frequently raised in the petroleum industry, which is the unwanted methane emissions and leakage from various sections of the infrastructure, creating economic and environmental issues. The company was created to address this issue via detecting these points of emissions using various types of space data, and providing mitigating solutions to avoid the leakages, as a service package.

GHG utilizes 3 different types of data – satellite data, drone and aerial-based data, and ground-based data, among which satellite data is the best option based on the companies experience and market research (looking at acquisition effort needed). They started with using data provided by the Sentinel-5, then moved on to other satellite data sources with better characteristics (i.e. resolution).

Barriers & Support Requirements

GHG faced financial constraints in its early stages, with the ESA BIC incubation program providing crucial support. Accessing and utilizing satellite data, particularly from non-Sentinel European providers, posed challenges due to limited documentation, requiring additional time and resources. Transitioning from prototype to a full software service demanded substantial funding. Moreover, effective methane emission monitoring depends on high-resolution data, which often comes at a high cost, increasing overall project expenses.

Success Factors

ESA BIC was a great help not only from a financial perspective but also a network building one (within space sector). ESA BIC acted as a dynamic intermediary in the ecosystem to help connecting with similar companies working on space-related services but from various sectors. This diversity of SMEs on space applications supported knowledge sharing and supported problem solving in GHG. Furthermore, ESA BIC also helped connecting/ collaborating with (i) other European companies beyond Hungary, and (ii) universities like Budapest University of Technology and Economics (BME) that also led to multiple cooperations.

Lessons Learned

GHG realized that clients did not initially understand their service and solutions (to detect and mitigate methane emissions). Sort of mutual education was important, especially for GHG to understand the clients' needs and provide solutions for them specifically, instead of offering your service upfront.

As advice, first focus on open access data – then move to subscription-based data providers that can cost a lot.

Develop good synergies and cooperation with research institutes/ universities (with similar focus to your company), because they face the sector-specific problems earlier usually, so they are the first usually to start working on solutions that can help with service development and your projects.

SENSORBITE P.S.A.	
Industry/Ecosystem	Digital, Agri-food (Agriculture / Smart Farming)
Location	Warsaw, Poland
Year Established:	2024
SENSORBITE	SENSORBITE develops a geospatial intelligence platform that integrates geospatial data to generate detailed, intuitive maps and reports. Through advanced algorithms and AI-driven analytics, it transforms complex remote sensing data into insights that simplify decision-making. Users can interact with SENSORBITE using plain language queries, enabling them to quickly access information on crop health, environmental changes, water usage, and other critical parameters.

Applications of Space Data

SENSORBITE integrated Earth Observation data with Large Language Models (LLMs) to enable agricultural advisors in Poland to easily access satellite imagery and insights through natural language queries. Using data from the Copernicus Data Space Ecosystem, SENSORBITE created WMS services that could be embedded directly into GIS software or online platforms. This approach allowed non-technical users to monitor crop conditions and environmental changes without specialized knowledge, enhancing decision-making in precision agriculture. By integrating satellite imagery into an AI-driven platform, the PoC enabled users to see the potential of crop health assessment, tracking environmental changes, and optimization of resource use.

Barriers & Support Requirements

One of the main challenges SENSORBITE faced was the low level of awareness among end users—such as agricultural advisors and local stakeholders—regarding the practical value of satellite data. Many users lacked a clear understanding of how Earth Observation could support decision-making in agriculture, leading to hesitancy in adopting such tools. While this reduced the knowledge gap through implementation of LLMs for EO access, broader adoption of this system could benefit from additional support mechanisms such as targeted training programs, demonstration projects, public-private partnerships, and funding schemes aimed at capacity building in digital agriculture and geospatial literacy.

Success Factors

Successful adoption of space data should be driven by strategic parnerships and support from key players (both public and commercial). Collaboration with domain specialists in agriculture and remote sensing ensured that the platform addressed real-world needs. Access to free and open data from the Copernicus programme significantly reduced entry barriers, while internal and external capabilities in AI, GIS, and cloud infrastructure will allow for agile development and deployment of the solution.

Lessons Learned

SENSORBITE's experience shows that technical excellence alone is not enough, successful adoption of space data requires a strong focus on user experience and relevance to existing problems. Bridging the knowledge gap through intuitive interfaces, such as natural language access powered by LLMs, was essential to engage non-technical users. Best practices include starting with clearly defined use cases, using open data sources, like Copernicus, to minimize costs, and involving end users early in the design process to ensure alignment with their workflows. Building interdisciplinary teams that combine expertise in Earth Observation, AI, and domain-specific knowledge may be critical for delivering impactful, scalable solutions.

6. State-of-play of SMEs in downstream space awareness

6.1 Overview of SMEs' survey

A comprehensive survey was conducted to evaluate European SMEs in terms of: their awareness of the potential of downstream space technologies for the green transition; their capacity and skills to integrate such data into their operations; their current adoption of sustainable and green solutions; the integration of social aspects and corporate responsibility into business practices; and the external factors and risks that may affect or limit their potential.

This survey gathered insights from 503 individuals working in entities across all 14 EU industrial ecosystems, namely Aerospace & Defence, Agri-food, Construction, Creative & Cultural, Digital, Electronics, Energy-intensive, Health, Mobility, Transport & Automotive, Proximity, Social Economy & Civil Security, Renewable Energy, Retail, Textiles, and Tourism[95].

To ensure a holistic thematic coverage, the questionnaire was structured into the following sections:

- Sustainability Practices & Environmental Impact
- Awareness & Adoption of Downstream Space Data
- Barriers & Support Needs

and passed an internal review process to guarantee clarity, relevance, and consistency with the project's research objectives.

Prolific was selected as the primary data collection platform for the survey, chosen for its reliability, extensive reach, and proven ability to efficiently target and gather responses from European SMEs through integrated screening. Before launching the main survey, we conducted a pilot survey with 25 participants to identify potential response collection issues, assess the completion time, and estimate the associated cost.

Following the completion of the survey, the raw data will be uploaded to the open-access repository, Zenodo, to ensure that all interested stakeholders can benefit from this representative dataset exploring companies' awareness, adoption capacity, sustainability practices, barriers, and business needs related to the use of downstream space technologies.

[95] European Commission. (2021). Updating the 2020 New Industrial Strategy: Building a stronger Single Market for Europe's recovery [COM(2021) 350 final]. https://commission.europa.eu/system/files/2021-05/communication-industrial-strategy-update-2020_en.pdf

6.2 Results analysis

The respondent sample comprises individuals from various European countries, with notable participation from Poland (13.4%), Germany (12.5%), Spain (11.7%), Italy (11.6%), France (8.6%), Greece (7.0%), and the Netherlands (5.9%), along with other countries, each contributing less than 5%. While the survey shows higher participation from certain countries, it is important to note that these rates do not necessarily reflect a more developed space ecosystem in them. Factors such as population size and the selected survey distribution method likely influenced the participation rates.

In terms of employment type, 51.0% of respondents worked in medium enterprises (50-249 employees), 35.8% in small enterprises (<50 employees), 6.8% in scale-ups, and 6.4% in start-ups.

Moreover, survey responses are primarily concentrated in the Digital & IT Services sector (33.4%), followed by the Cultural & Creative (9.5%). Other sectors with notable participation include Health (6.8%), Tourism (7.0%), Energy-intensive (6.4%), Mobility, Transport & Automotive (6.8%), Electronics & Telecommunications (5.6%), Construction (6.4%), and Agri-food (6.8%). The "Other" category (7.0%) mainly includes respondents from the mechanical and machine, financial services, and the education sector.

Despite the broad sectoral representation in the survey, certain limitations should be acknowledged. Notably, some key industrial domains are underrepresented. For example, the Aerospace and Defence sector accounts for only 8 out of 503 total respondents, which limits the generalizability of findings to stakeholders in this domain. This uneven distribution may introduce bias in interpreting sector-specific needs, challenges, and opportunities, and should be considered when extrapolating insights across the broader industrial landscape.

6.2.1 Sustainability Practices & Environmental Impact

Sustainability is becoming a strategic imperative for companies across sectors, driven by evolving EU regulations such as the Corporate Sustainability Reporting Directive[96], increasing consumer demand, and shifting investor expectations. Evaluating the extent to which companies integrate sustainable technologies enables a better understanding of actual practices, existing limitations, and areas where targeted support may be needed to facilitate broader adoption. This section explores how companies position themselves within this green transition.

In all figures throughout Chapter 6, the survey results follow the same presentation pattern, using 5 pie charts to represent: the overall dataset (all enterprises), Scale-ups, Start-ups, Small enterprises, and Medium enterprises.

Survey participants were initially asked whether they use sustainable solutions. The figure below shows a comprehensive overview of the adoption of sustainable technologies per employment type.

[96] European Commission. (2023). Corporate Sustainability Reporting. Retrieved from: https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en

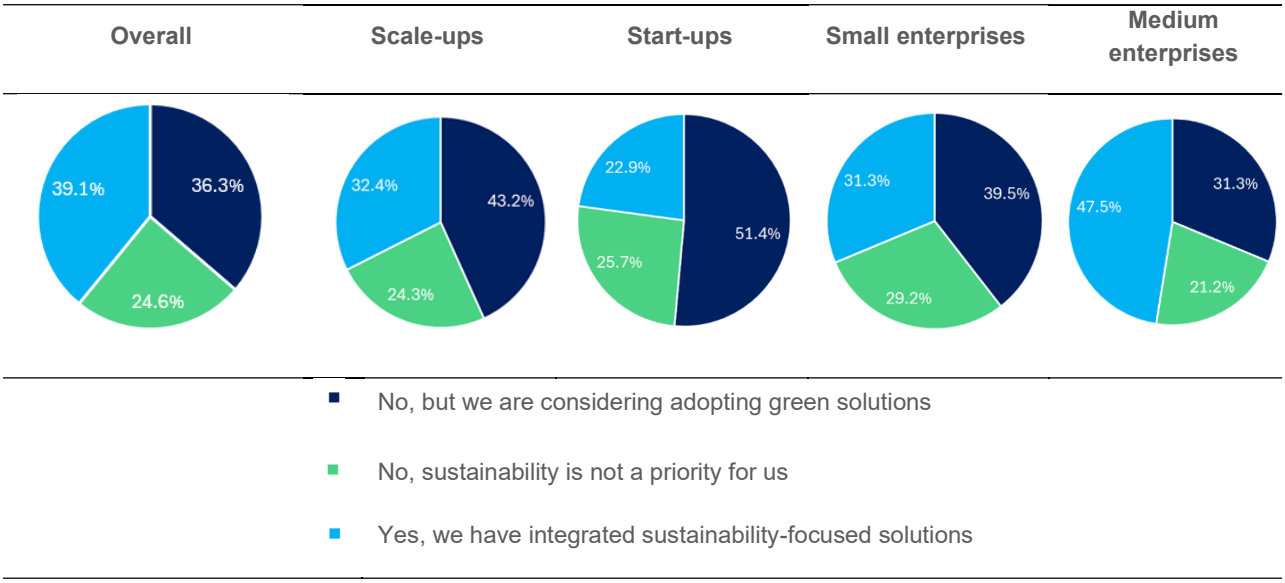

Figure 11: Current Use of Sustainable Technologies

According to the "Overall" pie chart, 39.1% of the enterprises have already integrated sustainability-focused solutions, indicating a proactive approach towards environmental responsibility. Meanwhile, 36.3% are considering adopting green solutions, reflecting a growing awareness and willingness to embrace sustainability practices. However, 24.6% of respondents do not prioritize sustainability.

Breaking down the results by company type reveals several notable differences. Start-ups demonstrate the highest openness to adopting green practices, with 51.4% considering adoption, but only 22.9% having implemented them to date, indicating strong awareness but limited internal capacity. Scale-ups appear more advanced, with 32.4% already using sustainable solutions and 43.2% actively considering them. Small enterprises are relatively balanced, as 31.3% have implemented such practices and 39.5% are planning to, whilst medium enterprises lead in actual implementation, with 47.5% reporting adoption, though 21.2% still do not view sustainability as a priority.

When analysed by EU industrial ecosystem, 50% or more of the Agri-food, Electronics & Telecommunications, Energy-intensive, Mobility - Transport and Automotive, Proximity - Social Economy & Civil Security, and Textile sectors have already implemented sustainability-focused solutions.

Figure 12 further complements these findings by showcasing the levels of engagement in monitoring environmental indicators per employment type.

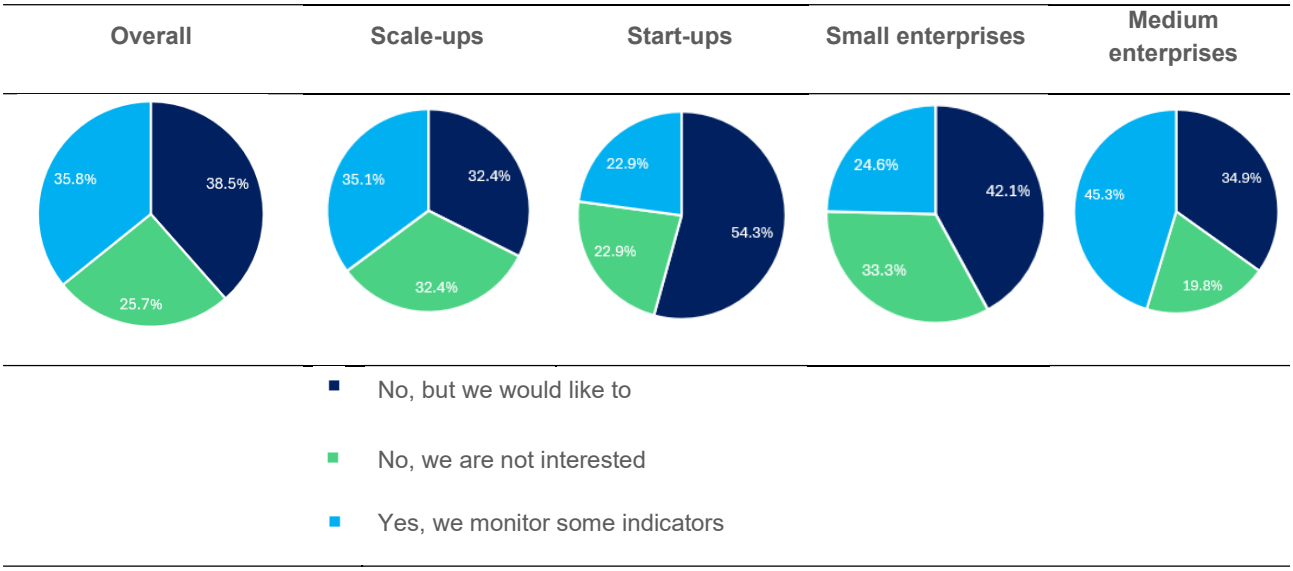

Figure 12:Engagement in Environmental Monitoring

Overall, a significant portion of companies (35.8%) already tracks relevant indicators, suggesting a degree of operational readiness or existing internal processes. Interestingly, a slightly larger share (38.5%) expressed interest in environmental monitoring but have not yet implemented it, which may reflect uncertainty around technical feasibility, cost, or resource availability. Meanwhile, 25.7% of respondents indicated no engagement in such practices.

By company type, start-ups show strong intent to begin environmental monitoring, with over half (54.3%) expressing interest, though only 22.9% currently track indicators. Medium enterprises are the most engaged, with 45.3% already monitoring environmental indicators.

When analysed by EU industrial ecosystem, 50% or more of the Agri-food, Electronics & Telecommunications, and Proximity - Social Economy and Civil Security sectors are currently monitoring some environmental indicators.

These findings highlight an important awareness and willingness among European enterprises to integrate sustainability-focused solutions and environmental monitoring into their operations. However, the pace of adoption varies by company type, with start-ups showing strong interest but facing barriers to implementation, while medium enterprises lead in actual adoption. When analysed by sector, Agri-food, Electronics & Telecommunications, Energy-intensive, Mobility - Transport and Automotive, Proximity - Social Economy & Civil Security, and Textile have already implemented sustainability solutions, while Culture & Creative and Renewable Energy companies are considering them. To accelerate broader uptake, targeted support strategies, such as financial incentives, clearer regulatory frameworks, and accessible technical resources, are essential. Additionally, enterprises that do not currently prioritize sustainability may benefit from stronger communication on its strategic value to act.

6.2.2 Awareness & Adoption of Downstream Space Data

While sustainability is gaining ground downstream space technologies present a promising and still expanding opportunity to accelerate progress toward the Sustainable Development Goals[97]. This section introduces survey findings on companies' familiarity with space-based data and services, their capacity to adopt them, and their interest in technologies such as Earth Observation, Satellite Communication, and GNSS.

The following figure illustrates the awareness levels of companies regarding space data and services, categorizing respondents based on their familiarity with space data and services.

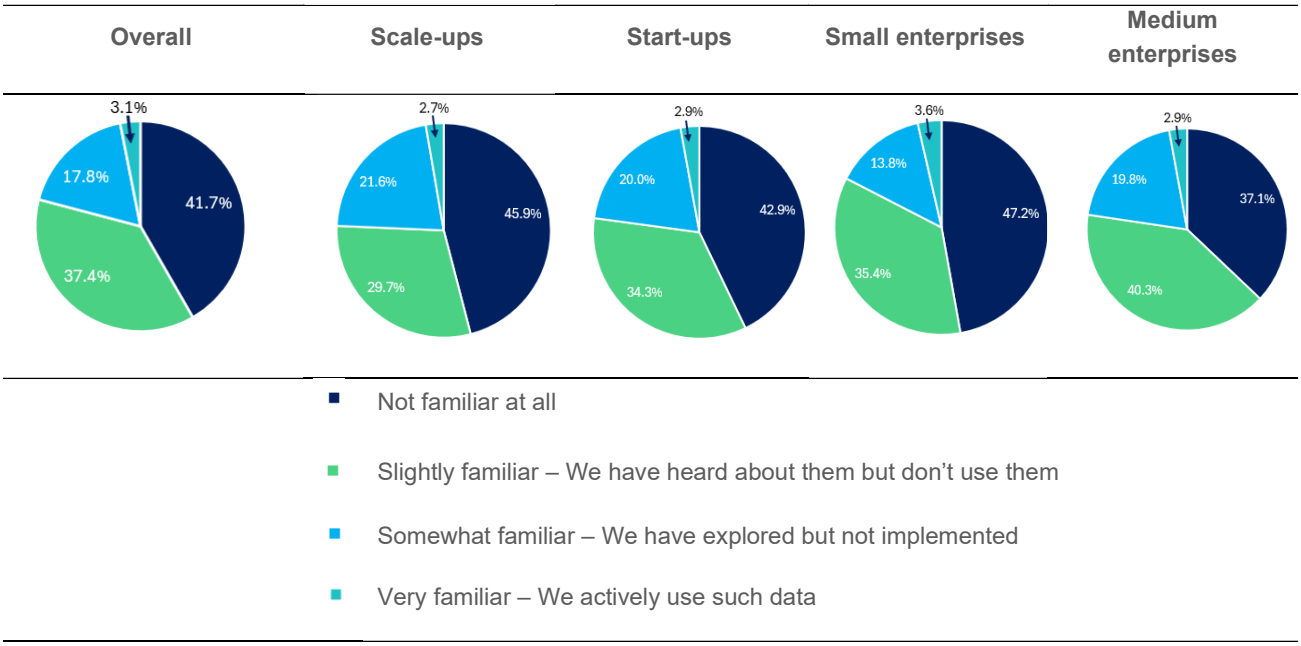

Figure 13:Awareness of space data and services

Overall, 17.8% of the respondents have explored the potential uses of downstream space data and services but have not yet implemented any of those. A significant portion (37.4%) has heard about downstream space data and services but does not currently use them. The largest group (41.7%) is not familiar with downstream space data and services at all, whilst only a small segment (3.1%) indicates that they are very familiar with downstream space data and services and actively use them in their operations.

Looking at different company types, medium enterprises appear more advanced in terms of awareness: over 40% are slightly familiar with space data and services, and nearly 20% report some

[97] United Nations Conference on Trade and Development. (2021). Harnessing frontier technologies for sustainable development. https://unctad.org/system/files/official-document/dtlstict2021d1_en.pdf

level of exploration. Small enterprises have the highest shares of respondents with no familiarity at all (>47%), while actual usage across all categories remains very low, at around 2–3%.

When broken down by EU industrial ecosystem, at least 39% of companies in the Agri-food, Construction, Cultural & Creative, Digital & IT Services, Health, Retail, and Tourism sectors are entirely unfamiliar with downstream space data. Even in more technology-driven sectors such as Aerospace & Defence and Mobility, Transport & Automotive, active usage remains limited to 11.1% and 14.7%, respectively, with no other sector surpassing 8%.

Building on these insights, the next figure delves into the expertise and infrastructure available for processing and using space data. This figure provides a clearer picture of how equipped different entities are to handle space data, which is essential for effective utilization.

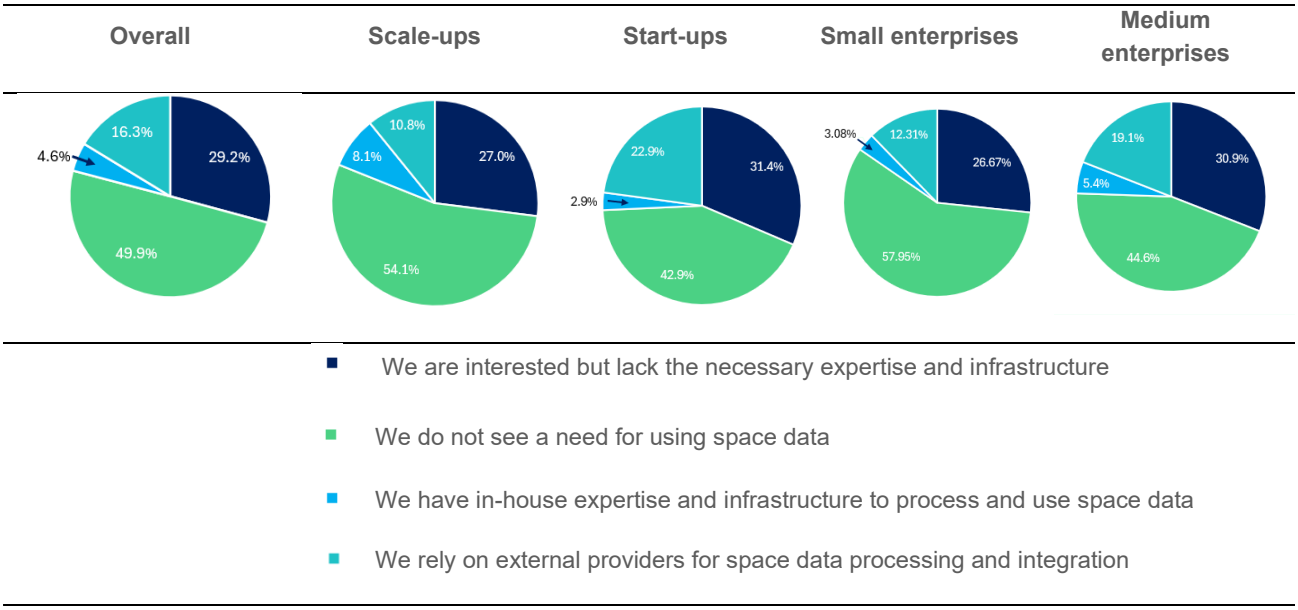

Figure 14:Readiness to use space data

The overall results indicate that a small portion of respondents (4.6%) are well-equipped with in-house expertise and infrastructure, while 16.3% depends on external providers. A significant portion (29.2%) show interest but face challenges due to a lack of expertise and infrastructure and surprisingly, half of the respondents do not perceive a need for using space data.

By company type, scale-ups and medium enterprises appear to be more advanced, with 8.1% and 5.4% respectively reporting in-house expertise. Moreover, 19.1% of medium enterprises use external providers, the highest percentage among all company types.

By EU industrial ecosystem, over 75% of companies in the Construction, Cultural & Creative Digital & IT Services, Energy-intensive, Health, Retail, and Tourism sectors neither have in-house expertise nor rely on external providers for space data processing and integration.

Building on the discussion of expertise and infrastructure, the focus now shifts to businesses' interest in specific space technologies. The following figure illustrates how different types of businesses perceive its relevance and potential for their operations.

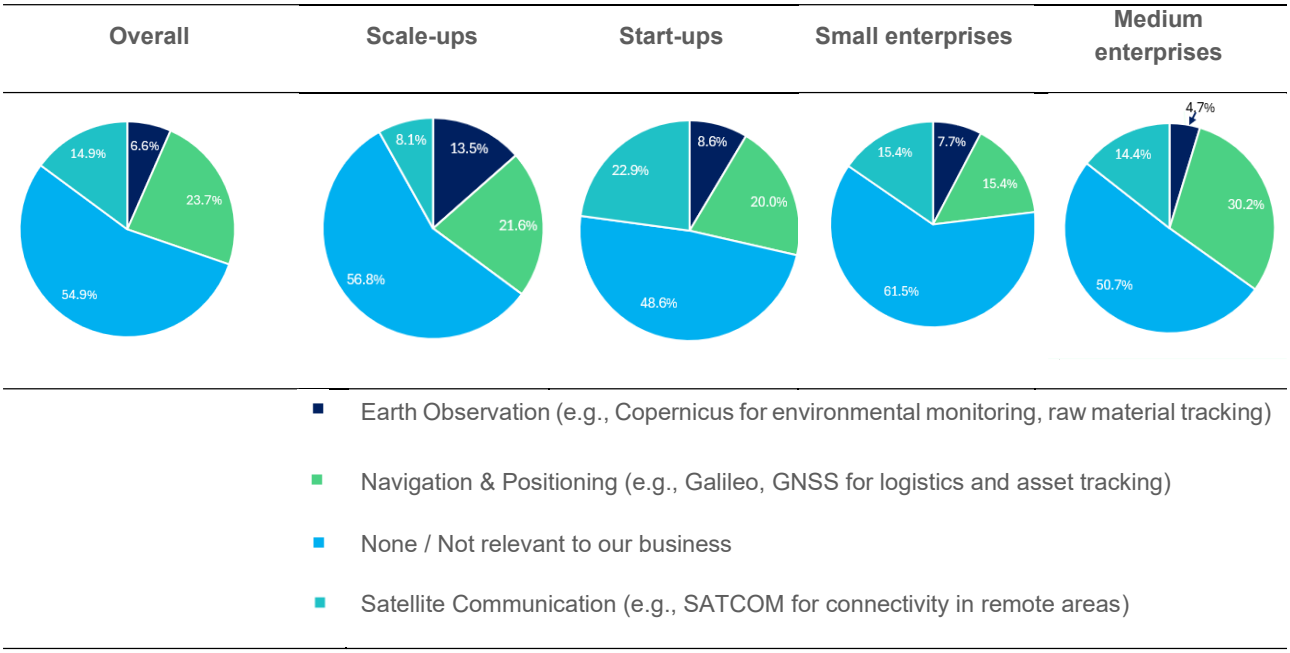

Figure 15:Interest in space technologies

Overall, only 6.6% of respondents show interest in **Earth Observation technologies**. **Satellite Communication** used for remote connectivity, attracts 14.9%, while 23.7% focus on **Navigation & Positioning**. Nonetheless, the majority (54.9%) consider space technologies irrelevant to their business.

Scale-ups exhibit a higher interest in Earth Observation (13.5%), start-ups show notable interest in Satellite Communication (22.9%), and medium enterprises show the highest interest (30.2%) in Navigation & Positioning.

Across EU industrial ecosystems, over 30% of companies in the Agri-food, Construction, Mobility – Transport & Automotive, Proximity – Social Economy & Civil Security, Renewable Energy, and Retail sectors show interest in **Navigation & Positioning**. Interest in other space technologies is lower, except for Satellite Communication, which is reasonably relevant for Electronics & Telecommunications companies.

Examining next the future outlook on space-enabled sustainability solutions among businesses, survey participants were asked to examine the likelihood of implementing these solutions, offering a glimpse into the potential adoption trends. The summary of their responses is shown in Figure16.

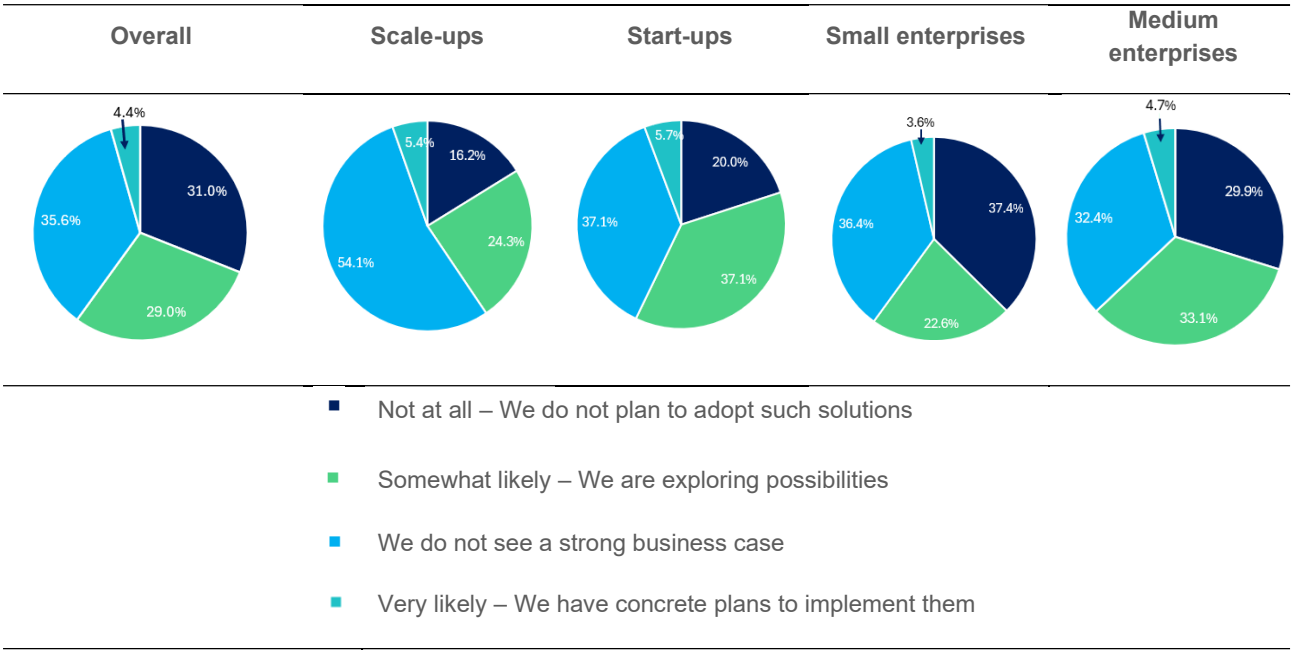

Figure 16:Future Outlook on Space-Enabled Sustainability

Overall, the results indicate that only a small portion (4.4%) of respondents have concrete plans to implement space-enabled sustainability solutions, while 29.0% is exploring possibilities. A significant number (35.6%) do not see a strong business case for these solutions, and 31.0% do not plan to adopt them at all.

Across different company types, scale-ups appear the most sceptical, with 54.1% indicating they do not see a strong business case for adopting space-enabled sustainability solutions. Small enterprises remain the most hesitant, with 37.4% stating they do not plan to adopt such solutions and just 3.6% indicating readiness to implement them.

Adoption potential is more pronounced for some industrial sectors. Indicatively, more than half of the companies in Aerospace & Defence, Electronics & Telecommunications, Proximity – Social Economy & Civil Security, and Renewable Energy are either actively exploring opportunities or have concrete implementation plans, indicating stronger sector-specific drivers for space-enabled sustainability solutions.

The findings reveal a generally low level of familiarity with and adoption of downstream space data and services among European enterprises. While some companies, particularly medium enterprises and scale-ups, demonstrate higher awareness and limited in-house expertise, the vast majority remain unfamiliar with space technologies or perceive them as irrelevant to their business. Interest in specific applications, such as Navigation & Positioning and Satellite Communication, is more pronounced among certain company types, yet actual implementation remains rare. Additionally, the adoption of space-enabled sustainability solutions faces significant barriers, with many companies struggling to identify a strong business case. At the sectoral level, awareness and expertise gaps are particularly evident in Agri-food, Construction, Cultural & Creative, Digital & IT Services, Health, Renewable Energy, Retail, and Tourism, where companies are entirely unfamiliar with space data, and the majority lacks both in-house capabilities and external support. In Aerospace & Defence, Electronics & Telecommunications, Proximity – Social Economy & Civil

Security, and Renewable Energy on the contrary, most of the companies are already exploring or planning implementation. To bridge the existing gaps, targeted awareness campaigns, sector-specific technical support, and clear demonstrations of business value showcasing tangible benefits and potential returns on investment will be essential in driving wider adoption across companies.

6.2.3 Barriers and support needs

Despite the growing potential of space-enabled solutions, many companies encounter significant challenges to adoption[98]. Understanding these challenges, as well as the type of support companies are looking for, can help us fine-tune future actions under the FIERCE project. This final section identifies key barriers and highlights where technical or business support could make a real difference. In parallel, it acknowledges a number of potential risks that, if unaddressed, may inhibit the broader uptake of space data applications.

Building on the findings about adoption intentions, the following graph provides insight into what currently holds companies back. Figure 17 presents respondents' selection of 5 potential barriers that may hinder adoption of space data across different types of enterprises.

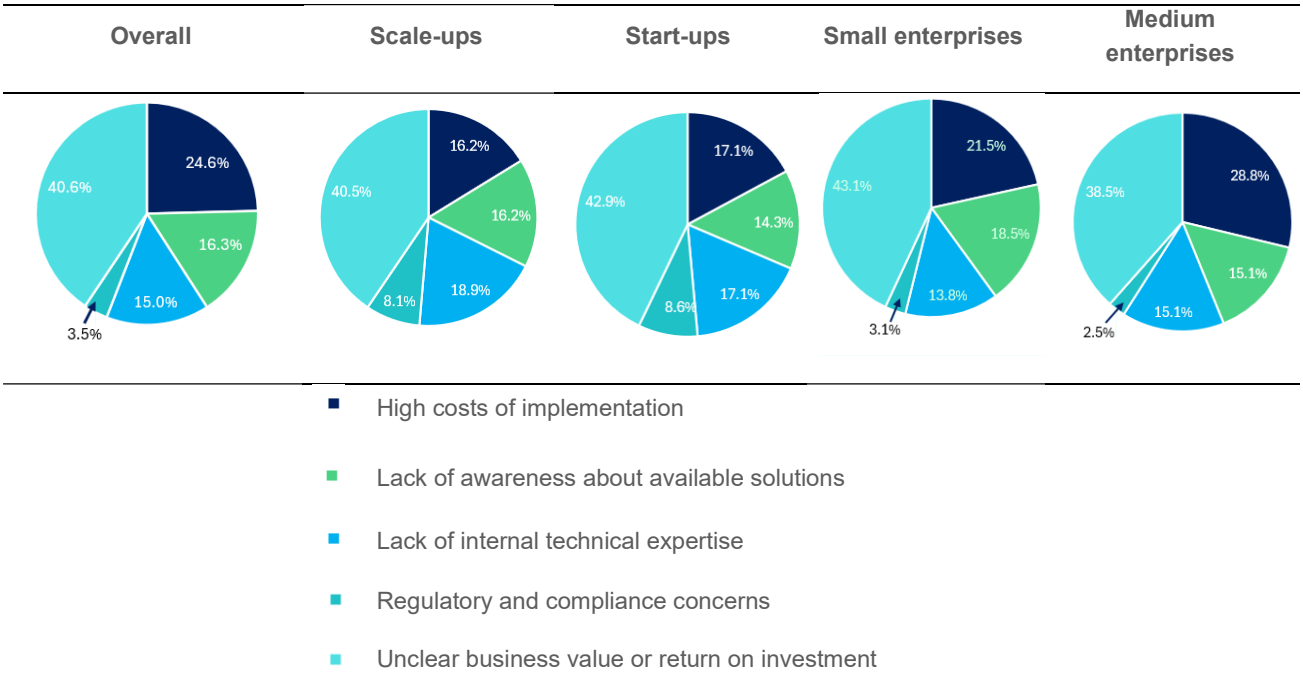

Figure 17:The biggest barriers preventing adoption of space data

[98] European Commission. (2014). Satellite Enabled Applications. Retrieved from https://ec.europa.eu/docsroom/documents/13429/attachments/1/translations/en/renditions/native

In total, the results reveal that regulatory and compliance concerns, although less prominent (3.5%), still represent a barrier for some businesses. Lack of internal technical expertise (15.0%) and lack of awareness about available solutions (16.3%) are notable barriers. High costs of implementation discourage 24.6% of respondents, suggesting that the initial investment required for space data solutions is a significant deterrent, while the most significant challenge is the unclear business value or return on investment, cited by 40.6% of respondents. This also poses a strategic risk for technology providers and public stakeholders, as uncertainty around perceived value may to stagnation in demand.

Interestingly, regulatory and compliance concerns were considerably higher among scale-ups and start-ups, while high costs of implementation were reported more frequently by small and medium enterprises.

Across various EU industrial ecosystems, over 30% of companies in Electronics & Telecommunications, Mobility – Transport & Automotive, Proximity – Social Economy & Civil Security, Renewable Energy, and Tourism are deterred by high implementation costs. Additionally, more than 20% of companies in the Construction, Energy-intensive, Health, and Mobility – Transport & Automotive sectors lack awareness of available solutions. Similarly, over 20% of companies in Agri-food, Electronics & Telecommunications, Renewable Energy, and Tourism face challenges due to a lack of internal technical expertise. Furthermore, more than 40% of companies in Aerospace & Defence, Agri-food, Digital & IT services, Health, Retail, and Textiles cite unclear business value or return on investment as significant barriers. This trend poses a latent risk of uneven adoption across sectors, potentially amplifying digital divides and slowing ecosystem-wide innovation.

Beyond identifying barriers to adoption, it is also important to understand the type of support that companies consider useful for building internal capacity. The figure below illustrates the extent to which companies are open to technical- and business-oriented training.

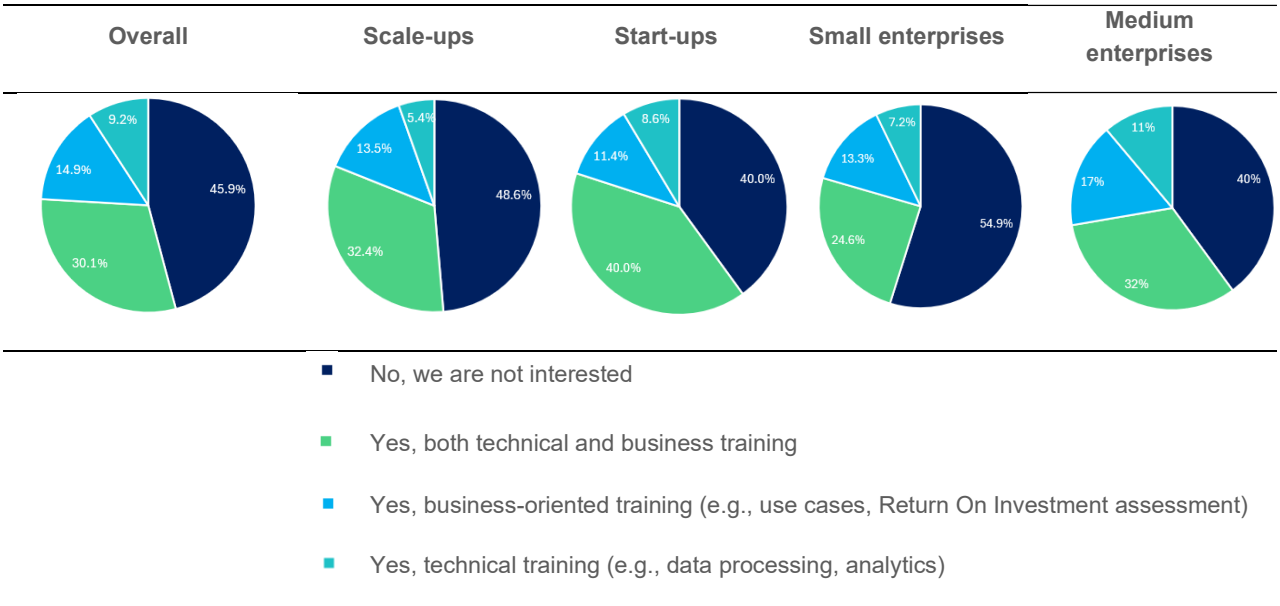

Figure 18:Interest in training for Space Data Integration

The overall results show varied perspectives on training for space data integration. While 45.9% of respondents reported no current interest in training, the remaining share expressed demand for a combination of technical and business-focused support (30.1%). Smaller groups indicated interest in either business-oriented training (14.9%) or technical skills development (9.2%), pointing to more specific needs.

A closer look across company types reveals that start-ups and medium enterprises are the most receptive to training, whilst small enterprises are the least engaged, with 54.9% expressing no interest. The high level of disinterest in training, particularly among small enterprises, may reflect a risk of skills stagnation, with long-term implications for innovation capacity.

Interest in space data integration training also varies significantly across EU industrial ecosystems. Over 20% of companies in the Energy-intensive and Renewable Energy sectors are interested in technical training. More than 20% of businesses in Aerospace & Defence, Agri-food, Electronics & Telecommunications, Mobility – Transport & Automotive, Proximity – Social Economy & Civil Security, Textiles, and Tourism are seeking business-focused training. Additionally, over 40% of companies in Electronics & Telecommunications and Retail sectors are interested in both technical and business training.

The findings highlight key barriers to the adoption of space data solutions, with unclear business value emerging as the most significant challenge, followed by high implementation costs and limited technical expertise. While regulatory concerns are less prominent overall, they are more pronounced among start-ups and scale-ups. When broken down by industrial ecosystem, high implementation costs deter over 30% of companies in Electronics & Telecommunications, Mobility – Transport & Automotive, Proximity – Social Economy & Civil Security, Renewable Energy, and Tourism. More than 20% of companies in Construction, Energy-intensive, Health, and Mobility lack awareness of available solutions, and over 20% in Agri-food, Electronics & Telecommunications, Renewable Energy, and Tourism face challenges due to a lack of internal technical expertise. If left unaddressed, these barriers pose cumulative risks that could limit the reach and impact of public and private investments in the space economy. The demand for training is mixed, with nearly half of respondents uninterested, while the rest express a need for both technical and business-oriented support. Notably, start-ups and medium enterprises show the highest willingness to engage in training, while small enterprises remain the least receptive. Addressing these challenges through targeted awareness campaigns, financial incentives, and blended training programs will be essential to fostering broader adoption and maximizing the potential of space data solutions.

7. Synthesis and Findings

7.1 Summary of key findings from previous chapters

The analysis conducted through desk research, SME case studies, and the online survey highlights a significant but uneven adoption of downstream space data and technologies in supporting green entrepreneurship across Europe. While EO, GNSS, and satellite communications have proven their potential in enabling resource efficiency, circular economy practices, and environmental monitoring, the awareness and operational integration of these technologies among SMEs remain limited outside certain frontrunner sectors like agriculture and renewable energy.

Key enablers identified include:

- The broad availability of free and open-access datasets from Copernicus and Galileo.
- The supportive policy landscape (e.g., EU Green Deal, CSRD, Methane Strategy).
- Accelerators and funding mechanisms such as ESA BICs and the CASSINI initiative that foster innovation and entrepreneurship.

On the other hand, major barriers persist:

- Low technical capacity and limited in-house expertise within SMEs to integrate space data solutions.
- Fragmented value chains and insufficient connections between space technology providers and green economy actors.
- Lack of tailored, easy-to-use solutions and limited awareness of space-enabled service possibilities among non-space sectors.

The SME survey confirmed these challenges, showing that although interest in space-based solutions is high (over 60% of respondents expressed readiness to explore space data integration), actual adoption rates are still low (only 7% actively use such technologies today). Across case studies, successful SMEs demonstrated strong interdisciplinary collaboration (e.g., combining EO with AI or IoT), which was key for unlocking added value from space data.

7.2 Cross-refence of findings between sector, technology, country

The cross-sectoral analysis revealed varying levels of maturity in space data adoption:

- **Agriculture and Food Systems**: Highest levels of integration, especially in precision farming, crop monitoring, and irrigation optimization, facilitated by EO (Sentinel-2) and GNSS.
- **Raw Materials and Mining**: Emerging use of InSAR and hyperspectral data for site monitoring, risk assessment, and closure phase revegetation monitoring, with strong examples in Spain, Italy, and Eastern Europe.
- **Environmental Monitoring and Corporate Sustainability**: Growing but fragmented adoption, particularly in ESG reporting, deforestation-free supply chains, and emissions

monitoring. Larger companies are more active here, while SMEs show interest but lack capacity.
- **Circular Economy and Waste Management**: Promising potential, especially in logistics optimization through GNSS and illegal waste tracking via EO, but adoption remains in early stages.

From a geographic perspective:
- **Northern and Western Europe** show higher adoption levels, largely due to stronger startup ecosystems and easier access to acceleration and funding programmes.
- **Southern and Eastern Europe** demonstrate lower levels of space data adoption, though several standout SMEs and initiatives exist (e.g., mining-related EO use in Bulgaria, circular logistics projects in Greece).

Technology-wise:
- **EO solutions** are dominant across all sectors, especially in monitoring applications.
- **GNSS services** are critical for logistics, mobility, and supply chain traceability.
- **Satellite communications (GOVSATCOM)** remain underutilized but hold potential for remote area connectivity and disaster response.

7.3 Recommendations for FIERCE services

To effectively bridge the identified gaps and unlock the potential of downstream space technologies for green entrepreneurship, FIERCE will consider the following service design recommendations, based on the insights gathered from this Deliverable that will feed directly to T1.3 for the development of the Blueprints and to the design of the services offered in WP3:

1. **Capacity Building and Onboarding Services**
    - Develop modular training offerings on "Space Data for Sustainability" tailored to sector-specific needs (e.g., agriculture, raw materials, ESG reporting).
    - Provide hands-on capacity-building programs, including data literacy, use case identification, and small-scale pilot projects for SMEs.
2. **Advisory and Matchmaking Services**
    - Offer facilitated matchmaking between SMEs and technology providers (including EO and GNSS service developers).
    - Support co-design of solution pathways through feasibility studies and early-stage technical assessments.
    - Provide advisory services on integrating space data into sustainability strategies and compliance with CSRD, EU Taxonomy, and other regulatory frameworks.
3. **Simplified Access and Data-as-a-Service Tools**
    - Access to user-friendly digital interfaces and dashboards that allow SMEs to easily access, visualize, and interpret space data.
    - Promote pre-packaged services for common sustainability use cases, such as emissions monitoring, crop health monitoring, or deforestation detection.
4. **Demonstration and Transformation Projects**
    - Prioritize real-life demonstration pilots across sectors and countries with low adoption rates, showcasing tangible benefits.

- Leverage these pilots to create sectoral playbooks, best practices, and replicable models to scale impact.

5. **Community Building and Knowledge Exchange**
    - Establish a network for sharing experiences, tools, and success stories.
    - Foster peer learning through networking events and knowledge exchange between SMEs, space data experts, and sustainability professionals.

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