
Destination Earth
Destination Earth Service Platform
Attractiveness Study
Destination Earth
Funded by
the European Union
Implemented by
ECMWF
esa
EUMETSAT

Destination Earth

Executive summary

Destination Earth (DestinE) is a European Union funded initiative, with the aim to build a digital replica of the Earth system. The initiative is being jointly implemented by three entrusted entities:

- the **European Space Agency (ESA)**, responsible for building the 'Open Core Service Platform',
- the **European Centre for Medium-Range Weather Forecasts (ECMWF)**, responsible for the creation of the first two 'digital twins' and the 'Digital Twin Engine', and
- the **European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)**, responsible for the creation of the 'Data Lake'.

Access Destination Earth at destination-earth.eu.

This **attractiveness study**, conducted by ESA between February 2024 and May 2025, assesses DestinE's potential to attract and retain stakeholders across diverse sectors. It offers a strategic analysis of user needs, sector-specific opportunities, platform competitiveness, and key considerations related to digital responsibility. The study concludes with concrete recommendations to support wider adoption and long-term sustainability of the platform.

The DestinE service platform is based on a **robust technological foundation** that integrates Earth observation, climate and environmental data, digital twins, high-performance computing, and artificial intelligence, creating favourable conditions for scalable and interoperable services.

DestinE's ambition demonstrates **high sectoral relevance** for various stakeholders, from **industry** to **policy making**, with the potential to deliver clear value in domains such as finance, insurance, energy, smart cities, education, forestry and construction.

The findings highlight that success depends on **strong stakeholder engagement**, built through collaborative development with a diverse ecosystem of public and private actors.

To support broader usage, **several improvement levers** have been identified. Enhancing **usability** and providing **low-code** tools will help lower technical barriers, while tailored **business models** and well-defined **governance** frameworks will ensure the platform meets the expectations of different user communities.

Finally, the initiative should continue to place strong emphasis on **environmentally responsible digital practices** but also inclusiveness and accessibility, guided by a commitment to sustainability, transparency, and ethical technology development.

Destination Earth

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1. Introduction

1.1. Context and Scope

Destination Earth (DestinE) is an initiative launched by the **European Commission** (DG-CNECT) to create a **highly accurate replica or Digital Twin of the Earth**. This constitutes a new type of information system, with unprecedented levels of detail, quality, and interactivity to support EU-policy makers and users who implement these policies to better respond and adapt to the challenges posed by environmental change.

With the service platform only recently launched and numerous challenges still ahead, preserving its appeal remains a key concern.



Given these challenges, the European Space Agency (ESA) has carried out this "**DestinE attractiveness study**" to: (i) identify key factors that drive DestinE's attractiveness, provide recommendations, and (ii) establish a framework for assessing its appeal.

Note: the following analysis was performed from February 2024 to May 2025.

1.2. Objectives of the report

The purpose of this document is to provide an analysis of the DestinE ecosystem, with the aim of identifying levers to enhance and evaluate the platform's attractiveness. This document is organised as follows:

- **Chapter 1** is this introduction. It recalls the three components of DestinE (Digital Twin, Data Lake, DestinE service Platform), its schedule and ESA`s vision for DestinE. It also provides an overview of the DestinE stakeholder's ecosystem.
- **Chapter 2** is a preliminary sectoral analysis that summarises the environmental data market with a focus on four sectors of relevance to DestinE: Insurance and Finance, Energy, Smart Cities, Education and Construction.
- **Chapter 3** is a study of the technological landscape. It provides an analysis of platforms currently providing environmental data, but it also introduces potential relevant technological blocks. It tackles transverse topics, such as interoperability and business models. Finally, it integrates a panorama of existing challenges or support programmes for startups and projects on environmental solution implementation.
- **Chapter 4** focuses on DestinE's approach to digital responsibility (including ethical considerations, accessibility, and sustainability) providing an overview of the challenges and associated strategic directions.
- **Chapter 5** presents an artificial intelligence (AI) roadmap, identifying potential applications and directions to strengthen DestinE's technological edge and service capabilities.
- **Chapter 6** provides strategic recommendations to increase the platform's attractiveness. This includes guidance on improving user experience, expanding market access, fostering engagement, strengthening governance, and aligning with digital responsibility principles.

1.3. Overview of Destination Earth

1.3.1. DestinE objectives

The objective of DestinE is to create a highly accurate replica or Digital Twin of the Earth. This constitutes a new type of information system, with unprecedented levels of detail, quality, and interactivity to support EU-policy makers and users who implement these policies to better respond and adapt to the challenges posed by environmental change.

Several thematic digital twins of the Earth-system are developed over the course of different phases of DestinE. DestinE's digital twins exploit the latest advances in digital technology, science, artificial intelligence, and the huge opportunities offered by the world-leading

supercomputing capacities of the European High Performance Computing Joint Undertaking (EuroHPC JU). By combining cutting-edge Earth-system physical and Machine Learning / Artificial Intelligence (ML/AI) and observations DestinE's digital twins accurately simulate natural and human activity and allow to test scenarios that would enable more sustainable development and support European environmental policies.

DestinE thus significantly augments the capabilities in support of the European Commission's Green Deal, Data strategy and Digital Strategy, complementing existing efforts in this direction from national and European environmental services like the Copernicus services. The European Green Deal is the EU's strategy for tackling climate and environment-related challenges. Destination Earth will bring tools to policy and decision makers in support of Europe's strategic options in key Green Deal areas from agriculture and food security to disaster risk management and climate change adaptation as well as for gaining new actionable insights from advanced analytics and simulation tools. These users will be able interact with the DestinE's novel information system, by directly interacting with the DestinE data streams, by bringing in their models and data and creating high quality information. The large amounts of data produced by DestinE naturally contribute to the European Green Deal data space, facilitating data flows inside the EU and across sectors, for the common good. Destination Earth implements European rules, for privacy, intellectual property, cybersecurity, technological sovereignty and data protection.



DestinE has the potential to bring significant innovation through the exploitation of novel digital technologies and of the EuroHPC facilities. Breakthroughs lie in the quality of the provided information, in the integration of Earth-system and impact-sector models and observations into a unified framework allowing to provide users with collocated weather, climate and impact-sector information, and in the interactive, configurable, and scalable access to DestinE data, models and workflows. DestinE supports the users across the very wide range of science-technology required expertise to favour adoption, maximise the impact and reinforce users operational contexts wherever gaps are jointly identified in the existing information delivery ecosystem that supports decision making in response to the challenges posed by environmental change (e.g. Copernicus services, national meteorological services), so that resources can be optimized, and acceptance thresholds can be overcome.

DestinE will implement process and control mechanisms to establish trust in data, information, models, applications, and quantitative results for services based thereupon that are made available to the users.

Data and services offered within the scope of DestinE will be available free of charge from access points operated or procured by ESA, ECMWF or EUMETSAT. Third party services may develop in this ecosystem, complementing and enriching the DestinE offer.

1.3.2. DestinE components

The DestinE system is composed of the following components:

- **The DestinE Digital Twin Engine (DTE):** The Digital Twin Engine is a software-defined environment to operate DestinE's DTs and manage their corresponding control and data flows across distributed HPC and cloud computing resources. It provides a common system approach to a unified orchestration of Earth-system Digital twins. Moreover, it creates a framework for the fusion of observations with Earth-system simulations and the integration of applications targeting specific impact-sectors via selected use cases. The engine enables the porting and optimization of codes, developing and managing the digital twin workflows, and provides the data handling and model interaction and interactivity capabilities that run on diverse HPC and cloud infrastructures including the Data Warehouse hosted on the data bridges. The DTE concept focuses on interoperability and interactivity and delivers the expected access agility and performance for the digital twins and associated data access.
- **The initial two high-priority DTs on weather induced extremes and climate change adaptation:** highly accurate replicas of the Earth-system that simulate the system behaviour at temporal and spatial scales where weather extreme events happen and where the effects of climate change are felt. They combine several cutting-edge Earth-system models and Earth observations as well as advanced data analytics and integration or interoperability with impact sector applications. They allow to monitor and predict environmental change and test scientific hypotheses and adaptation scenarios. A DT is a DestinE system component, interfacing with the Digital Twin Engine, offering a seamless production service of actionable knowledge for users that results from the fusion of observational and simulated data of the physical Earth system and of impact-sector relevant information.
    - **DT on Weather-induced and Geophysical Extremes:** provides capabilities and services to support decision making for rapid response to meteorological, hydrological and air quality extremes. The system combines weather, hydrology and air-quality observation and cutting-edge simulation capabilities into a unified framework to provide high-quality weather and impact-sector information from global to continental, to country and city scales for the assessment and prediction of environmental extremes on a timescale of a few days ahead. It has a global component, which produces simulations on a time scale of 4/5 days ahead with a spatial resolution of about ~1-4 km. It also has a regional component, which produces simulations on a timescale of two days ahead with a spatial resolution of 500-750m and which is configurable(on-

demand) for specific triggering and tailoring of the provision of information in terms of geographical region, extreme event type and related impact-sector needs, or what-if scenarios. The DT thereby represents a substantial breakthrough in terms of provision of integrated earth-system-impact-sector information, spatial resolution and interactivity. In addition to weather-induced extremes, the preparatory work for the inclusion of geophysical extremes (earthquakes, volcanic eruptions and tsunamis, geomagnetic storms) will take place.

  - **DT on Climate Change Adaptation**: provides capabilities and services to support planning activities and decision-making linked to climate change adaptation. The system combines cutting-edge Earth-system and impact-sector simulations and observations into a unified framework to provide global high-quality climate projections and impact-sector information on multi-decadal timescales (2020 to ~2050), at a very high spatial resolution (~5km). Another important novelty is the operationalization of the capacity to produce global multi-decadal projections, which allow providing globally consistent high-quality climate information on a regular basis. The interactivity of the DT will allow to tailor the information streams, including through the possibility to perform what-if scenarios and impact assessments from global to regional and national levels, in support of the elaboration of policies for the Green Deal. This DT thereby also represents a substantial breakthrough in terms of provision of integrated earth-system-impact-sector information, spatial resolution and interactivity.

- **DestinE Core Service Platform (DESP):** A user-friendly platform that provides a large number of users with evidence-based policy and decision-making tools, applications and services, based on an open, flexible, scalable and evolvable secure cloud-based architecture. DESP federates access to users' platforms, European cloud and HPC infrastructures and integrate access to an increasing number of Digital Twins as they become gradually available via related European Commission and, possibly, national efforts. The platform will employ novel digital technologies for providing data analytics, visualization, and Earth-system monitoring, simulation and prediction capabilities to its users. At the same time, it will allow users to customise the platform, integrate their own data and develop their own applications.
- **DestinE Data Lake (DEDL):** provides discovery, access, and big data processing services according to a defined and evolving tailored to user needs DestinE data portfolio offered to DestinE users, including required data storage. It provides a seamless access to datasets via GUIs or APIs to data in accordance to the DestinE Data Portfolio, regardless of data type and location. The DEDL big data processing allows near-data processing and by this conceptually supports ML/AI applications executed on the DEDL. The DestinE data lake federates with existing data holdings as well as complementary data from diverse sources like in-situ, socio-economic, or data-space data.

1.4. Vision

This report aims to provide **recommendations to contribute to a successful attractiveness of the DestinE platform at short (2024/2026), medium (2026/2030) and long (2030+) terms.** A forward-looking analysis was undertaken with ESA to explore ambitions to be achieved through DestinE by 2030. This is summarised in the following figure.



Figure 1: DestinE vision by ESA

1.5. Stakeholder mapping

DestinE stakeholders can be categorised into six main groups, each playing a distinct role.

- *DestinE owner and Entrusted Entities :*

The **European Commission (DG CNECT)** plays a central role in funding and overseeing the DestinE initiative. The European Commission's contributions to DestinE extend beyond financial support to include strategic guidance, ensuring policy consistency and alignment with broader European priorities.

DestinE is implemented by three key entrusted entities:

- **EUMETSAT**, specialised in the operation of meteorological satellites, plays a critical role in providing data and services for weather forecasting, climate monitoring, and environmental analysis. Within DestinE, EUMETSAT leverages its expertise in satellite operations to contribute valuable Earth observation data and services, particularly in managing the DestinE data lake.
- **ECMWF**, specialised in numerical weather prediction and climate research, acts as a key operational partner for DestinE, providing advanced modelling capabilities and scientific expertise. Its contributions enhance the accuracy and reliability of Earth

system simulations and predictions, particularly through the development of digital twins.

- **ESA**, which coordinates space projects carried out jointly by 22 European countries, is a strategic partner in DestinE. Leveraging its extensive experience in space technology and exploration, ESA contributes to the project by developing the DestinE Platform, which serves as the front-end-user interface and supports the initiative with its own ESA Digital Twin Earth Programme.

- *DestinE Platform contractors :*

The DestinE Platform contractors are key stakeholders engaged by ESA through contracts for the platform's development and operations. This category includes (but is not limited to):

- **Destination Earth Core Service Platform** contract (led by SERCO) encompasses the design, implementation, and maintenance of essential infrastructure. It includes the management of the related OVHCloud IaaS deployment, services for data integration, modelling, and visualisation.
- **Advanced Application Service (AAS)** contract (led by Atos) is designed to select and support the onboarding of advanced applications and services that create value from the DestinE digital twins and Platform core services. It seeks to elevate DestinE's offerings by harnessing cutting-edge technologies and pinpointing key factors that will enhance its attractiveness.
- Other actors such as **Mines Paristech** contribute to DestinE by developing a co-design methodology specifically tailored to DestinE.

Use-cases leaders – A series of contracts initiated by the European Commission (Horizon Europe) or the DestinE Entrusted Entities.

Use-case leaders' early engagement and feedback provide valuable insights that contribute to the project's attractiveness to future service providers. By being pioneers in using DestinE, they offer practical perspectives on the platform's usability, effectiveness, and potential for addressing specific needs and challenges. This firsthand experience allows the DestinE project team to refine and optimise the platform's features and offerings, improving its appeal and value proposition to prospective service providers. The input from the use-case leaders is significant in shaping DestinE's success and adoption within the service provider community.

- *Other platforms :*

In the environmental data sector, several platforms already provide access to data and services, such as GAFA[1] companies, government-funded agencies, and other stakeholders. Even though certain of these entities operate with their own distinct initiatives and strategies, and can be seen as competitors, they share the overarching goals of advancing environmental data technologies and their applications. They are characterised by their usage of shared satellite data sources or by their open data policies, facilitating the exchange of valuable information and fostering collaboration despite certain competitive

[1] Google, Apple, Facebook and Amazon companies

dynamics. By largely embracing open data principles, they enable knowledge exchange, innovation, and the development of interoperable solutions that benefit various communities.

- *Technology and service providers :*

Technology and service providers play a dual role within DestinE. As key players, they contribute to the platform by providing AAS for instance, thereby enriching the platform with new value-added services. Additionally, they function as service consumers by leveraging various offerings within the platform to strengthen and optimise their own products or operations.

Their active participation and role as service providers are fundamental to attracting users and other service providers to the platform. Technology and service providers help create a vibrant ecosystem of value and collaboration within DestinE.

- *Service consumers :*

Service consumers are the most important stakeholders for DestinE. They drive demand and utilisation, thus directly influencing the platform's success and impact. Service consumers rely on the platform to access valuable environmental projection data, advanced analytics, and applications that support their specific needs. Their feedback and requirements shape the evolution of the initiative, guiding the development of new services and functionalities. Service consumers play a critical role in validating the platform's value proposition and ensuring its relevance and effectiveness in addressing real-world challenges. Their engagement and satisfaction are critical attractiveness metrics of DestinE's impact and success in delivering value to stakeholders and the society at large.

This ecosystem and the **user segmentation** (i.e., service consumer, technology and service provider) are summarised in the following illustrations.

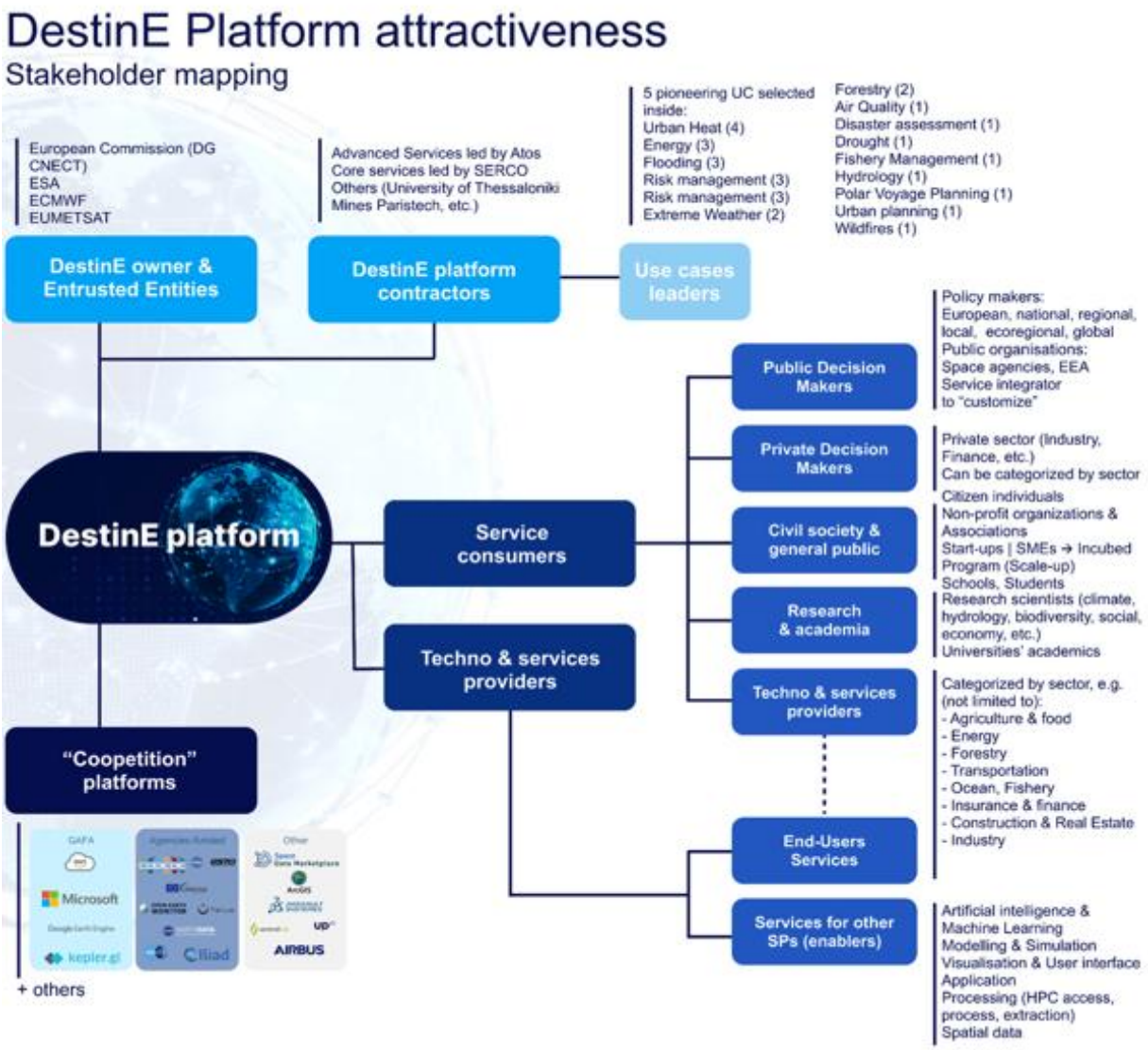


Figure 2: DestinE stakeholder mapping

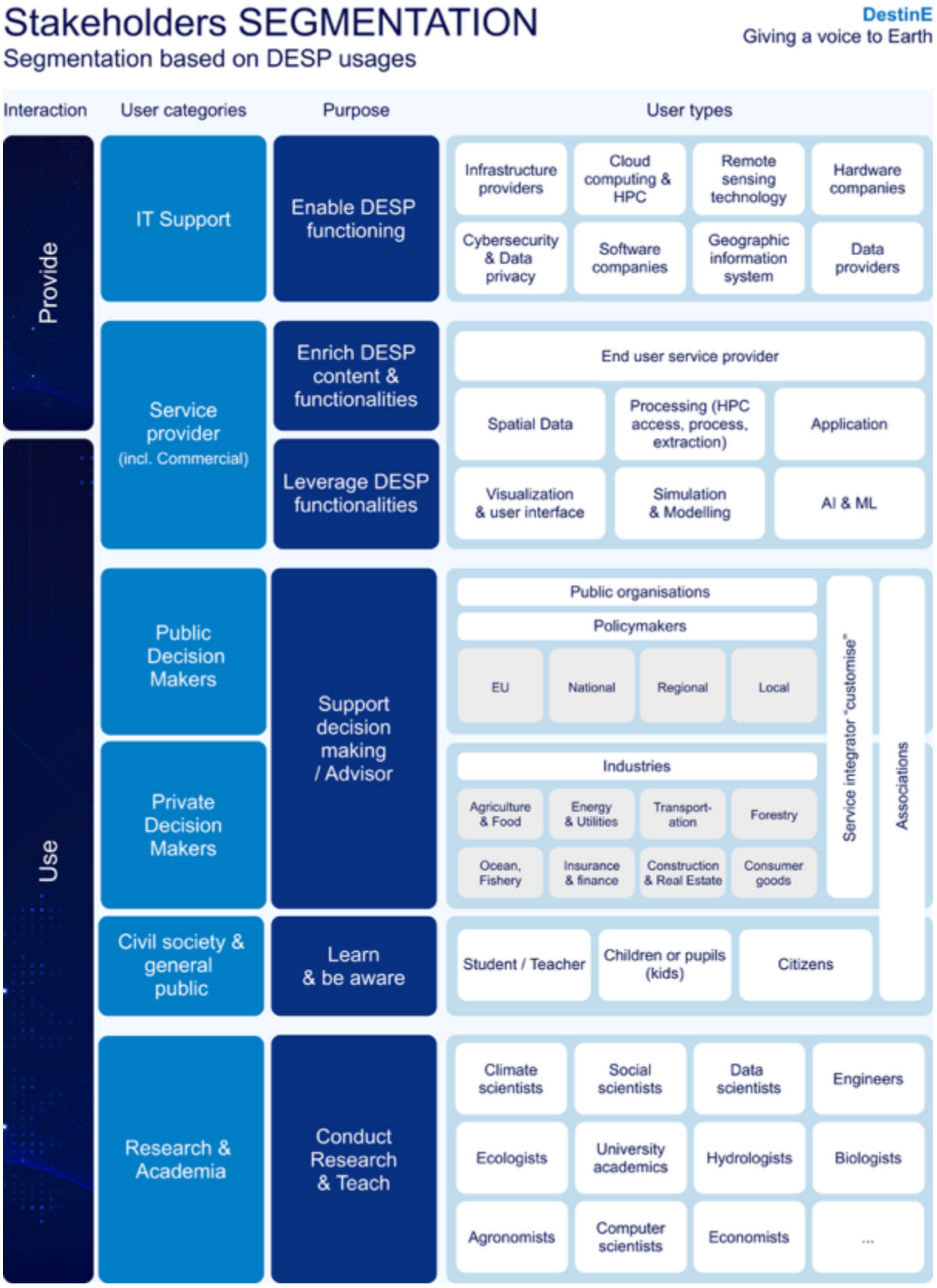


Figure 3: DestinE Platform user segmentation

2. Sectoral analysis

This chapter summarises key trends in six sectors that could benefit from the DestinE Platform. Other sectors will be analysed in the future.

2.1. Insurance and Finance sector

As Europe's largest institutional investor with over €10.6trn of assets under management [1], the insurance sector has the potential to significantly contribute to financing the transition to a more sustainable economy. The pressure for this transition has been amplified by EC policy initiatives. Under the **Taxonomy Regulation** and the **Sustainable Finance Disclosures Regulations**, insurers and financial institutions are required to monitor through indicators and to report their activities and impacts on sustainability. These regulations highlight **the need for Environmental, Social and Governance (ESG) data** to be made available. ESG provides a framework for evaluating companies and investments based on their sustainability and ethical impact, -hence surpassing pure traditional financial metrics.



Consistent growth is anticipated in the use of environmental data within this sector. Notably, risk assessment and commodities trading are projected to experience the most significant evolution, boosting the usage of Earth Observation data applications in the insurance and finance industries between 2021 and 2031[2].

To be more adequately equipped and guided in their response to market challenges, certain operators, such as (re)insurers (e.g., AXA, Swiss Re) and financial institutions are forming partnerships. These partnerships are illustrated by the collaboration between the non-profit association **Global Credit Data**, owned by more than fifty member banks worldwide, and the **United Nations Environment Programme Finance Initiative**, experts in climate risks. In June 2024, they announced their collaboration to **enhance ESG and climate risk efforts** [4]. The aim is to present **common methodologies and best practices** to perform their climate risk analysis using the same realistic scenarios and climate data.

- *Focus on the (re)insurance industry: increasing granularity in risk management*

The Swiss Street Institute estimates that global economic losses from natural disasters mounted to around €234 billion in 2022, yet less than half of that amount was insured. Building a "*climate-resilient*" economy requires an accurate understanding of current and

future risks. In this regard, the integration of environmental data into the insurance cycle - from underwriting to claims management and prevention - is accelerating, thanks to additional value-added tools and services, artificial intelligence as well as machine learning, all of which enable more refined and predictive risk analyses.

Three main insurance products are presented based on climate data:

1. **Risk modelling:** risk models that estimate potential losses for a given asset based on its location and the likelihood of climate-related disasters affecting it. Climate data are used to build this probabilistic model (e.g., heatmaps). These models are then used by insurers and underwriters to develop their insurance products.
2. **Parametric insurance** is an insurance product that addresses specific and time-sensitive needs against the occurrence of events based on their magnitude. The insurance provides pre-specified payouts to be triggered as soon as a calculated index reaches a threshold value. For instance, in the case of a flood, satellite and sensor data are used to assess the flooding extent and intensity. If the percentage of the affected area exceeds a threshold, a payment is made to insured residents. This type of insurance is often used when it is difficult to assess damage quickly. The significant market growth that will accelerate the uptake of both environmental data acquisition and distribution and value-added services across the finance and insurance industries is mostly related to the use of parametric insurance [2]. Parametric insurance is a relatively new innovative approach, which is now expanding into new markets, beyond the agriculture and property insurance markets that are already well-established.
3. **Event footprint** is an insurance solution that allows the **comparison** of the claims received from insured clients with the **actual material damages** incurred during the claim management process. Environmental data, especially EO, can be used to detect continuous changes in relevant assets and/or geographical locations or to conduct in-depth analysis following an event and assess damage remotely.

- *Focus on the finance industry: the growing role of environmental data in improving forecast accuracy*

Current regulations, such as the **Green Deal net-zero strategies**, the **Task Force on Climate Related Financial Disclosures** (TCFD), or the **EU Taxonomy**[2] are prompting businesses to align sustainability efforts with financial prosperity. With the growing demand for access to reliable sustainability data, environmental data become indispensable. They provide real impact measurements and transparency for sustainable financial and policy decisions.

Environmental data applied to financial institutions (FI) play several pivotal roles:

- **Commodity trading** and production traceability, using satellite EO data for yield forecasts, crop prices, and raw material inventories (in compliance with the EU

[2] The **EU Taxonomy** is a **classification system** developed by the **European Union** to guide investment and financial decision-making towards **environmentally sustainable activities**: EU taxonomy for sustainable activities

Deforestation Regulation), aiding investors and traders in supply-demand forecasting.

- Crucial source to feed FI's **risk assessment** (screening processes) in the development of an investment strategy.
- **Provide ESG indicators for sustainable investing**, assessing financial returns and impact. European regulations (e.g., taxonomy, green finance) promote ESG integration in investments. Satellite EO data complement traditional environmental monitoring with higher resolution, as seen in the UK Catapult's Spatial Finance Initiative[3] leverage the extensive capabilities of satellite EO data combined with machine learning to transform access to information within the financial ecosystem. Examples include carbon credit ratings and supporting companies in reducing emissions.

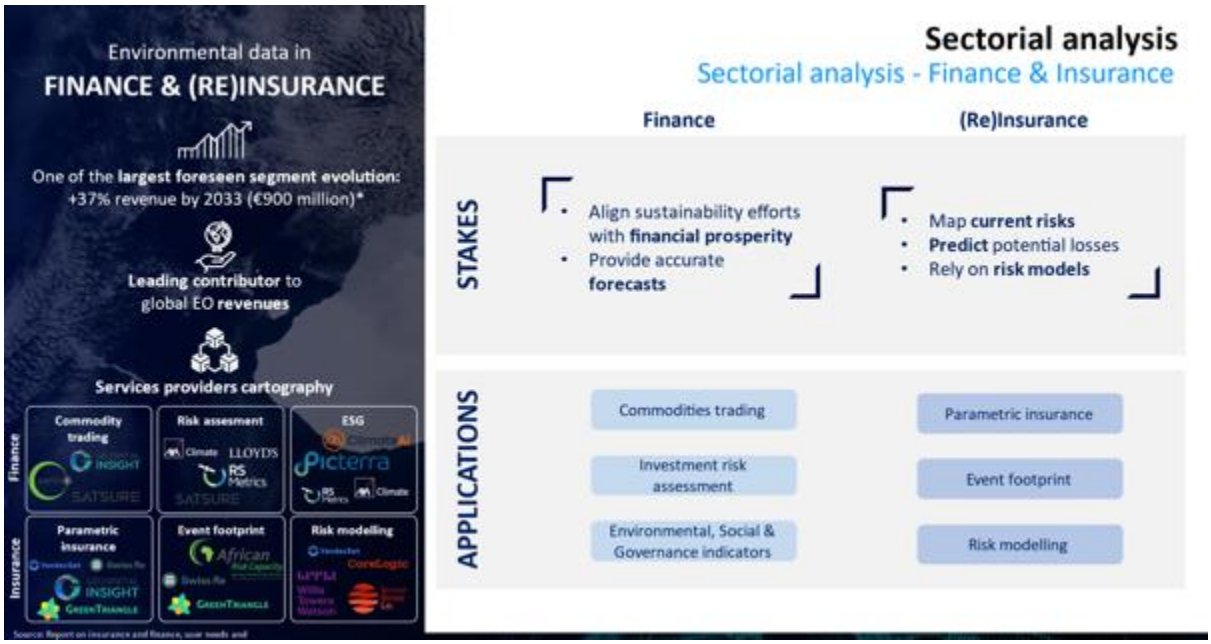


Figure 4: Overview of the Insurance and Finance sector analysis

2.2. Energy sector

In March 2022, in response to the **extreme volatility of the energy market**, the European Council decided to gradually reduce the EU's dependence on imports of Russian fossil fuels by diversifying supply sources and accelerating the transition to clean energy. This energy instability led to the implementation of the **REPowerEU Plan by the European Commission**, which aims to establish a resilient energy system whose requirements promote the use of climate and EO data [5].

[3] For more information, UK Catapult website Spatial Finance Initiative

In addition, in order to reach climate neutrality by 2050 and to reduce emissions by 55% by 2030, the EU targets 40% of its total energy to be derived from renewable sources by 2030 (to comply with **EU Green Deal** objectives[OBJ][OBJ]. This major shift in the energy mix requires a substantial acceleration in deploying energy sites and fuels a strong demand from energy stakeholders for environmental data.

At COP28 in December 2023, parties called for a "just, orderly, and equitable" shift from fossil fuels. In May 2024, the Nuclear Alliance of 15 EU countries set a 2050 goal of 150 GW in nuclear capacity (30-45 reactors), reinforcing nuclear as the EU's top low-carbon energy source [6]. Despite the energy transition, oil and gas continue to **be the fastest and most reliable sources for energy security**, with companies in the sector investing an additional €1.3 billion in new extraction projects [7]. The main challenge remains aligning these investments with the 1.5°C pathways of the Green Deal.



Thus, **environmental data and services will prove fundamental** to meet these sectors` challenges and, more broadly, **accelerate the green energy transition**. According to EUSPA, revenues from EO data and services within this sector should have around 70% higher revenues forecast in 2033 compared to 2023 [3].

To support current and future investments and facilitate the energy transition, climate and EO data play critical roles across the energy value chain, which includes exploration, production, transport, storage, and distribution to end consumers [8]. Energy stakeholders, represented by international bodies like the International Energy Agency, partly shape the needs and requirements of users. EO data could be essential in addressing sector challenges through their applications:

- **Exploring and selecting site implementation:**
    - **Forecasting potential** for renewable energy generation—specifically for solar, wind, and hydropower sites—relies on real-time and predictive weather data, including long-term projections spanning years or decades. This information is crucial for selecting optimal locations for renewable energy infrastructure. For example, in wind energy, production shifts and wind characteristics are anticipated due to the ongoing rise in average global temperatures. As temperatures increase, air density decreases, which directly impacts wind power potential. It has been estimated that, depending on the climate-change scenario and the region, by 2100 changes may exceed 30% of current average wind power density values.[28] Space-based technologies can be meaningful byin offering crucial data to determine and model wind speeds on the ocean surface. This, in turn, can enable the prediction of **Annual Energy Production**.

- **Mapping geological resources:** As the oil and gas industry faces new challenges, such as expanding into higher latitudes or further offshore and meeting increasingly stringent legislative requirements for environmental sustainability, environmental data is becoming increasingly important for the sector. Satellite data reduces location errors and delivers faster, accurate and reliable information by systematically revising and updating pre-existing maps and datasets on field intensity and the probability of finding the substances. This application is linked to one of the ten actions recommended by the Action Plan on Critical Raw Materials (namely "*Deploy Earth-observation programs and remote sensing for resource exploration, operations and post-closure environmental management*").
- **Identifying areas** that have **minimal ecological sensitivity** and lower risks to biodiversity. Historical environmental data and projected climate models can support the identification and classification of "**go-to-areas**", aiding the evaluation of ecological risks, such as minimal foreseen environmental impact.
- **Mapping Vulnerability** to assess environmental risks. **Climate modelling** is employed to assess the likely frequency or intensity of events driven by climate change. For instance, sea-level tracking performed by the ESA Climate Change initiative could prove invaluable for coastal nuclear facilities at risk of flooding due to rising sea-levels, such as the Hinkley Point power station in the UK.

- **Monitoring exploitation**:
  - **Managing exploitation assets:** Earth Observation is an effective tool for **monitoring emissions** and **detecting accidents**. Provided adequate data acquisition and availability, satellite data offers **timely information** on leaks and emissions, allowing organisations to prioritise repairs that minimise both production losses and environmental damage. For example, a systematic scanning of offshore basins enables the detection of oil leaks on the sea surface. Addressing these leaks not only

    saves valuable products but also permits oil & gas companies to optimise the overall environmental impact of their operations. Accordingly, the International Energy Agency estimates that oil and gas companies can **reduce almost 45% of methane emissions from oil and gas operations** at no net cost. This, in turn, can help eliminate 1.7 Gt of GHG emissions per year [9].
  - **Enhancing energy efficiency and energy grid stability:** Weather forecasts and climate models can be used to predict **heating and cooling demand**, helping to optimise energy
  - supply and reserves. Unlike traditional fossil fuels, renewables like solar and wind are subject to **weather variations**, which lead to fluctuations in energy

production. Climate data can **support simulations of weather conditions affecting energy production, which is necessary for planning a reliable and resilient system**.

- **Dismantling energy installations:**
  - Climate data enables proactive planning of infrastructure changes, by considering both their scale and environmental resilience. **Monitoring transport and storage system assets** (pipelines, powerlines, etc.) and their **structural integrity**, is essential for preventing natural and social disasters. Earth Observation supports the construction and use of a Digital Twin for powerline networks to assess the risks of harmful interactions between those lines and their surrounding environment.

Some European-funded projects have already conducted in-depth studies on the specific use of climate data in the energy sector. See CLARA, RESPONDENT, SATSDIFACTION.



Figure 5: Overview of the Energy sector analysis

2.3. Smart city sector

Europe's urban areas are home to over two-thirds of the EU's population. According to the United Nations, the world's population is set to rise to 10.4 billion in 2080. This demographic growth will be marked by a rural exodus: **80% of the European population will live in urban areas by 2050** [10]. This poses a considerable challenge; alongside existing ecological concerns, environmental impacts are already evident in the form of urban heat islands (e.g., London and Paris regularly record night temperatures up to 4°C higher than their rural surroundings).

To address these challenges, the EU is launching the European Urban Initiative to support sustainable urban development. The aim is to establish 100 smart, climate-neutral cities by 2030, serving as models for other European cities to follow. To drive transformation, these cities will continue leveraging private-sector partnerships—a strong European tradition—**with €9.8 billion invested in public-private projects in 2022** [24].

Building on the vision of sustainable cities and the ongoing technological transition, smart cities aim to optimise resources, reduce emissions, and improve the efficiency of services and traditional networks through digital solutions. This city concept is designed to provide technological solutions to the challenges of urban densification and to meet public policy needs [12]. Digital technologies offer cost-effective solutions and are projected to enhance quality of life by 10–30%.



The IEA (International Energy Agency) estimates that **by 2024, urban areas will have 83 billion devices connected.** Those devices can cover a range of aspects, such as air quality, energy consumption, geospatial data and traffic patterns. Digital technologies, such as smart sensors and building control systems, could reduce building emissions by 350 million tons of CO2 by 2050 [22].

Connected devices are used in several areas to improve the resilience and sustainability of cities:

- **Energy management: Urban areas consume over 65% of global energy** [14]. Smart cities are addressing the **European Energy Efficiency Directive** [11] as well as contributing to the ambitions of **RePowerEU**. Resources and energy management are optimised according to climatic and weather conditions, usage and consumption patterns. For example, Barcelona (Spain) uses humidity, rain, and other sensors to refine park irrigation by assessing the actual need for watering. Owing to a 25% increase in water conservation, the introduction of the water conservation program in 68% of public parks is generating annual savings of almost €500 000[4] for the city. [3]
- **Mobility:** Due to high density and historic infrastructure, European cities tend to be more congested [13]. Congestion carries a significant cost, amounting to approximately 1% of the EU's GDP annually [15]. Moreover, transport is a major problem for air quality, with the European Environment Agency estimating that 96% of Europe's urban population is exposed to levels of fine particles above the World Health Organisation`s recommended thresholds. With the help of satellite data, these

[4] Annual savings estimated at $555 000 in 2014 [3]

issues can be better managed. For instance, researchers developed a machine learning model that integrates Sentinel-5P satellite data with ERA5 meteorological data to estimate ground-level nitrogen dioxide (NO_2) concentrations in the Metropolitan City of Milan [4]. Data used include those from the TROPOMI payload instrument carried out on Sentinel-5P which is available daily with around 3 hours of latency (considered near real-time).

- **Urban planning and climate resilience:** Cities must also **prepare for the changes induced by climate change**. Urban planning and resilience are key elements since they make it possible to assess, anticipate and resist the impacts of climate change while guaranteeing the security and well-being of the inhabitants. Using climate scenarios and risk assessment, decision-makers can design policies and infrastructure that minimise environmental risks and maximise resource efficiency. **Climate data can be used to highlight the risks associated to the occurrences and impact of rare and extreme events**, providing early indications, so that preventive measures can be taken.
- **Easier decision making**: Decision-making is enhanced by the abundance of data, enabling more efficient planning and execution. It also helps to ensure that urban development projects adhere to initial plans. This technology provides the flexibility to adjust and reorient models on site as needed. For example, the **digital twin** developed in Copenhagen allows **city planners to test different scenarios**. They can use "what if" **simulations to adjust road speeds** for example and understand how these changes affect mobility demand [27].

The following figure summarises the main stakes and applications of the Smart City sector. It also provides an overview of key providers.



Figure 6: Overview of the Smart City sector analysis

2.4. Educational sector

Education, encompassing approximately 1.6 billion students worldwide—from primary (740 million), secondary (614 million), to post-secondary (254 million) levels—is essential for leveraging environmental data. This challenge is addressed within a fast-growing field known as Climate Change Education (CCE). CCE can be formal, non-formal or informal, multidisciplinary at every education level. Climate Change Education is critical for fostering the skills, attitudes, and behavioural patterns of young generations regarding, all emphasise the role of schools in engaging pupils and students on the necessary changes to address urgent climate challenges.

To effectively integrate climate education within the educational sector, engaging with key stakeholders across various categories is indispensable. First of all, **initiatives linked to space companies** provide a substantial foundation in the discussion of climate education. For example, **ESERO**, a European Space Agency initiative, focuses on using space to inspire and engage students in STEM (science, technology, engineering and mathematics) subjects.



In addition to space initiatives, **teaching associations** offer a strong network for the dissemination of climate education. General associations, such as the European Schoolnet, play an important role in promoting innovation in teaching across Europe. Specialised associations, like the **Challenger Center for STEM education**, provide targeted platforms for integrating climate related themes into topics like geography, geoscience, and STEM curricula.

Further, climate and environmental education initiatives foster advanced climate literacy. **GLOBE (Global Learning and Observations to Benefit the Environment),** for instance, engages students, teachers, and scientists in collaborative, hands-on learning projects about the environment.

Lastly, **governmental and intergovernmental bodies** strongly influence educational policies. The European Commission's Directorate-General for Education and the Education for Climate initiative promotes climate education across Europe, while Member States education ministries shape national curricula. Additionally, UNESCO's efforts in education provide a global perspective and support for integrating climate education into national curricula.

However, data analysis reveals that most climate change education references in country submissions focus on public awareness.

This highlights the need for countries to expand their climate change education activities to systematically address other elements of climate change education, especially formal education and training [16]

- **Student experience enhancement**: The enhanced visualisation capabilities of environmental data allow a vivid and engaging presentation of climate challenges. This approach connects theoretical knowledge acquired at school with real-world, up-to-date environmental issues, which, in turn, can render learning more relevant and stimulating. Studies, such as those conducted with Greek teachers [53], have recognised the potential of Earth Observation as an effective tool to attract the students' interest and to engage them in active learning.

  Further, teachers favour the development of simple, short activities (activity-shots) that can easily fit into the classroom curriculum with minimal preparation effort. In this direction, the European Space Agency is continuously developing and freely offering space-based educational activities for use during school hours along with training opportunities for teachers at all educational levels.

  Other opportunities arise for providing ready-to-use educational materials that climate change education topics with non-STEM subjects, thus enhancing interdisciplinary learning. Initiatives like the "Climate Across Curriculum" project by Smith College demonstrate the potential of such an approach. This resource aims to promote climate literacy across disciplines by exploring and documenting the various ways in which climate impacts the Earth, with a focus on art, history, literature and music.

- **Apprehending climate change reality**: Environmental data, including precise EO data, enables learners to focus on local climate change impacts, making the subject matter personally relevant and meaningful. By engaging students with their local environment and community, Place-Based Education (PBE) fosters a deeper commitment to sustainable practices and equips them with the tools to address these challenges. [17]. Environmental data at a local scale allows students to interact with difficult concepts through a local lens, thereby simplifying the understanding of global phenomena. This could include for instance local flood risk analysis, local air quality projections, or concrete biodiversity changes. By making climate change information locally relevant, these data empower learners to connect with the material on a personal level, enhancing their grasp of the subject.

- **Reinforcing students' skills**: Environmental data fosters advanced research and data analysis skills. Through APIs and local applications, students gain hands-on experience with real-world data, enhancing their analytical, problem-solving, and critical thinking abilities. This engagement promotes autonomous thinking and broadens their perspective on global issues, while keeping them connected to scientific and technological advancements. Additionally, working with environmental data increases climate awareness and environmental responsibility. This notion may further support educational efforts to drive large-scale social change. As a result, this

strategy has the potential to prepare students for careers in related fields, owing to increased interest in geospatial, space, and remote sensing technologies.

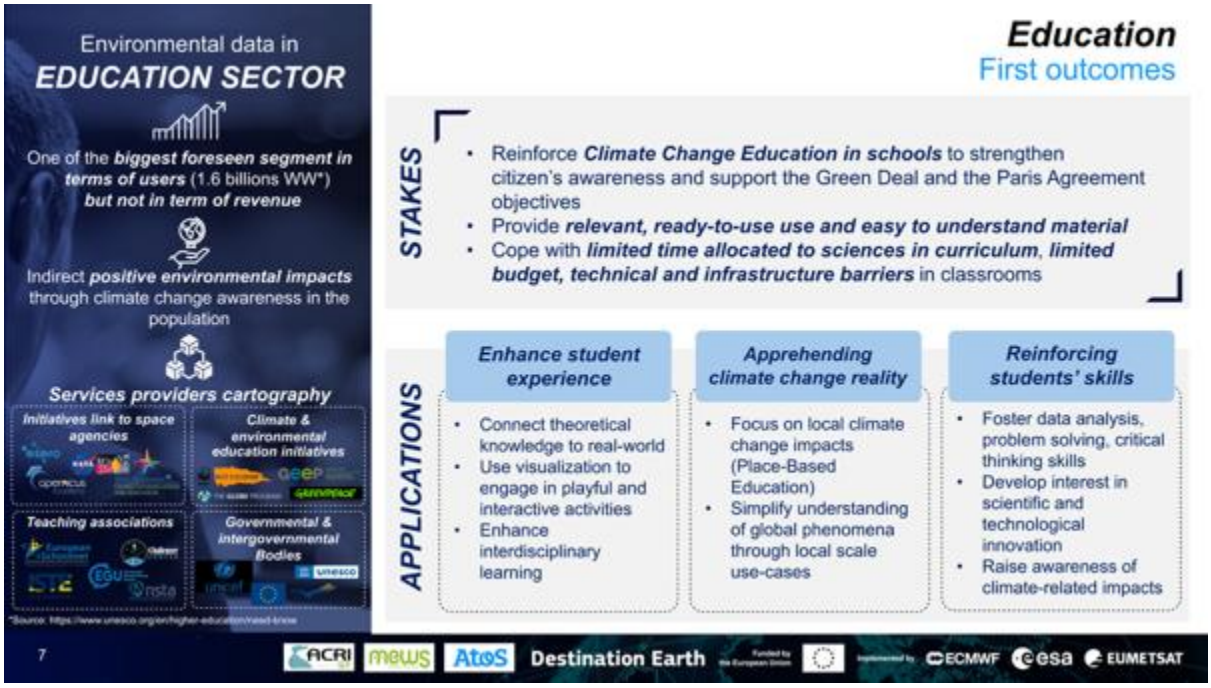


Figure 7: Overview of the Educational sector analysis

2.5. Construction sector

The construction industry is pivotal in today's economic and environmental challenges. With a global housing crisis, increased frequency of natural disasters, such as hurricanes and floods, maintaining, rebuilding and developing infrastructure has never been more pressing. Besides, the need to renovate a large number of aged infrastructures intensifies the challenge. A significant growth potential is therefore expected for the construction industry, whose market is expected to reach €18.6 trillion in 2027 at a CAGR of 6%, according to the Business Research Company [26]. Rapid urbanisation and the expected increase in the number of people living in urban areas to 2.5 billion by 2050 will further accentuate this dynamic [29].

To reduce the sector's energy consumption, the European Commission is committed, as part of its “Renovation Wave” strategy, to renovating 35 million buildings by 2030. This initiative forms part of the ambitious objectives of the European Green Deal, where to achieve its goal of reducing greenhouse gas emissions by 55% by 2030 (compared with 1990 levels), it must reduce buildings emissions by 60% [25].

Indeed, behind these market opportunities lie real environmental challenges. The building sector accounts for 36% of European CO2 emissions and 40% of energy consumption. Consequently, this sector is at the heart of today's ecological concerns, especially as environmental crises worsen and the fight against global warming intensifies.

Environmental data offer considerable advantages to the construction industry. They enable the analysis of historical data to assess vulnerabilities to natural hazards. They also support the creation of projections related to future impacts of climate change and provide regular updates in a variety of formats to monitor construction progress and identify potential threats to infrastructure. These capabilities have contributed to the growing integration of Earth Observation into all phases of infrastructure management: In 2022, the use of EO data and services by the construction sector generated more than €250 million in revenues, with service-based offerings accounting for more than 75% of this total. In this context, EUSPA estimates that revenue from the sale of EO data within the EU's urban development sector will increase from €20 million to €50 million by 2033, more than doubling over the period [3].



The construction sector's interest in environmental data stems from its wide range of applications across the entire value chain. This data offers actionable insights that drive efficiency, productivity, sustainability and resilience across the entire value chain — from design and material sourcing to construction processes and end-of-life management:

- **Resources and raw materials management:** Resource management is becoming a key element in the sector, as overuse can create shortages. Thanks to satellite images and hyperspectral sensors, it is possible to support the identification of deforestation, soil erosion or water pollution caused by these activities. Material and resource management also applies to company assets. Since construction work is carried out outdoors, it is subject to weather conditions that sometimes must be anticipated to guarantee the safety of sites, employees and equipment.
- **Construction site analysis**: By integrating earth observation data into 3D construction models, architects and engineers have more information to anticipate problems encountered during the construction phase in real time. The use of Earth Observation data can thus **enhance risk management** in the construction sector, especially by enabling the early detection and continuous monitoring of environmental and geotechnical hazards.
- **Real estate portfolio management:** Earth observation data are increasingly leveraged in the real estate sector to support property valuation, urban development monitoring, ESG reporting, and commercial investment decisions, while also addressing the environmental impacts of urban expansion. Urban planners and local governments can use such insights to mitigate the ecological impact of unchecked

development, promote nature-based solutions, and better integrate green-blue infrastructure into real estate strategies.

- **Progress documentation:** Satellite images can strengthen stakeholder engagement. Indeed, unlike the companies executing the work, other stakeholders (financial institutions, future owners, public authorities, etc.) often lack visibility into the project's progress. Successive images from satellites on a temporal ellipse can support progress monitoring [23].
- **Resilience of building: 85 to 95% of current buildings will still exist in 2050** [25]. Without improving the resilience of buildings, climate change will increasingly weaken buildings, and the damage could be even more important. Rising temperatures, increased humidity, and more frequent extreme weather events accelerate material degradation, such as corrosion of metals, cracking of concrete, or deformation of asphalt. EO data helps identify high-risk areas and their impact on urban communities. Improved maintenance routines can detect problems before they become critical. Moreover, by analysing past and future weather events and environmental changes, environmental data can help to predict potential risks.
- **Energy efficiency:** As part of RePower EU's strategy for energy independence, the EU is committed to achieving zero fossil fuel emissions from all new residential and non-residential buildings by 2028 for the public sector and 2030 for the private sector. EO data can support this objective by assessing the solar potential of existing rooftops and façades. By integrating satellite-derived solar irradiance, seasonal cloud coverage, and shading analysis based on surrounding structures, stakeholders can identify suitable surfaces for photovoltaic installations and estimate production capacity. Though EO data alone are not sufficient, they provide valuable input when combined with building models and on-site assessments to guide the deployment of solar energy systems and contribute to broader decarbonisation efforts.



Figure 8: Overview of the Construction sector analysis

2.6. Forestry sector

European forestry is expected to face several major challenges in the coming decades: climate change will not only affect forest health, but it will likely change the composition of forest trees with compounding effects on wood resource management, apparition of new invasive species and biodiversity loss. The European Union's forest management strategy is a critical component of the European Green Deal. This strategy is designed to enhance the quantity and quality of EU forests, while strengthening their protection, restoration, and resilience. Moreover, deforestation is a major issue in this global forest policy, which is why the European Union has introduced the European Union Deforestation Regulation (EUDR) regulation, due to come into force at the end of 2025.



The EUDR aims to 'prohibit the placing on the market or export from the European market of products that have contributed to deforestation or forest degradation'.

There are many different stakes related to forestry. Many of these stakes can be addressed in whole or in part thanks to climate data (such as the ones provided by

DestinE) and can be segmented into three main categories**: Environmental monitoring**, **Forest resources monitoring** and **Operation management**.

- **Environmental monitoring** of forests is essential for understanding and addressing the complex challenges posed by climate change, biodiversity loss, and forest degradation. Climate data significantly support these monitoring efforts by providing comprehensive, timely, and cost-effective information over large areas. Satellite imagery and remote sensing technologies offer detailed insights into forest structure, health, and changes over time. This environmental monitoring also encompasses wildfire identification and monitoring, which is becoming a key element for population safety as the risk increases.
- **Forest resources monitoring** is important for sustainable forest management and conservation efforts, addressing critical challenges, such as deforestation, degradation, and illegal logging. Earth observation data can be used to carry out this large-scale forest inventory, thanks to InSAR technologies, which can detect species types based on their spectral footprint. Deforestation and degradation can also be monitored from space to identify areas experiencing forest loss or decline, allowing for targeted interventions to protect biodiversity and maintain ecosystem services. Finally, illegal logging monitoring is crucial for detecting and preventing unauthorized timber harvesting, which undermines conservation efforts and contributes to environmental degradation. The detection of illegal logging could be performed by combining EO data with administrative maps to discriminate legal and illegal activities.
- **Operations management** is the third dimension of forest applications for environmental data. On the one hand, there has been a growing interest in certified forest-based products with labels supported from different programmes or entities like the Forest Stewardship Council GmbH (FSC) or Programme for the Endorsement of Forest Certification (PEFC). Space data can be very useful to assist certification auditors in verifying that certified forests are compliant with those standards and are not subject to non-compliant activities. A new field of application complementary to these certifications is around the compliance with the EUDR regulation, which will be implemented from the end of 2025, and which imposes strict standards on deforestation. On the other hand, environmental data can also support classic forest management practices by allowing monitoring forest road conditions or by providing insights on global land use: who owns which parcel? How do parcels interact with other land uses such as agriculture or urban development?

Traditionally, forest industry players have not relied heavily on analytical data to manage their forest resources. This is now changing with the emergence of a number of services designed to support these players in more sustainable forest management. The utilisation of Earth Observation data has emerged as a pivotal element in modern forest management. By coupling advanced satellite technology and data analytics, the Forest industry is better equipped to monitor forest health, track changes, and implement sustainable practices.

In terms of end-users, the main categories are public interest stakeholders, such as governmental agencies, scientific researchers and NGOs; commercial forest managers (industrials or private owners), and industrials. Two types of industries can be distinguished

here: the ones who are directly involved in the forestry industry and those who are involved in the supply chains of commodities like wood, palm oil, soy, cattle, rubber, coffee, and cocoa and must comply with EUDR standards.

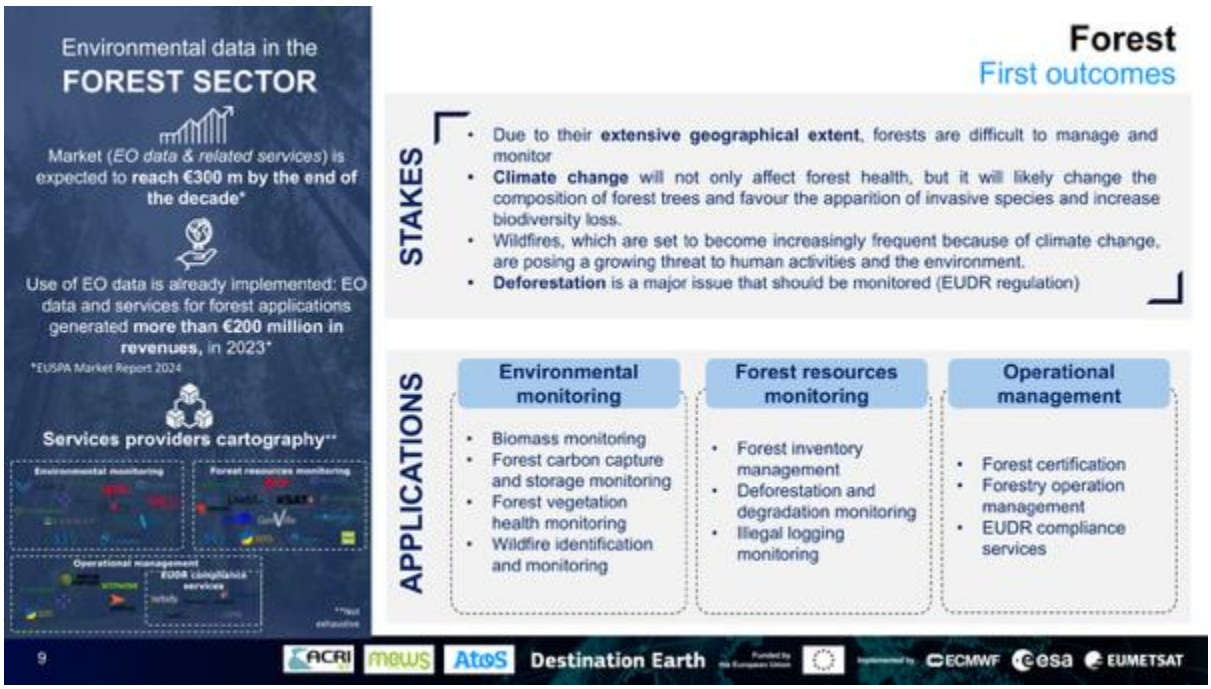


Figure 9: Overview of the Forest sector analysis

3. Technology landscape

3.1. State-of-the-art of Earth Observation or Climate related platforms and systems

An analysis of existing Earth Observation or Climate related platforms that provide similar features as the DestinE Platform has been conducted. It provides a view of the domain's state-of-the-art and supports the analysis of potential applications and service needs.

3.1.1. Platforms and systems analysed

Twenty-two platforms and systems were analysed and placed into categories based on funding source (i.e., public) or objective (i.e., commercial), with the large GAFA ecosystem forming its own separate category.



Figure 10: Platform types from left to right: GAFA / Public / Commercial

3.1.2. Main outcomes of the analysis

The landscape of existing platforms is highly heterogeneous, as highlighted with the three main categories described in the previous paragraph. The GAFA type of platforms are providing generic features that can also be used for environmental data valorisation, public platforms implement dedicated infrastructure and services for greater environmental, social, and economic benefit. Commercial platforms are operated by private companies, SMEs and start-ups, developing Earth-Observation specific solutions, mainly with SaaS business models. Below is a summary of the identified primary advantages and unique differentiators.

1. *Environmental data usage*

The sharing of open data is common among platforms, especially for large free datasets which are widely available, notably from GAFA and public platforms dealing with these topics. For example, Copernicus data can be found in the NASA data access platform, as well as from the Google Earth Engine and AWS platforms. This is less often the case for

commercial platforms that rely on proprietary data (e.g., Airbus and the Pleiades Neo constellation).

2. *Business drivers*

Open data and open-source code are largely encouraged, with collaboration-oriented features and pay-as-you-go models. GAFA type of platforms usually provides free access for academics and research projects, with quotas for storage and computation resources that can be extended. Public platforms are mainly open while Pay-as-you-go models are the baseline for the commercial type, sometimes with additional monthly fees for basic services.

3. *Public utility interest and policy support*

Platforms generally promote easy access to data and related services, to enable usage by a large audience and collaboration for various purposes, either private usage, or public usage like research and policy making.

A wide range of services and apps already exists, addressing many different topics. However, **platforms often miss effective referencing** for existing services or datasets that could be used for other purposes. It is also a matter of valorising the work done by service providers (at algorithm, datasets or app level), to showcase what has been done to a wider audience and ultimately enable them to adapt their business model accordingly.

Hubs of development for code and documentation are **systematically available**: GitHub and JupyterHub are the two main hubs used by the various platforms which were analysed. GAFAs and public entities also structured their community around events, conferences, hackathons or developers' discussion forums.

4. *Multipliers potential*

The ability to reach users has also been analysed. Indeed, all of these platforms are **aimed at relatively experienced users** (service providers, researchers, scientists, etc.). For example, using GAFA platforms effectively requires a learning curve, potentially leading to user lock-in to maximise value. Another example is the fact that public platforms are often used by scientists for research projects, whose funding is sometimes conditional on the use of a particular platform. Finally, the services provided by commercial companies are subject to a fee, with often specific objectives for a dedicated sector or a dedicated use case. This prevents them from being used by the general public, especially novices, who are usually expecting free features to start, or even small public administration organisations which have restricted budgets – only advanced users would take the plunge in that case.

3.1.3. Syntheses on the five analysed dimensions

Below are provided syntheses on each of the five main dimensions analysed for platforms and systems.

3.1.3.1. Business Model

- **The GAFA platforms** are based on existing Infrastructure as a Service (IaaS) cloud solution, providing access to storage and computational resources. As such, these resources are not tailored solutions for environmental data that are just one-of-a-kind

type of data hosted on the platforms. These platforms offer the same “elementary bricks” (e.g., Software as a Service, ML algorithms…) to all customers or users, whether they are working with environmental data or not. The business model is based on the usage done by third-party service providers of their cloud infrastructure, with paying fees (either monthly or pay-as-you-go) for most users. Exceptions, such as free access for non-commercial projects (e.g academic, research, NGOs, journalists depending on the platform) and reduced fees for start-ups or newcomers are meant to support marketing efforts or early capture of users as part of the ecosystem. Investing effort in compiling attractive reference datasets (such as those from NASA or Copernicus), these platform providers are also competing and increasingly offering specific services for Earth Observation applications.

- **Public platforms** are developed and operated on public funds under the responsibility of public entities. These platforms aim to provide publicly needed environmental data and information on specific EO or Climate related topics. Often built around research projects or operational public services, these platforms are mainly offering free access.
- **Commercial platforms** often rely on private infrastructure with a business model based on paid specific or tailored-made services or data, through licensing for SaaS or PaaS, as they are targeting specific commercial use.

Business models **vary considerably** from one player’s type to another, due to organisation and strategy. The GAFA platforms rely almost entirely on end-user payments (e.g., AWS), therefore, the challenge for them is to attract as many users as possible, in order to maximise profits. To do so, they draw on their experience in developing software, platforms and clouds, with strengths that are appreciated by today's users. These include continuous development of new features or rapid consideration of relevant user feedback, to offer cutting-edge content. Instead, public platforms do not aim for direct profitability; their goal is to support project development in their economic zones, thereby promoting indirect economic spin-offs. While the necessity for innovation may be less pressing for these platforms, it remains a significant factor in maintaining competitiveness. More explicitly, these platforms typically aspire to encourage innovation in the content they offer (new data, new algorithms), including through collaboration and co-building initiatives, as opposed to prioritising the delivery of innovations that enhance platform performance, such as computing power and user-friendliness. Ultimately, in addition to the aforementioned aspect of innovation, these public platforms tend to give greater consideration to data governance, infrastructure sovereignty and the establishment of partnerships with other initiatives.

3.1.3.2. Core Services

Platform users or customers access the platform's services through a set of core functions that enable their management and operation. The configuration and availability of these functions or platform management services determine the characteristics and potential of the platform. For example, a platform's Infrastructure-as-a-Service (IaaS) offering might be limited by the underlying infrastructure's capabilities, such as the lack of scalability in a private cloud.



The following services are considered as part of the platform`s management services:

- Registration and authentication, IaaS and accounting enable the definition of transactions and unlock scalability at user level. The ability to manage projects and user groups with allocated usage pools is also a key feature, along with efficient user support and an appealing front-end interface.
- **Authentication and payment processes are dependent on the user's profile:** End users log in and make payments through the service interface. Service providers may log in and make payments on the platform.

One crucial point regarding registration is that it could be a showstopper for users to be forced to provide personal information, especially credit card information, just to log in to the platform to explore its features. Another element highlighted during lead users' interview is that one platform-level authentication shall be sufficient to access all services.

3.1.3.3. IDE and Sandbox

A "**sandbox**" is defined as a ready-to-use development environment entirely dissociated from production (i.e., with dedicated datasets, user accesses, computation resources, …), enabling application prototyping without the risk of impacting the data and resources available in operation. The Digital Earth Australia initiative provides such an environment, including sample data, Jupyter notebooks to experiment with DEA's Earth Observation datasets, and explore proof-of-concept applications.

"**Integrated development environments**" (IDE), running on the production platform, can also help to enable rapid prototyping thanks to an efficient access to available data, documentation, development libraries, trainings and examples, supported by dedicated computational resources and providing embedded results visualisation. In this regard, the **Google Earth Engine "Code Editor"** serves as a reference, offering a user-friendly, and entirely free interface for prototyping and publishing applications.

The combination of Sandbox and IDE with text-to-code functions is considered valuable for easing development, especially rapid prototyping. However, this functionality is still in its early stages.

3.1.3.4. Collaborative services

Collaboration is promoted by GAFA and public platforms, especially using open-data and supporting open-code capabilities. The FAIR principles (Findable, Accessible, Interoperable, Reusable) are frequently applied hereby. Dedicated Hubs (GitHub, JupyterHub) are used to share APIs as well as documentations, and are further strengthened by developer communities and events like hackathons.

Recognising the value of user-generated content is essential to building momentum, yet this is often lacking on public platforms. Notably, many platforms still lack an effective framework for referencing enhanced datasets, user-developed algorithms, and services. This is of course not applicable to the commercial initiatives, as no collaboration services shared outside of their ecosystem has been found.

From a developer's perspective, a community similar to 'Stack Overflow'—where users can post development-related questions and receive answers from peers, with moderation—is considered a valuable feature. AI could assist by identifying and suggesting similar existing questions, potentially reducing the need for human moderation in the short term. However, for more technical queries, the value of a human-to-human forum remains significant, notably in fostering a sense of community. Going beyond the analysis of platforms mentioned above, one notable collaborative platform is Hugging Face, which has structured a community of AI developers by providing collaborative resources and services for hosting models, datasets and applications around AI. Hugging Face supported the collaborative development of the open-source large-language model "BLOOM". It provides features that have made it particularly attractive to the community, such as pre-trained "Natural Language Processing" models, libraries of Machine Learning processing building blocks or its "Model Hub", a space where users can share, discover and download pre-trained models.

Another interesting platform for collaboration on AI is Kaggle, which is known in the Machine Learning world thanks to its open competitions.

3.1.3.5. Applications and services

There are already apps and services available across every field of interest. Two types of applications can be identified: those offering insights into past and present events, and those focused on simulation and prediction.

Service providers are usually not showcasing the platform they are using for data collection and processing. In fact, platforms' branding promotion also depends on the service provider's strategy. For many services, the user experience is outside the platform entirely, e.g., on the service provider's own website.

This is particularly true for GAFA and public platforms: except for projects specifically highlighted on a given platform, it is often difficult to identify which platform a particular service provider uses. Given these conditions, it is challenging for the platform to establish a "mainstream" image. Other commercial platforms (Dassault Systèmes) offer a complete user experience on their platform, with additional services appearing as widgets or analysis layers fully integrated into the platform (same layout, logo, etc.). Initially, constraints on service providers may reduce the platform`s attractiveness, however, this could change once the platform is recognised as a source of new business opportunities.

Other arguments, such as a “Sustainable label” described in Section 4, could reinforce the interest for third-party applications to showcase their use of the platform.

3.2. State-of-the-art of relevant technologies and building blocks

Various technological bricks or functionalities have been identified as potentially adding value to DestinE, or aligning with the platform’s planned components. The aim is to provide a better understanding of these functionalities and their level of maturity through existing or planned use cases or benchmarks. The objective is to be able to assess the value of embedding these elements in order to improve the platform's attractiveness for service providers or consumers.

Six concepts have been studied so far, with a summary provided for each below.

- **No Code and Low code** services offer a full-graphical environment to create apps with little or no development knowledge, facilitating broader access to digital technologies among non-experts, businesses and organisations. Various applications for DestinE (e.g., webpage creation or workflow automation), based on mature examples, could be integrated in the foreseeable future.
- **Text-to-code** services utilise AI “Large-Language Models” to ease and accelerate the development of computer code. While advanced features, such as automatic generation of complete code chunks seem difficult to achieve and deploy in the short term, other functions like commenting, unit testing, security and performance testing could be integrated more rapidly into the DestinE environment as the technology matures.
- **Digital-Twin-as-a-service** features enable users to simulate complex systems. This leaves aside the complexities of modelling the system itself—an ambition central to Digital Twin software publishers like Dassault Systèmes. Their aim is to provide turnkey modelling solutions and associated IT infrastructure, to simplify real-time data retrieval and exploitation of real-time data. Providing such a service within DestinE would be a real key to the success of a spreading exploitation of Digital Twins data.
- **Visualisation-as-a-service** features aim at providing ready-made indicators, for individuals to easily grasp data related to a specific theme or indicator, or pre-defined dashboard templates and graphical visualisation tools. Efficient with large datasets, the system supports seamless integration of user-provided data. The “Our World in Data” website, which compiles charts and data on various topics and provides them freely and openly; or PowerBI or Tableau Software for data manipulation and visualisation customisation, are good examples of mature features that could add short-term value to DestinE.
- **Sandbox and IDE**: fully integrated, turnkey environment, which can be used to carry out initial tests of the platform and its main functionalities or quickly prototype a solution to evaluate its potential are not systematically provided. Two benchmark initiatives, from DEA Australia and Google Earth Engine “Code Editor”, illustrate the

benefits users and administrators could expect from such functions, to accelerate DestinE's adoption, ease service implementation and reinforce external services verifications.

- **Collaborative tools and environments**: providing development and code-sharing environments to encourage collaboration, supported by hubs (GitHub or JupyterHub) which provide code management features, are already a baseline for existing platforms, designed
- to attract service developers and researchers. Other initiatives, such as hackathons and associated prizes, or a structured community building, could also be valuable for DestinE attractiveness.

3.3. Challenges and support programmes for environmental projects

Numerous initiatives aiming to support **the development of projects and businesses** that combat climate change, helping to reduce the environmental impact of human activities, or improving general knowledge of environmental issues, have emerged in recent years. These can be organised by private organisations, which see a potential interest in promoting their products, or public organisations aiming to identify promising local innovations or address specific issues. Several of these initiatives have been examined in this attractiveness study to understand their scope, target projects or organisations, and the rewards offered to those selected.

Among them, the **2025 Compute for Climate Fellowship** **organised by AWS and IRCAI** (International Research Center for AI, under the auspices of UNESCO) will elect 20 startups to support the implementation of proof-of-concepts on clean energy, low-carbon transportation, sustainable agriculture, carbon removal, etc. These rewarded startups will benefit from financial grants in AWS credits ($4,000,000 in total), expert support from AWS and IRCAI on AI, HPC or quantum computing; the other applicants will be granted $5,000 in AWS credit.

In Europe, the **European Lighthouse of AI for Sustainability** (ELIAS) issued a first **Open Call** in 2025 to support AI applications for Sustainability with a clear European dimension. With a grant up to €60,000 and communication facilitation in ELIAS network, the four future winners will be expected to implement their projects before the end of 2025. The **UK Centre for Greening Finance and Investment** **Hackathon 2025** aims to help the reinsurance industry assess the likelihood of hurricanes making landfall in the USA and typhoons in Japan occurring simultaneously over the next 5 to 10 years The objective is to bring together teams of data scientists, financial risk practitioners and researchers, to work for 2 days on

this question, while any new intellectual property created during this event will be dedicated to the public domain, with no grant provided.



Other initiatives offer a support programme to help startups grow and scale up. It is the case of the AI Climate Accelerator, which provides a 12-week coaching for founders of companies working on environmental and resilience issues, or the Startup 360 Connect Programme which connects Kenyan and East African startups with UK investors and VC.

Many other challenges or programmes have been identified and may be analysed in more detail in the future: Google Accelerator for startups, Google.org impact Challenge on GenAI, AWS's Climate Tech Accelerator, Microsoft's "Startups AI for Good accelerator", IBM's Hyper Protect Accelerator, Alibaba Cloud's Sustainability Challenge, Oracle for Startups – Green Tech Solutions.

3.4. Interoperability

Interoperability was first defined by the Institute of Electrical and Electronics Engineers (IEEE) as "*the ability of two or more systems or components to exchange information and to use the information that has been exchanged*". The emerging technologies composing systems-of-systems have increased their importance and scope. Interoperability can be thought of as the ability of software systems to interact for a specific purpose, once differences (development platforms, data formats, culture, and legal issues) have been addressed.

In this context, the following challenges must be overcome:

- Harmonise the systems provided by a wide-open ecosystem (researchers, public, industry, service providers…)
- Make resources (data and services) on the platform reusable for most users
- Ensure sustainability of the platform in the long term, in other words, ensure sustainability of each component along their usage chain

Several frameworks and working groups exist to tackle this issue, different types of European and international standards and initiatives have been investigated. They concern either Earth Observation and spatial data services, software development or European administration and services: New European Interoperability Framework and its application on Smart cities and communities, INSPIRE directive from EC, Semantic Web Earth and Environment Technology Ontology from NASA, Earth Observation data cubes, Open API initiative and manifesto.



The main aspects that come into play for most of these approaches are:

- **Data and metadata common ontology and semantics -** A common recommendation in interoperability frameworks concerns the ontology and semantics of data shared within the system of systems ecosystem. This requires a catalogue that clearly describes the data being handled, along with their metadata. INSPIRE directive from EC, or the SWEET framework from NASA require a common structured ontology provided in data catalogues.
- **Consistent data quality -** ISO19157 identifies the conceptual model for describing quality elements in a geographic dataset and defines several quality elements describing different quality aspects in a dataset: completeness, logical consistency, positional accuracy, thematic accuracy, temporal quality, usability and meta quality.
- **Data policy and privacy, including legal aspects -** Open data is promoted in interoperability frameworks proposed at European level, which cannot be the case in DestinE context. As a minimum, a harmonised data governance and clear data policy are required within the ecosystem of interoperable services.
- **IT interoperability through standardised APIs -** Interoperability between software applications or services is ensured by APIs working under different protocols HTTP, or HTTP like, or WebSocket. It should rely on structured data in JSON or YAML format. As for the data, interoperability frameworks recommend open source APIs (e.g., OpenAPI Specification).
- **Standardised documentation -** Beyond technical aspects, interoperability relies on the documentation of the different elements that should be reused by other systems. It concerns data and metadata (as already mentioned regarding ontology and semantics), as well as information on APIs. Indeed, the objective is to make APIs easy to discover, use and implement into third party-apps, with clear specifications.
- **Reuse and reproducibility -** ISO19115 proposes a model to record all inputs necessary to execute an analytic process, as well as to describe the process itself. The objective is to trace the description of the algorithms used, their inputs and

outputs, the computing environment where the process runs, the organisation/person responsible for the product, etc., so as to enable third parties to reuse and understand the process.

- **Harmonised governance, including subsidiarity concept -** In order to facilitate communication for both service providers and users within the system of systems ecosystem, harmonised governance is promoted by several frameworks, notably in the European Interoperability Framework (EIF), which remains applicable for the digital services ecosystem.
- **Accessibility / multilingualism -** Accessibility to all people in Europe is a strong principle proposed in the different frameworks investigated. It concerns equality regarding nationality, disability, gender, age, etc. Once again, it is particularly valid for public administration services but is also applicable to digital services.
- **User centricity -** Particularly relevant for digital services, the European Interoperability Framework (EIF) advocates user centricity to benefit both individuals and organisations.
- **Reliability and sustainability -** For the sake of service continuity in the whole ecosystem, each service provided should ensure its own sustainability and reliability, regarding technical aspects and support. It is paramount to ensure sustainability and reliability of the chain in which they are used on top of their own usage.

3.5. Business models

A vivid market but fierce competition

A large part (around 75%) of Earth Observation commercial services revenue is generated by governmental customers, in the Defence and Security sector it is 50% [18]. EO service providers vary in size and scope, and generally offer services to a limited range of applications. While the EO market demand is very dynamic, its supply remains fragmented with many small players catering to niche or local markets. Besides, some end-users may develop their own solutions internally to maintain control over their data, stay independent from any service provider, and handle the last mile IT integration. This is true for insurance companies or major energy providers which developed in-house solutions for instance.

IService providers all have their own business models, sometimes applying different ones, depending on their customers. It is worth noting that some service providers also propose credits purchase, where credits are used to access any type of commercial service provided under their brand (i.e., data reseller, post processed data and imaging, consultancy).

In addition, some non-profit organisations, such as universities, research associations or education organisations may also act as service providers. Their R&D efforts may entail refining specific models and applications, to achieve adequate TRL for potential usage in industrial settings. Development is funded by public grants at local, national, or European levels, complemented by partnerships with particular industrial firms for customised development. In the case of public funding, applications and models are generally released as open sources and used for publications. Operating services based on SLA in the long term is not part of their model.

A strong need to control cost

Despite a fast-growing market, service providers must face strong cost pressure. In addition to the service development costs, service providers typically use cloud infrastructure to host their services (AWS being to be the most commonly used). As a result, back-to-back business models are essential for service providers to control margins and guarantee profitability. Besides, it is worth noting that service providers do not only rely on EO data but also use other data (e.g., social networks, national or regional land covers, drone images, market data, ground elevation, infrastructure referential, weather data) which may not always be freely available.

Focus on the last mile IT integration

The last mile IT integration is crucial for end-users as it is not easy to integrate EO services into customers' IT architectures. Issues such as data integration, data migration, data warehousing, and data wrangling may occur. It also requires investment in IT systems and data governance processes. Human intervention and deep domain knowledge are still needed to develop and fine-tune data analytics algorithms and manage this last mile.

Different business models for service providers

Service providers have different business models, including free services funded by public organisations or commercial services paid by private or public customers. The business models for services can be based on different models as known in Software as a Service (SaaS) context as presented below.

- Pricing per users (individual or tiered): Pricing is based on the number of users using the service. This model is widely used for software licences selling. In case of tiered pricing, the pricing is increasing per users range instead of per individual user.
- Pricing per active user: This model is similar to the previous one, but based on "active" users, individually or per range. Some providers propose to repay non used ranges.
- Service based pricing: Pricing is distinguished for the users per service type and related upgrades. It requires defining service packages, with corresponding pricing.
- Storage based pricing: This business model is similar to the previous one but related to storage capacity. Range of storage must be defined here, corresponding to users' needs.
- Service usage-based pricing: This model is suited to users whose demand fluctuates significantly. Pricing is tailored to the usage, e.g., depending on calculation resources used, on data transfers
- Personalised pricing: This corresponds to a configurable services package with corresponding pricing which can be composed by the users. This enables tailored services for each user well adapted to their feature needs.
- Fixed price / fixed fee: Fixed pricing is proposed for the full range of services, independently from any other distinction.
- Free of charge for users:

- Funded by advertisement: Lighthouse service is free of charge, but revenues are generated by advertisers which have access to users. Two types of advertising can be distinguished: *search ads* occurring when users are searching for service and *display ads* pushing advertising to users.
- Funded by public investment: Service providers are usually fully paid by governmental institutions to provide these services to the general public as a public good.
- Funded by purchase in the service

  Service providers generate revenues through payment of physical goods and services, or access to specific content (newspaper for instance) purchased with the service.
- Funded by crowd funding or donations

  Service providers depend on a large base of small donations, supplemented by substantial donations from sponsors. A system to collect donations can be embedded in the service itself. Specific crowdfunding campaigns can be launched to energise funding of the service. Famous platforms relying on this system can be mentioned: Wikipedia, The Guardian, etc.

- Freemium (free + premium):

Freemium are business models that attract users by offering a basic version of a product or service free of charge. However, they rely on charging for advanced performance features or services in a premium access. To extend the possibilities, the different types of limitation in free versions are:

- Feature or Functionality-Limited
- Time-Limited
- Usage-Limited
- Freemium with Ads
- Support-Limited
- Content-Limited
- Collaboration-Limited
- Customisation-Limited

The choice of model depends on the nature of the product, the target audience, and the business's revenue strategy. Charging mode for this premium access can vary depending on the service provider, based on the listed business models.

“Business models” at platform level

The focus can be placed on effectively managing diverse business models from multiple providers that may be integrated into the platform. This is typically the case for smartphone application marketplaces (Apple Appstore). Indeed, the embedded payment in the platform gives access to different business models for application providers. This model gives sufficient flexibility to application providers to reach their market and proposes the most relevant payment model regarding their business, while **ensuring simplicity and a unique selling point for the users**.

4. Digital Responsibility of DestinE

4.1. Digital responsibility awareness

4.1.1. Context

The digital sector accounts for **3% to 4%** of greenhouse gas (GHG) emissions worldwide, which is twice as much as the aeronautics sector, and equivalent to all the heavy commercial vehicles in the world, with **forecast annual growth of 6%** [20]. When set against global GHG emissions reduction targets to limit climate disruption and its consequences (e.g. the "Fit for 55" plan, which aims to reduce European Union GHG emissions by 55% by 2030 compared to 1990 levels), these factors make a strong case for using **digital technologies both efficiently and sparingly** in the coming decades.



Today, around **two-thirds** of digital GHG emissions are linked to the production, use and end-of-life of the **devices** (computers, smartphones, tablets, televisions, etc.), while the final third is due to **data centers and infrastructures** (networks, etc.) [21]. For example, the explosion of video-on-demand services (Netflix, AmazonPrime, etc.), combined with the increase in video resolution (UHD, 4K, 8K), is one of the main factors contributing to the rise in GHGs in the sector. In the foreseeable future, the rise of AI, and in particular generative AI, could jeopardise the sector's ability to decarbonise, and even to be able to operate, as Gartners estimates that 40% of AI data centres could face electricity shortages by 2030. **Reduction initiatives must therefore question the end use of content by users** and not confine themselves solely to the direct emissions of data producers and providers, which account for only a minor share of the problem.

Other impacts also need to be considered to assess the environmental and social footprint of the sector:

- In the age of increasingly scarce materials and water depletion, **the extraction of rare earths,** on which the digital sector is highly **dependent,** and the **use of water** in the manufacture of equipment, their lifespan and the conditions under which they can be recycled are all factors to be taken into account when assessing the sector's environmental footprint, which must encompass the entire lifecycle of products and services if it is to be properly evaluated.
- In 2022, the digital sector accounted for around **10% of the world's electricity consumption**, making it one of the major challenges for planning the transformation

of the systems and prioritising access to energy sources, in particular renewable ones, **in a context of intense electrification of uses** (mobility, industry, etc.).

- **Social impacts**, such the “digital divide”, lack of accessibility , and increasing inclusiveness, may also be considered, to gain a comprehensive view of the sector`s benefits and negative impacts.

Labels, methods and tools have gradually emerged to help companies measure and reduce the environmental footprint of their digital activities. This is the case in France, for example, with the “Numérique Responsable” (Sustainable IT) label, which certifies companies that have defined and implemented action plans in this area.

4.1.2. Definition of Digital Responsibility in DestinE’s context

Within the context of DestinE, the concept of “Digital Responsibility” aims **to identify and implement levers for reducing the direct and indirect negative environmental and social impacts** associated with the platform over its entire lifecycle, while **maximising the positive impacts**.

This includes, but is not limited to:

- **Assessing the GHG emissions** linked to the **implementation** of the platform (and its hardware components in particular), the emissions linked to the **services and applications** hosted on the platform, and also estimating the environmental benefits linked to the use of these services.
- The **definition of a strategy** for reducing the platform’s negative impacts, consistent with regulatory requirements, and an associated action plan including, for example, the optimisation of hardware resources to meet just-enough needs, the gradual introduction of environmentally and socially binding specifications for DestinE registry services or raising user awareness of the impact of their use of the platform.
- The implementation of **a governance structure** dedicated to monitoring DestinE Platform’s environmental issues, supported by ad-hoc indicators.

These points are discussed in more detail in the following paragraphs with an emphasis on environmental aspects and introducing social impacts through accessibility issues of the platform.

4.1.3 Challenges ahead

It seems essential to **align the platform’s objectives**, namely, to offer services to a wide range of users, that enable them to understand, assess and respond to their environmental challenges, **with the means by which these objectives are achieved.** Otherwise, the approach risks becoming unsustainable for two reasons:

- On the one hand, **users are increasingly mindful** of environmental and social issues, and the lack of coherence between objectives and path may render the platform **less attractive**. It may even generate negative communication against DestinE, if the platform’s positive actions appear to overrate real gains, or even mask significant negative impacts.

- On the other hand, organisations (including service providers) which will fail to assess their environmental impacts and to identify the associated risks and opportunities will be **less resilient**. Indeed, their activities are likely to be negatively impacted by environmental issues, either directly (e.g., shortage of materials, greater exposure to extreme weather events) or indirectly (e.g. users preferring other, “greener” solutions). Setting a course now on the integration of environmental stakes for business would therefore limit risks in the future, or even contribute to identifying opportunities of sustainable growth.

The platform will be **even more attractive,** if it supports its entire value chain in more **virtuous practices**, from suppliers to end-users, thus making it more resilient. Fostering the eco-design of digital services, which integrates environmental aspects into service design with the aim of improving its environmental performance throughout its whole life cycle, is one of the main levers identified for reversing the trend of the digital sector’s growing environmental footprint.

Focusing on GHG emissions, it is particularly important to **pay attention to the communication** around any initiatives to reduce or limit negative externalities of a product, a service or an organisation. In the event of incomplete or even erroneous information, there is a high risk of being accused of **greenwashing**, which can considerably harm a project's attractiveness. It is therefore essential to back up statements with verifiable figures and reliable sources of information, and to specify the scope of the analysis. Similarly, several expressions are becoming increasingly popular, but should be used with caution:



- **“Carbon neutral”** or **“Net-Zero Carbon”** is a generic term that corresponds to a global balance between man-made emissions and man-made absorption capacity. According to the IPCC [22], it is **only scientifically valid if considered at a global level**, which implies that a product, service or organisation cannot be carbon neutral by itself, but can “**contribute to global carbon neutrality**”, which is the preferred expression for communication on the subject.
- “**Carbon negative**” is generally reserved for devices or ecosystems that **extract CO2 from the atmosphere**, also known as “carbon sinks”, for example forests, soils, or industrial capture devices. These items can also be said to contribute to global carbon neutrality.

Even if a system is described as “carbon neutral”, “net-zero carbons” or “carbon negative”, this should not obscure the other environmental and social impacts mentioned above, which are not considered in these expressions.

4.2. Implementation directions

Three main complementary areas can be addressed by a responsible digital strategy, and are described hereafter: measurement or environmental impact, associated strategy and action plan definition, and governance aspects. DestinE's application of these guidelines is detailed in the “Recommendations” section, in paragraph 6.5.1.

4.2.1. Workstream 1: Measurement

For Destination Earth, the main challenge would lie in being able to measure not only the ecological cost of setting up the platform and running it, but also the impact induced by the use of customer services hosted by the platform.

These assessments are generally carried out at company, product or service level. In the context of DestinE, the advantage of carrying out this analysis at the platform level, thus encompassing the three EEs and their subcontractors, would be to be able to compare the benefits provided by the platform and all its components, with the negative externalities linked to its design and operation.

Focusing on GHG emissions, it is particularly important to **pay** When measuring GHG emissions, it is customary to separate “direct” emissions (grouping together emissions from an organisation's sites, known as “Scope 1”) from “indirect” emissions linked to energy consumption (“Scope 2”), and “indirect” emissions linked to the upstream (suppliers) and downstream (use of products by customers and end-of-life) value chains (“Scope 3”). In the context

of DestinE, for example, “direct” impacts can be defined as those linked to the operation of one of the platform’s components (DTs, DL or DESP). In contrast, “indirect” impacts are those caused upstream of the platform, for example during the manufacture of hardware components (datacentres, networks, etc.), or downstream, including in particular service providers activities, and end-users’ consumption during their use of the platform.

The data to be exploited for this assessment generally come from a variety of sources, internal and external, and are consequently heterogeneous. Given this, data quality and management play a central role and necessitate dedicated governance.

Several levels of the environmental impact assessment can be defined, depending on the ambition of the organisation, the needs expressed and the resources available:

- **Partial GHG reporting**, including **Scope 1 and Scope 2,** is considered as the easiest step to reach, as most of the information required to perform this assessment are available internally, or can be easily estimated with adequate emission factors.
- Including **Scope 3** to assess the **global GHG footprint** is becoming the new regulatory baseline in many countries, as for most activities (including Digital) Scope 3 means even more than 90% of the global amount of GHG emissions. Consequently, properly estimating Scope 3 ensures a **comprehensive view of the**

carbon emissions, especially given the growing number of users and service providers. To achieve this, it may be necessary to make assumptions about consumption and average impacts associated with the various services hosted on the platform. Several benchmark methodologies already exist to support this assessment, among them the GHG Protocol, the ISO 14064 norm or the Bilan Carbone®, which provide the most comprehensive approach and associated tools.

- While measuring carbon emissions is a first step, **it is not sufficient to assess the environmental impact of the platform** in the broadest sense. By carrying out an **Environmental Life Cycle Assessment (LCA)**, one can expand the number of parameters taken into account to eighteen, including mineral depletion, water scarcity, human toxicity, climate change, ecotoxicity, land transformation, fossil depletion, eutrophication, etc. The aim of this analysis is to measure the impact of the platform on each of its criteria, at every stage of the life cycle. From design to implementation, service operation and end-of-life, thus making it the most exhaustive analysis feasible. It would even be possible to perform social LCA, to identify the impact of DestinE on people and communities.
- **Double materiality analysis** is a concept designed to assess and communicate a company's financial and sustainability impacts. It is pushed as a requirement of the European Union's CSRD (Corporate Sustainability Reporting Directive), to force organisations to identify **impacts, risks and opportunities**, laying the foundations for a business development strategy that integrates the impact of the environment on the organisation, and vice versa.

The organisation will need to adapt these concepts to its context, to find levers in its internal activities, as well as in its upstream and downstream ecosystems, if it is to propose a comprehensive and credible action plan. The "Accelerated Climate Transition" international initiative (previously known as "Assessing Low-Carbon Trajectory" - ACT) could help to set this initiative in motion, providing a step-by-step method to develop a low-carbon strategy at company level, regardless of its size or sector of activities.

4.2.2. Workstream 2: Strategic and action plans

Reducing the environmental impact of a product, a service or an organisation is generally based on several pillars which provide a common thread in the construction of an action plan. Regarding GHG emissions, several frameworks exist ("Avoid, Reduce, Compensate", the "Net-Zero Initiative", the "1.5°C Business Playbook" or the UN's "5Ps") that largely overlap and can also be extended to impacts other than GHGs. These frameworks suggest structuring an action plan by prioritising:

- The actions within the organisation's value chain (internal, or external, involving suppliers or users), before integrating actions outside the value chain (such as financing projects to reduce greenhouse gas emissions)
- The actions of sobriety and efficiency, to avoid or reduce emissions, rather than so-called 'compensation' actions which are more hypothetical and often subject to criticism.

The organisation will need to adapt these concepts to its context, to find levers in its internal activities, as well as in its upstream and downstream ecosystems, if it is to propose a comprehensive and credible action plan. The “Accelerated Climate Transition” international initiative (previously known as “Assessing Low-Carbon Trajectory” - ACT) could help to set this initiative in motion, providing a step-by-step method to develop a low-carbon strategy at company level, regardless of its size or sector of activities.

4.2.3. Workstream 3: Set-up of the organisation and supporting tools

These projects to measure emissions and define and monitor action plans require dedicated

resources to coordinate the activities, ensure the necessary awareness-raising within the business units, collect the data, and so on. For many organisations, beyond the regulatory aspect of reporting which exists in many countries, it is, in fact, a matter of undertaking global transformation projects that integrate environmental and social aspects as a key decision-making factor, alongside economic considerations.

Hence, a structured approach is necessary, especially for multi-entity projects, such as DestinE, to rationalise efforts and guarantee the coherence and success of the measures taken. To be impactful, it is important that project sponsorship comes from the top, and that all stakeholders are made aware of the project from the outset.

Environmental and social data are key to identifying the levers for the action plan, making the introduction of data governance highly beneficial. Collaborative tools can facilitate suppliers in sharing their information regularly.

However, it is sometimes necessary to use ad-hoc questionnaires to capture specific information, or to adapt to the maturity of your ecosystem. Some of the software available on the market enables this.

4.3. Digital accessibility for all

The concept of accessibility for the DestinE online platform is a crucial component to ensure that all users, irrespective **of their disabilities**, have access to the information and services offered. This is particularly relevant given the broad target audience of DestinE. Ensuring accessibility on the platform offers numerous advantages:

- Promoting digital and social inclusion and reducing discrimination against people with disabilities
- Simplifying the user experience (UX), DestinE can also improve its search engine optimisation (SEO) and overall visibility
- Increasing the audience and user volume for Destination Earth. As of 2022, individuals with disabilities over the age of 16 represent 27% of the European population, underscoring the significance of this demographic.

Moreover, as an initiative of the European Union, the Destination Earth platform would need to comply with relevant regulations, such as Directive (EU) 2016/2102 on the accessibility of websites and mobile applications of public sector bodies and adhere to ethical standards and frameworks, such as the "POUR" methodology described in the following illustration.

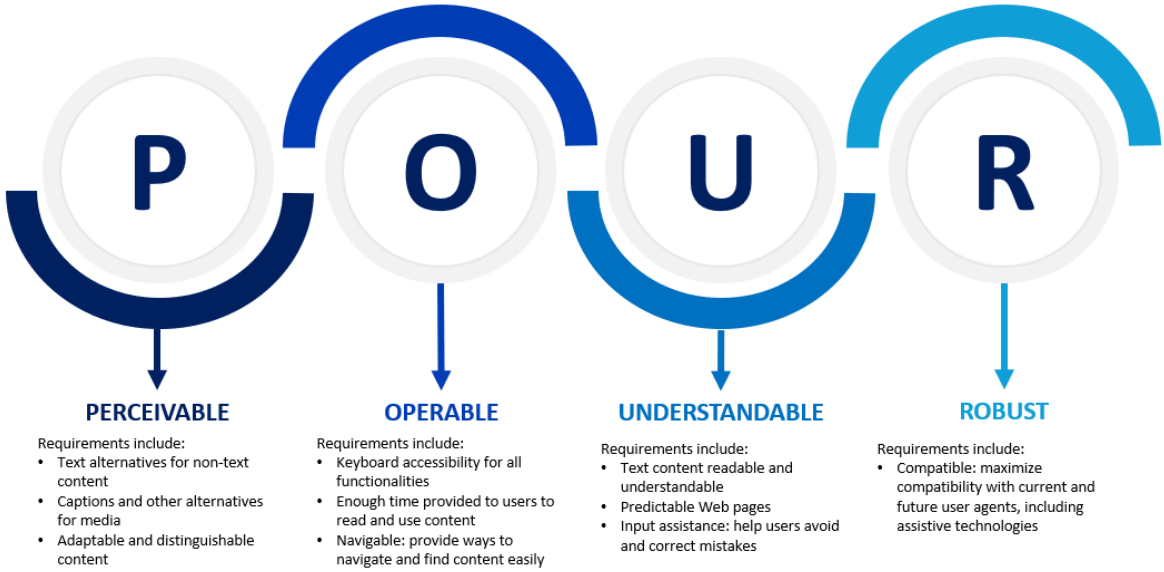


Figure 11: POUR framework for Web Content Accessibility

A preliminary analysis has identified several areas for improvement on the DestinE platform, including missing alternative text for images, contrast errors, and potential errors in the headings or the structure of elements.

5. AI Roadmap

Based on DestinE's strategic goals, four objectives were defined for the DestinE Platform's AI roadmap, namely accessibility, innovation, development tools and digital responsibility. Some of the topics focus on improving the experience of service users, while others are aimed at supporting service providers or the DestinE platform management team, as described in the following figure.



Figure 12: The four main objectives of DestinE AI roadmap

Ten priority topics have been identified to support these objectives. They include **benchmarking leading AI infrastructure providers** (such as AWS, Google Earth Engine, OVH, Azure, and NVIDIA), **enhancing customer support** through personalised AI solutions, and **improving environmental data workflows** for processing and analysis. The roadmap also highlights the importance of **digital accessibility** and proposes the use of **AI multi-agent systems** to improve information accessibility and modularity. Other explored topics include the potential use of **blockchain** for secure, decentralised collaboration, and **quantum computing** to advance AI and machine learning capabilities. Additional focus areas target **performance monitoring, cost and resource optimisation**, the **development of secure and efficient tools** for service creation, and the implementation of advanced **data compression and transport solutions** to manage large-scale environmental data.

The AI roadmap for DestinE is structured around four strategic pillars, spanning three distinct time horizons: short-term (2025–2026), mid-term (2026–2030), and long-term (beyond 2030). The following figure provides an overview of this roadmap.

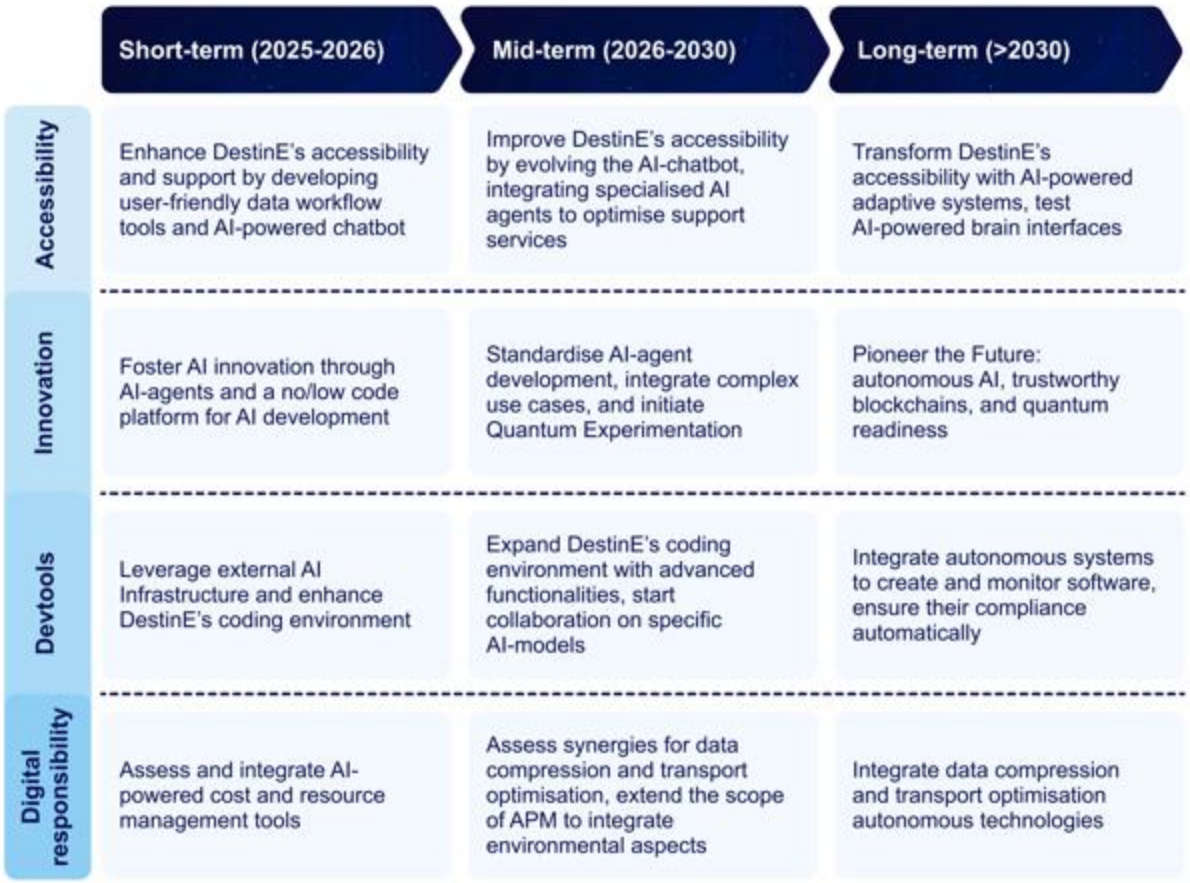


Figure 13: Overview of AI roadmap's objectives for each strategic axis

6. Recommendations to increase DestinE attractiveness

The recommendations presented in the following chapter are based on the preceding analysis and were co-designed with ESA. The recommendations outlined in the following chapter were initiated in July 2024 and further developed through to April 2025. As a result, some of these recommendations have already been set in motion.



This section builds upon:

- The analyses presented in the previous chapter
- An analysis of the identified needs based on over forty interviews with lead users across the ecosystem of users, classified according to the Kano model

The proposed recommendations aim at creating the optimal conditions for a demand-driven platform, prioritising user experience, raising awareness and engaging with users, while creating the conditions for successful and effective management of the platform.

An executive summary of the proposed recommendations is provided in the following section.

6.1. Overview of recommendations



Demand-driven platform	#12 Short-term	Clarify the freemium business model conditions for onboarded services and enable the possibility of different business models for federated services, while proposing a simple and clear pricing model for users.
	#13 Short-term	Provide users with a readable price catalogue and a full and detailed commitment on DestinE technical Roadmap.
	#14 Short-term	Ensure rights for service providers to commercially exploit DestinE data with limited barriers.
	#15 Short-term	Set up a marketplace of applications and services connecting service consumers with service providers, also favouring business and technological collaboration between all parties.
	#16 Mid-term	Provide advanced services facilitating the answer to specific Europeans challenges.
	#17 Short-term	Offer specific access conditions to research centres and universities developers and start-ups.
Awareness	#18 Mid-term	Advocate the "EU label" brand of DestinE as a key asset to comply with sovereignty, sustainability commitments and EU policy.
	#19 Mid-term	Leverage Digital Twins' services development and stir up interest towards new services made from these new capabilities, including merging Digital Twins data with other data.
	#20 Short-term	Proactively foster engagement of service users and service providers through specific interviews and user ambassadors.
	#21 Short-term	Organise industry-specific webinars to highlight DestinE's tangible benefits and innovations.
	#22 Short-term	Actively participate in sector-specific events and communities of practises to promote Destine's capabilities and applications.
	#23 Short-term	Set up an accelerator programme or organising a recurrent challenge dedicated to climate-change projects.


Conditions for successful and effective management
#24
Short-term
State the ambition of DestinE in terms of Digital Responsibility and define a clear strategy following the ACT methodology.
#25
Short-term
Create a dedicated Digital Responsibility governance team, supported by tools to measure DestinE global footprint, monitor the progress of the action plan and take decisions.
#26
Short-term
Assess the environmental impact of DESP, by choosing the appropriate perimeter of measure for negative externalities and improving it gradually.
#27
Short-term
Accompany the ecosystem on its Digital Responsibility path, with specific strategy and actions towards service providers.
#28
Short-term
Stimulate user commitment by making Digital Responsibility accessible, concrete and motivating through personalised, high-impact interactions.
#29
Short-term
Integrate environmental impact as a criterion for data management rules.
#30
Short-term
Communicate broadly but with precision to make DestinE's Digital Responsibility a competitive advantage.
#31
Mid-term
Propose accessibility awareness and trainings for service providers.
#32
Short-term
Enforce accessibility requirements and assessments for future service providers.
#33
Short-term
Publish and maintain a standard data catalogue with the DestinE Platform Information Model covering all data accessible through DestinE to ensure data interoperability. It includes DESP, DEDL and data available through services. DestinE data portfolio could be extended by interoperating with dataspaces from the Simpl programme from the European commission.



Figure 14: Executive summary - List of all recommendations

6.2. Prioritising user experience

6.2.1. User Interaction recommendations

> **Recommendation #1**
> Provide a comprehensive and high-quality inventory of cloud optimised datasets, services and applications.

A **comprehensive inventory,** based on DestinE Platform Information Model, could be created to facilitate user capture and retention by featuring captivating content.

It could take the form of **catalogues**, listing datasets, services and applications available on the platform, to enable the different types of users to quickly find relevant features with a guaranteed quality. These catalogues would include **robust filtering capabilities and**

certification labels. A unique catalogue gathering all datasets, services and applications could be defined, so as to group all capabilities at the same place and ease the discovery of all the content available, with a single-entry point. Splitting the content in different catalogues, based on the type of asset (datasets, services and applications) could also be a valid approach, but it may complicate content discovery, if the categories are not clear to users.

Furthermore, this inventory could also be a way to **distinguish free services and datasets from optional paid features** proposed by service providers. Indeed, DestinE is primarily an open public platform, enabling business creation through freemium business models. Clarifying this dichotomy between public and free from commercial and paid access may help users to better understand the functionalities provided by the platform.

All the content available in the catalogue would, of course, need to be "**Cloud-optimised**". These features may need to be distributed to optimise computation within the cloud infrastructure, thereby facilitating the use of existing data and services.

> **Recommendation #2**
>
> Enhance data accessibility with analysis-ready data and Visualisation-as-a-Service (VaaS) services.

The platform would need to provide easy access to analysis-ready data through services providing efficient and ergonomic user interfaces, designed to facilitate data exploration. These interfaces could be accessible **without requiring registration or payment information**, with user profiles utilised to tailor features and data availability. Additional **VaaS features** could also be proposed for various potential purposes, depending on the type of targeted user. For **novice developers**, indicators could be provided based on available data to facilitate users' understanding of the platform and support prototyping of applications. – e.g., the areas of the world where quality satellite imagery is most available (i.e., complete, cloud-free, etc.); or, in a designated area, the timespans when data are available, cloud-free, etc. This would speed up the creation of test datasets, which is often a time-consuming activity for developers.

Specific VaaS may be prepared to **support user's decision-making in key industrial sectors**, in particular in **Energy**, **Smart cities**, **Green finance** and **Education**. For these end-users, turnkey indicators could be considered, along the lines of "Our World in Data". The promotion of analysis-ready data has indeed been an output of a few service consumers' interviews, highlighting the importance of having impactful and simple visualisation. The creation of a specific **VaaS service provider** category could be a benefit in this respect, helping non-experts more easily find data that meet operational needs. Several service providers already possess such enabling technology, which could be offered to other providers. However, this visualisation service would need to go along with explanations on the data used, to help interpret it for their analysis. Providing visualisations illustrating an observation ("what?"), with textual interpretation of the consequences and implications ("so what?"), could be a game-changer to onboard people who do not normally use the kind of data available on DestinE yet, "particularly the general public, as it could

illustrate communication like IPCC reports", interviewees highlighted. To make it more concrete and comprehensible by all users, these kinds of visualisations and indicators should enable a navigation through different scales, from local to national and international.

> **Recommendation #3**
>
> Improve service discovery, offer tailored content and support

It is paramount to provide the best possible user experience for the service catalogue.

First of all, improving **clarity on the platform's full capabilities directly from the home page** is vital. Users wish to instantly grasp what DestinE offers them. Also, Ideally, they recognise it as the "entry point for users to an ecosystem of services" [19].

One recommended approach is to introduce a clearly labelled **"Explore DestinE" section or "onboarding" for service users** on the homepage. This section could provide users with a concise overview of the platform's features through succinct descriptions, interactive demos, and quick links to various services, thus ensuring users can easily comprehend the resources at hand.

Improving the user experience within the service catalogue itself, particularly under the "Services" tab, is also very effective. It would be beneficial to organise them around practical use cases, for instance, "I want to manipulate data" or "I want to visualise data." This user-centred approach would allow individuals to filter services based on their specific needs, making it easier to find relevant tools.

Improving the service catalogue's user experience (tab "Services" of the DestinE platform). This may be achieved by showcasing specific use cases of what users can do with the different services and filter by their needs instead of the scope of each service, for instance, "I want to manipulate data" or "I want to visualise data".

Additionally, **tailoring the platform experience to different user profiles** could significantly enhance intuitiveness. Descriptive content could be adapted for various levels of expertise — from beginners to intermediates and professionals — and services could be labelled with their respective levels of difficulty. Beyond expertise levels, the platform could also offer customised views based on user segments, such as those from educational institutions, industry, or policy-making bodies, ensuring that each group accesses information most relevant to their context. Further personalisation could be achieved by allowing users to configure their interface based on selected keywords, ensuring a more customised experience.

Clarifying distinctions between similar services is another critical point. Introducing an intermediate page to guide users based on their particular needs and compare the features of similar services would help prevent confusion. Complementing this with short overview videos for each service would provide additional clarity, making the platform even more accessible and easier to navigate.

Concerning the support, there is a clear user demand for a **dedicated space to raise questions**, including the implementation of a **live chat feature**. This would allow for

immediate assistance. Several levels of chat support can be studied: from a basic chatbot based on predetermined Q&A, to a more advanced **Chatbot based on Large Language Model (LLM) and Machine Learning**, to a human live chat for issues that require personalised attention or human judgement. In the context of DestinE, a human live chat could probably be covered by the development of a community of practices that would encourage the exchange of ideas and best practices among users. In order to support service providers and developers, the **integration of a platform like GitHub** could further support this initiative, providing a collaborative environment for services and users to share code and solutions.

Recommendation #4

Set up a team of experts supporting users on how to solve their operational problems with DestinE – Technology advancement encouragement strategy.

As a complement to the VaaS features, it is recommended to set-up a dedicated **team of experts** in climate and EO data projection. This team could **guide users** in the DestinE forum for instance in their **selection and interpretation of datasets and services responding to their operational challenges**. These experts would help users find, display, understand and properly use specific AAS to answer their operational questions.

Experts could be part of a DestinE help desk and would interact with users through email or live chat. They would also be developing FAQs, user guides and tutorials regarding DestinE Platform features and functionalities. Specific training sessions or onboarding programmes could be organised, to educate users on how to effectively use the platform.

This recommendation forms part of a broader strategy to encourage technological advancement, deemed necessary at the launch of DestinE to encourage wider user adoption. It can reasonably be expected that many potential users will not know exactly what they want or what is available, making it difficult to identify their precise needs. The demand-driven technology adoption development strategy could be reinforced in a second step, once the first lessons have been learned about users' profiles and platform's usages.

Recommendation #5

Promote No-code and Low-code features to facilitate the appropriation of the development resources made available by the platform and accelerate service development by as many users as possible.

Having **No-code** and **Low-code features** in DestinE could be seen as mandatory to help users meet their needs, whatever their use cases and development skills. It could also serve as a means of addressing the shortage of developers and reducing the time-to-market for business applications and services, while improving accessibility across various devices (computers, tablets, smartphones). These approaches may also **favour the onboarding of intermediate or advanced users** on DestinE. To do so, it would be mandatory to **offer the first bricks,** e.g., DestinE's website or **widgets templates**, **workflow management**, gathering data from several sources, transforming them, storing them, visualising them, etc.

By doing so, lead users would have the opportunity to build more advanced applications, which then could serve as templates for future users. As the number of users and services on the platform grows, the number of templates and examples available could increase, making it even easier for newcomers to access them.

No-code and low-code could also be seen as an opportunity to **strengthen collaboration** by imposing a **development framework by "bricks"**. This kind of framework is now the baseline (e.g., Google containerisation with Kubernetes), as it is widely promoted to enable reuse of existing content. It could therefore be useful to provide guidelines to service providers for their developments, to ensure the content (scripts, algorithms, libraries) they create may be reused easily by other developers but also non-developers, consistent with DestinE's specificities. Importantly, including container solutions such as Dockers or Kubernetes could be deemed essential for developers who are already accustomed to this type of development.

Additionally, it could turn into a **new source of revenue for no-code and low-code service providers**. For instance, one could imagine providing a "No-code" feature free of charge, with a dedicated fee to gain access to the source code or parametrisation possibilities ("low-code" mode)

Recommendation #6

Promote collaboration by offering a complete developer's experience within the platform thanks to benchmark tools, including tailored support.

To fulfil expectations for basic collaborative functions (such as code saving and sharing, version history, online documentation, etc.) or more advanced ones (like branch management, task assignment, etc.), it has been suggested to use the main **existing systems** (**GitHub** and **JupyterHub** mentioned earlier). This is primarily because they have already demonstrated their effectiveness and robustness, and secondly because they are widely embraced by the community, which reduces the necessity for users to acquire new skills.

Development services have already integrated such recommendations; however, it is noted that certain difficulties exist in the moderation of such exchanges that limit the full adoption. Consequently, the effort should be pursued, in accordance with the following guidelines:

- In addition to collaborative tools, the setting-up of a **structured development community** may be recommended. A dedicated forum tailored for developers, comparable to the renowned **StackOverflow** platform (a model used notably by Google Earth Engine), would **streamline the exchange of information and guidance**. Embracing a similar structure (where users pose questions, initiating discussion threads for other users to respond or vote on the most pertinent answers; all inquiries are public, with moderators ensuring they have not been addressed elsewhere), well-established within the IT development realm, would further enhance its accessibility to this community.

- A **dedicated space**[5] **gathering "official" development frameworks**, **API** documentation, dedicated **trainings** and other **development tips** could also be created. The goal is to create a one-stop shop for all the information required for fast and effective skills improvement. To accomplish this, providing training sessions with examples of code and datasets for experimentation may be suggested.
- A **centralised space specifically dedicated to bug management**: in the form of a **ticket** assigned to the service provider responsible for the module in question, in order to provide a framework facilitating the handling of incidents and their follow-up. This could be done in the form of a Kanban, with a workflow to be defined if it is to be exposed to the whole community.

Recommendation #7

Ease the development, deployment and integration of AAS through text-to-code IDE, intuitive API and access to standard development packages.

Development, deployment and integration of AAS could be **eased as much as possible** in order to onboard the widest possible audience. Development of AAS could be made easier with features such as a **text-to-code IDE**, enabling service providers to develop and **prototype quickly** within the platform. Interviews supported that additional **intuitive API** to access resources (data, computation, etc.) seemed necessary to attract advanced users, such as service providers, or to let existing services plug on the platform – which could also use **standard development packages/library** (e.g., in Python, REST) to **minimise the integration cost** of existing services. This would facilitate the migration of existing services to DestinE, accelerating the platform's operational maturity.

Recommendation #8

Provide a sandbox tailored to the real needs of service providers, to facilitate their early capture thanks to efficient prototyping features which could gradually be enhanced with additional functions.

It would be relevant to provide on such environment the **most up-to-date data possible**, and access **all the services deployed in production and their most recent updates**, for the developers to take advantage of all the existing content when prototyping. They may also need to invite **regular platform users to test** their services and applications in advance, without needing to access a separate web address or use credentials different from those employed on the production platform. In other words, it would be recommended to **integrate the sandbox as much as possible into the production environment**, rather than completely dissociate them.

[5] *Note: this is the purpose of the "Collaborative services" that have been made available on the DestinE platform since the first edition of this document.*

A complete IDE as provided by the Code Editor of Google Earth Engine, for instance, with coding and immediate results visualisation in the same place, would provide significant benefits to get acquainted with the platform. Aside from its entertainment value, which can enable a variety of audiences to manipulate the data available, this could be a real **membership trigger** for commercial service providers, researchers or academics, permitting them to simply prototype services and applications and make them accessible quickly. **Combined with No code/Low code functions**, this could also enable a sequence of packaged tasks to be tested on volumes of data to be restricted, giving an indication of how well the transformation works and how well it performs at each stage. The use of "**text-to-code**" functions would further enhance the appeal of this IDE, making it all the more accessible, given that examples of platform use will be limited in the initial stages. However, the technology does not seem sufficiently mature to envisage advanced use of this feature as yet.

Recommendation #9

Provide a true DTaaS feature to enable selected users to perform customized simulations, with adequate business model and guardrails on resources usage.

Expectations are high for the two first DestinE DTs. Numerous interviews echoed strong interest **to access both the data generated by the DTs, and the ability to run ad-hoc simulations**.

To truly offer a DTaaS, users need to be able to access data and **run simulations on demand**. This means defining a specific business model, based on the volume of data required, the computing power needed to launch new simulations, and the volume of data generated by these simulations. The question of the durability of data generated by simulations launched by "individual" players may arise: a **trade-off would have to be defined in accordance with the usefulness of the data for the community as a whole**. By default, it would probably be necessary to consider that the results of simulations launched "on demand" may not be stored and shared widely, insofar as it is likely that these simulations would meet a precise need, not exploitable by other players – and consequently rendering the cost of conservation higher than the cost of a new simulation.

Free access to simulation capabilities may not be recommended, except for certain specific profiles (e.g., researchers, academics, start-ups). Indeed, given the resources required to carry out these simulations and store the data, it seems inappropriate to provide the option of carrying out simulations to all users, including the most inexperienced. The above-mentioned issues may need to be addressed through a **specific governance**, which would define which type of users can be granted access to such features of DTaaS, for what purpose, and how data questions are to be handled.

If a free access was to be offered (as this could be perceived as a major differentiator, and serve the objective of making these data accessible and appropriable by all), then DTaaS users should at the very least be forced to **follow a training course** (such as a one-hour MOOC), and **quotas per user should be introduced** (e.g.: a maximum number of simulations per day, with a limited spatial and temporal scale).

Pilot projects could serve to evaluate the feasibility of opening this type of service, while illustrating the added value of DTaaS for specific simulation use cases. For example, it may be a good idea to propose this type of pilot project to cities, so to help them evaluate the impact of climate change on their area and define resilience plans. This could also be an opportunity to test the integration of DTaaS capability into these cities' digital twin, if they have one, to showcase the benefits of these functionalities to go beyond existing modeling.

To enable different types of users to run their simulations, several execution modes should be offered. APIs would thus be needed for service providers, to enable them to integrate these simulations into their developments. For users with less development experience, an intuitive graphical interface (enabling them to select a zone and period of interest, and to adjust modelling parameters, e.g., mesh size) to enable them to generate the data that could be useful for their use case.

6.2.2. Content quality, enrichment and personalisation recommendations

> **Recommendation #10**
>
> Federate existing features and data through a unique portal-based interface and ecosystem, with the possibility for service providers to enrich the current pool of data.

If moving to another Cloud provider was not perceived as a blocking point by interviewed service providers, relying on data not currently available in the datalake could be more problematic (e.g., non-EO images, carbon market data, social media data, ground elevation, etc.). The platform should therefore enable service providers to **import and use its own data, including local datasets**, store it into the datalake or **make it available through the platform**, thus reinforcing the "**one-stop-shop**" pledge, and helping to **break existing silos between the EO and climate communities**. As an example, DestinE could be imagined as a place where climate researchers' models can be validated thanks to satellite imagery. To implement this, both climate and satellite data should be made available within DestinE, which is considered by service consumers as a selling point for the platform.

Providing a unique portal-based interface could be useful to reinforce the brand image and thus reassure users: the DestinE interface could be perceived as a **guarantee of quality content**. Nevertheless, as mentioned before, service providers should be given the **latitude to develop their content outside the platform thanks to API**, as it is common practice for viewing interfaces (including user registration and payment capabilities) to be managed via the service providers' dedicated website.

Service providers, particularly the larger ones, would be incentivised in joining the platform, if it gives them **access to a wider audience** (see recommendation#15 on market access), and thus new international customers (notably in the EU). **Federating all services in one place will attract more users**, which will make them **more easily accessible to service providers**. This will end up in a **virtuous loop** attracting both users and service providers, addressing the expressed request.

DestinE must also be able to aggregate the services already available in the Copernicus "environment" (in the broadest sense: Copernicus Services, DIAS), to offer a single-entry point for existing and new users of this data.

Overall, this recommendation is expected to strengthen DestinE's "brand" and make the ecosystem easier to understand and use.

> **Recommendation #11**
>
> Ensure data quality, freshness and availability through FAIR access principles enable their usage across various users' needs.

On the data side, requirements must also be met to enable collaboration, starting with compliance with the **FAIR** (Findability, Accessibility, Interoperability, and Reuse) principles. A concerted effort should be made to turn these principles into practice, for example by **sharing annotated input data** adequately to facilitate model trainings with greater accuracy. Pooling this kind of effort will result in **better data quality**, and eventually in **enhanced services availability**.

Moreover, an utmost standard of data quality should be ensured. Regarding **data freshness and availability**, having the latest version of all data **at the same place** is considered of high value, and a **differentiator** from GAFAs' platforms especially. In a broader context, having access to data in near real-time or with a low delay is an expectation from many service consumers using business or situational intelligence services. From a more general point of view, users' needs on data quality, freshness and availability (e.g., spatial resolution) should be collected per sector and for the different use cases. This general set of requirements should drive a strategy to enhance datasets accessible though DestinE.

6.3. Creating optimal conditions for a demand-driven platform

6.3.1. Business model recommendations

> **Recommendation #12**
>
> Clarify the freemium business model conditions for onboarded services and enable the possibility of different business models for federated services, while proposing a simple and clear pricing model for users.

Offering **business model flexibility** is key for attracting various profiles of service providers thereby **fostering innovation through DestinE**. In addition, having a **simple and readable payment mode for users**, such as usage of common credits would be worthwhile to put in place, and thus to harmonise and establish a consistent approach to services.

Clarity is needed regarding the freemium conditions applicable to services during onboarding, by specifying what are the minimum features or services to be provided free of charge. The **first AAS open competition** organised as part of the life cycle assessment

process would be used to clarify the scope of the free part of the commercial services to be provided. It is also recommended not to limit business model options to reflect the various potential cost as well as selling models of service providers. Notably, this applies to "federated" service providers, whose current business models may vary, depending on the type of service or customer profile. **Customised fees, with different pricing and pay-per-use models** are required to appeal to the different types of users that DestinE targets, to match their budgetary limits or habits as best as possible. The AWS Lambda product could be taken as an example: resources are allocated according to need, and the price paid depends only on what is actually used for cost optimisation purposes.

Focusing on DestinE services, **example of charged services** could be:

1. Feature or Functionality-Limited: post processing of images (e.g., denoising)
2. Time-Limited: Charged after 30 days free trial
3. Usage-Limited: Charged after 5 maps or charts generated per month
4. Freemium with Ads: Free of ads in charged version
5. Support-Limited: Provide support to guide user in service usage, analysis of data
6. Content-Limited: Open charged access to additional datasets (cost models, in-situ data, predictions) which are not available in DestinE datalake.
7. Collaboration-Limited: offer additional charged services to share and spread visualisation, interact with other users in an analysis workflow.
8. Customisation-Limited: unlock configurable services and additional setting parameters for visualisation (e.g., refine time series, adjust resolution)

Finally, several service or application **developers may provide fully-free services** that are of pure public utility interest, and which may resonate with the DestinE *raison d'être*. These service providers will need to be supported for their development cost and integration cost considering that no revenue can be generated by these services. This may apply to educational purposes or research, for which specific access and charging conditions could be offered. In return, any developed feature or model could be made available through collaborative services.

Recommendation #13

Provide users with a readable price catalogue and a full and detailed commitment on DestinE technical Roadmap.

Users, Service Providers, in particular, require a positive cost-benefit balance in their own business context. This implies to master and plan costs induced by the use of the DestinE system. A **readable price catalogue to control costs** and manage margins ("back-to-back") is thus mandatory to engage in DestinE.

Moreover, as the functionalities provided by DestinE are set to expand and evolve over time, primarily related to DT features, but extending beyond them, service providers **need full visibility and commitment on the platform's technical roadmap**, so that they themselves

can adapt their developments and product roadmaps accordingly. Open publications should also be organised, in view of attracting the interest of new service providers when key new functionalities are made available.

> **Recommendation #14**
>
> Ensure rights for service providers to commercially exploit DestinE data with limited barriers.

Commercial utilisation of the data available through DestinE is perceived as a major expectation for service providers, offering either onboarded or federated services. It includes data from Digital Twins, **with limited barriers**. It also means that the **difference between "open data" and "free data" should be clear** for service providers, to avoid misunderstandings for those willing to remain owner of the content they produce even if they consent to give some free of charge.

6.3.2. Market access recommendations

> **Recommendation #15**
>
> Set up a marketplace of applications and services connecting service consumers with service providers, also favouring business and technological collaboration between all parties.

As depicted in Chapter 2, the environmental data market is a **fast growing but scattered market**. Many relatively small service providers operate in specific niches, and potential customers are sometimes inexperienced or have very limited resources (e.g., medium-sized cities).

Hence, a major expectation from service providers and service consumers is that DestinE could act as a **market catalyst** bringing more potential customers to service providers and offering more solutions to service consumers. This should first target on boarded services to attract capabilities inside the platform, but specific mechanisms should also be considered to extend participation of federated services.

The recommendation also encompasses the creation of **dedicated networks of excellence** where service providers could **share a catalogue of tools** to be implemented by other service providers to enhance their local service offerings. Indeed, a lot of business models are localised and not easily exportable into other countries, due to technical and business complexities (investment required for local presence and understanding of local challenges, which is essential for all applications). Thus, the local service provider could collaborate with his local client, gather necessary data and collaborate with another SP (which has the products and algorithms). The result is then a **fostered innovation through cooperation**. Note that this type of collaboration was successfully tested as part of the H2020 EUGENIUS project for instance.

Recommendation #16

Provide advanced services to find a solution to specific Europeans challenges.

DestinE aims at providing insights to **support key EU policy objectives, such as the Green Deal** policy. This positioning is unique and should be reinforced by identifying a few buzz apps to attract users on selected key topics for Europeans citizens (legislation, local risks, etc.) to reach a critical size.

Besides, it is recommended to ensure that services highlight compatibility with customer issues, such as **sovereignty** and **security**. This should lead to further market traction within EU public institutions such as cities which absolutely require a full control on their data.

Recommendation #17

Offer specific access conditions to research centres, universities developers by a start-ups.

Beyond the generic cost model, applicable to most service providers, it is advisable to offer **specific access conditions** to certain users, particularly research organisations, universities and start-ups. These organisations generally have very limited financial resources, which encourages them to use open platforms offering free resources.

To attract **researchers and academic**s, who can form an early adopter community, the condition is to offer them **free access**, without even the need to enter credit card details. This is all the truer for research projects, which will be offered with the prerequisite of using DestinE, otherwise the number of responses will be lower.

For **start-ups**, an **adapted cost programme** could be suggested, enabling them to develop at lower cost on the platform, for example for two or three years, before readapting the cost model. **Hackathon** events or **specific funded programmes or fund-raising campaigns** could also be launched to make the platform more attractive to this type of organisation.

6.4. Raising awareness and engaging with users

6.4.1. User's uptake strategy

A comprehensive users' uptake strategy is essential for the success and attractiveness of DestinE. It is recommended to follow a phased approach, patterned after the key steps of DestinE to effectively scale the platform and ensure its long-term sustainability. This phased approach is also aligned with the portfolio management recommendations in section 6.5.3.

Note: it is crucial to measure the impact of the proposed levers. T This could be implemented via attractiveness measurement and monitoring.

A summary of the users' uptake strategy is summarised in the following illustration.

Steps	Ignition	Scaling	Growth	Continuous growth
Target	**Raise awareness** about DestinE & its value proposition, **maintain momentum** after launch.	**Scale** its services and capabilities, **retain** users and **attract** new ones.	**Achieve steady growth by retaining & attracting users** and demonstrate **DestinE's impact** on both European society & industry.	**Retain users** and **providers** by **continuously improving and adapting to emerging trends & feedbacks.**

Levers & actions	• **Communicate largely to all users** (website, newsletters, events, webinars, etc.) & start targeting some sectors (green finance, smart city, energy and education)
	• **Capitalise on demonstrators and use-cases**
	• **Enhance DestinE's added value** through Open Call campaign
	• **Engage and align key stakeholders:**
	  • **DG CONNECT** to promote the initiatives in other DGs
	  • **The three EE** to review platform's status and communication strategies
	  • **DESP Contractors** to ensure continuous development & integration of users' feedback
	• **Set a user-centric continuous improvement approach through:**
	  • **Feedback mechanism** for both service users and service providers
	  • Launch of **Community of Practises**
	  • Test of **co-design methodology**
	  • Detailed **lead-users' interviews**
		• Continue and reinforce communication on **specific sectors or users' groups**
		• Continue to enhance **DestinE's added value** through Open Call campaign
		• Keep **user-centric approach with feedback mechanisms**, the deployment of **co-design methodology and the diversification of CoP**
		• **Continue engaging & aligning key stakeholders**
		• **Enhance user experience** with personalised recommendation or user-interfaces
		• Study the opportunity to **build partnerships or create collaboration** to broaden platform's user base
			• Continue **communication** on latest capabilities, make dedicated communication actions to fill gaps in sectors or users' groups not yet addressed
			• Continue to **enhance DestinE's services proposal**, study the need of new core platform capabilities or performance enhancement possibilities. Launch another campaign for services to join
			• Keep **user-centric approach and encourage delegated CoP management** for CoPs to become more self-sustained
			• **Continue to enhance user' experience, improve customer services** with better user support, extensive forums, bot, etc.
			• Study the development of **loyalty or reward programs**
				• Continue regular communication on latest capabilities, technical roadmap and share **success stories**
				• Continue to **enhance DestinE's services proposal and user' experience**, monitor the **Earth observation and climate data market**, integrating new technologies into the platform and observing competitors' choices to remain relevant to the targeted audience
				• Find innovative ways to foster **DestinE's community**, aiming to reach a fully self-sustained community

Figure 15: Users uptake strategy for each step

- *Step 1: Ignition (2024 – 2025) :*

During the ignition step, DestinE must build users' uptake among its diverse stakeholders, to promote the initiative towards both service consumers and service providers.

The primary goal of this phase is to **raise awareness about DestinE** and its value proposition. Multiple content and formats shall be used to maintain momentum after the official launch of the DestinE platform this year, for instance by organising events and webinars or updating newsletters and DestinE website. While no specific focus on a particular user group is planned, **efforts may target promising sectors, such as green finance, smart city, energy and education**.

During this initial phase, it is important to **capitalise on demonstrators and use-cases**, which serve a dual purpose. Firstly, they showcase the platform's concrete capabilities, highlighting DestinE's potential to address real-world challenges. Secondly, they offer valuable insights from early service providers, contributing to improve service onboarding.

Another crucial element at this stage is **enhancing the platform's added value**. While DestinE already offers clear benefits, its strength lies in federating services, providing a variety of capabilities. **Open competition campaigns** will contribute strongly to onboard new services onto the platform, supporting integration costs and easing service onboarding. Effective communication around these open competitions is essential to attract a variety of services, allowing for the selection of those most likely to interest DestinE's users.

This ignition phase sets the foundation for a **user-centric continuous improvement approach**. Four types of actions are proposed:

- **A feedback mechanism** shall be implemented for both early adopters and DestinE's first service providers to share their initial experiences, allowing for iterative improvements based on their inputs. This mechanism will also help identify any communication gaps or areas needing clarification.
- To foster engagement, it is key to create and animate **Communities of Practice.** A professional moderator should oversee each community, ensure active participation and raise knowledge on specific topics, such as how Earth Digital Twins can be used in the energy sector.
- The **co-design methodology** approach managed by Mines Paristech should be tested during this first phase, with key learnings informing the way forward in the second phase.
- Moreover, it will be interesting to make **detailed lead users interviews** and review platform customer journeys to feed future evolution of the platform.

- *Step 2: Scaling phase – (2026-2027) :*

The Scaling phase is a pivotal stage for DestinE's development. As awareness grows, DestinE needs to **scale its services and capabilities to retain users and attract new ones**. In parallel to actions listed above, new levers could be activated.

Communication should be reinforced including outreach programmes, engaging users through targeted webinars and events, demonstrating DestinE's capabilities with a focus on specific sectors or user groups. Community engagement efforts should be strengthened, diversifying the number of communities and fostering interaction.

To maintain its cutting-edge positioning, **DestinE's platform should continuously integrate news services**. This platform content enhancement will continue to go through

Open Competition processes, and the deployment of the co-design methodology, creating a diverse range of services with a user-centric approach.
With the multiplication of services, a **strong effort should be made on enhancing user experience** with the integration of personalised recommendations and personalised user interfaces for instance. To support new services usage, tutorials and guides could accompany these services, and the opportunity to integrate new data sources could be studied to answer users' or services' requirements.
An opportunity to explore at this stage would be to **build partnerships or collaborations to broaden the platform's user base**. Indeed, it could be interesting to work with international and European NGOs, government agencies, industry associations, or citizen associations to integrate new capabilities and more users within the platform.

- *Step 3 – Growth Phase – (2026-2030) :*

DestinE needs to achieve **steady, moderate growth by retaining its early adopters and the "early majority" and attracting the "late majority"**. It must also continue to demonstrate its impact on European society and industry, to hold both users and providers.
User retention is at stake during this phase as more and more services, data and users are integrated into the platform. **Enhancing customer services** and multiplying user support channels, e.g., forums, chats with official support staff or advanced users, bot, AI and emails, could ensure responsiveness and efficient problem resolution. The development of **loyalty programmes** and the introduction of rewards and incentives for long-term users could also be explored during this phase, maintaining engagement over time.
In parallel, **continuous improvement** should be implemented to refine DestinE's offering and keep building the community. For instance, proposing performance enhancements and introducing new core platform functionalities could help keep DestinE competitive. Launching another **campaign to encourage service providers to join** DestinE's service catalogue could also be beneficial at this stage, as the user base is more robust than in previous phases, encouraging service providers to join.
Regarding community building, management of these communities might be delegated to lead members outside of the 3EE, allowing them to become more self-sustaining.
Finally, after analysing the platform's strengths and gaps regarding its service offerings and coverage across all user categories, **dedicated communication actions** toward specific user groups might help strengthen DestinE's leading position or fill gaps in sectors that have not yet been addressed.

- *Step 4 – Continuous growth phase (after 2030) :*

In this phase, DestinE must retain users and providers by continuously improving its capabilities and user experience. It must also remain relevant and valuable by **adapting to emerging trends and feedback**, while maintaining sustained communication with stakeholders, service providers, and users to **ensure ongoing engagement**.
To maintain DestinE's relevance to its target audience, it is essential to **monitor the market evolution and trends** around DestinE, integrating new technologies into the platform. This vigilance would enable DestinE to anticipate or react to emerging trends.
Retaining current users and attracting new ones may involve **finding innovative ways to continue fostering the DestinE community**, organising specific events to sustain

enthusiasm and momentum. This can include exploring new formats for engagement, such as hackathons, virtual meetups, and collaborative projects, which can invigorate community involvement and create a sense of shared purpose. Spontaneous initiatives may also emerge, in which case DestinE's role will be to support these activities through communication and assistance to event leaders, ensuring they align with the platform's strategy.

During this phase, it remains crucial to **maintain regular communication** on DestinE's roadmap highlighting its progress and new capabilities. **Sharing success stories** is also essential to capture new users, emphasising DestinE's role in supporting the European Commission's goals and serving the broader society, particularly in relation to climate change.

6.4.2. Promotion recommendations

Recommendation #18

Advocate the "EU label" brand of DestinE as a key asset to comply with sovereignty, sustainability commitments and EU policy.

The promotion of DestinE as an EU-based initiative is key to attract users willing to find alternatives to foreign initiatives, especially US based. Guaranteeing **legislative compliance** and **sovereignty of data**, ensuring **user's privacy**, providing a **transparent socio-economic and environmental assessment** of benefits and costs of DestinE is a significant differentiator, especially for service providers or companies that must report on these dimensions for regulatory purposes, or whose own customers are looking for sovereignty and security.

This recommendation might have a meaningful impact on DestinE platform governance in which this kind of label could be decided for some services only.

Recommendation #19

Leverage Digital Twins' services development and stir up interest towards new services made from these new capabilities, including merging Digital Twins data with other data.

Showcasing Digital Twins' services is paramount for attracting users and service providers seeking unique features not found elsewhere. Indeed, DestinE's Digital Twins is expected to be a game changer in addressing environmental challenges. Hence, access **to DT datasets and services should be as** straightforward **as for other features**, so to make this type of data simple to manage and use, e.g., for dedicated simulation and **prediction apps with multi criteria analysis**. It is particularly important as the requirement to **merge DT data with other data** (e.g., local data for water consumptions, local agriculture usage, etc.) was raised by both service providers and consumers during lead users' interviews.

Promoting the functionalities and services offered by Digital Twins specifically needs to emphasise this fundamental difference from existing platforms. Early feedback on DestinE indicated that the interest in DT is not always fully recognised by large service providers, who have already put in place all the technological bricks for their activities, from data collection to processing and visualisation. For this reason, it is essential to highlight the potential benefits of DT data and services, particularly if they offer a greater spatial resolution for simulation and an increased precision in extreme events' precision. These are two aspects of great interest for the community to ease statistical post-processing and enrich data at the local level.

6.4.3. Communication levers and recommendations

The following recommendations are designed to enhance the attractiveness and user uptake of the DestinE platform, focusing on short and mid-term actions.

Recommendation #20

Proactively foster engagement of service users and service providers through specific interviews and user ambassadors

Engaging with potential service users and service providers is a crucial step in presenting the platform and highlighting the opportunities it offers. By showcasing various application cases, the practical benefits and innovations that service providers can achieve through the platform will be clearly demonstrated. Based on Mews Partners' network and benchmark, **a list of potential service users and service providers can be gathered**, especially in the priority sectors/applications identified, such as on renewable energy potential or urban planning and resilience.

Similarly, a list of **user ambassadors** can be issued with representatives from each user segment. User exchange events can collect volunteers, and a "call for candidates" can also be issued in a DestinE newsletter. This ambassador community may then be interviewed to explain different user segments and feed several customer journeys showing specific user needs. Defining clear roles and actions for these "ambassador" representatives will further support **continuous engagement, maintain momentum** and drive sustained interest in DestinE, especially between annual DestinE user exchanges.

This ambassador's community could also be coordinated with "key users" who are recommended to be involved as part of ESA DestinE platform portfolio management in section 6.5.3.

Recommendation #21

Organise industry-specific webinars to highlight DestinE's tangible benefits and innovations.

Contacting **opinion leaders** across various sectors will further enhance DestinE's visibility and attractiveness. Their endorsement and insights can strongly influence a broader adoption of the platform.

Organising **industry-specific webinars** is an effective way to highlight DestinE's benefits for each industry. Co-hosting webinars with industry experts will **enhance credibility and reach**, leveraging a network of professionals to maximise impact. For instance, a webinar focused on the **"Application of Environmental Data in the Construction Sector**", with the intervention of a large construction company, was planned at the beginning of 2025, and a focus on the DestinE application was placed. Practical benefits of environmental data could be highlighted in this way. A list of potential webinars per industry can be compiled with potential contributors. This approach encourages cross-sectoral uptake and DestinE's exposure by demonstrating real-world applications and success stories.

Recommendation #22

Actively participate in sector-specific events and communities of practises to promote Destine's capabilities and applications

Involvement in **Communities of Practice (CoP)** allows for the presentation of sectoral analysis in areas like energy, smart cities, education, and finance/insurance. Providing industry testimonies, inviting experts to share their insights, and creating diverse viewpoints will enrich the discussions, fostering a collaborative environment. Studying the feasibility of demonstrators to illustrate CoP ideas can enhance them with technical analysis and prototyping capabilities. Additionally, aligning with co-design methodologies developed and tested by Mines Paristech will help deploy and accelerate the co-design process that started in September 2024.

Active participation in **sector-specific events** is essential for promoting DestinE. These events provide the opportunity to introduce platform goals and achievements around various themes, such as space and environmental data applications. Presence can be established through conferences, presentations, roundtable discussions, and research-oriented papers.

Recommendation #23

Set up an accelerator programme or organising a recurrent challenge dedicated to climate-change projects.

Setting up an accelerator programme or organising a recurrent challenge dedicated to climate-change projects could boost the platform's visibility while attracting high-impact projects.

As proposed by AWS or Google, providing grants to awarded projects in the form of platform credits, with adequate support for technical expertise by DestinE's main stakeholders (Cloud and HPC providers, AI experts, …), could be beneficial to attract and retain projects that could easily be showcased. Providing grants for non-awarded projects could also help to attract service providers, at a modest cost to the platform, since it is likely that only a fraction of the participants would take the step of using the platform's credits. While AWS and Google

initiatives mainly focus on startups, these events could be extended to include universities or research projects to broaden the audience, following the approach taken by other programmes.

Having recurrent initiatives may help anchoring them in the calendar of target organisations, so as to expand progressively the focus area, the number of participants and winners. As part of the selection process for the awarded projects, a good practice could be to involve external chairs in the jury, to enhance the credibility and transparency of the challenge.



6.5. Creating the conditions for successful and effective management

6.5.1. Digital responsibility recommendations

6.5.1.1. Environmental aspects of Digital Responsibility

As mentioned in paragraph 4, DestinE's Digital responsibility aims to align the platform's ambitions with the way it is pursued. Several recommendations can be issued, to consider launching initiatives of various scales especially concerning the environmental dimension:

- Defining a Digital Responsibility's strategy, identifying the main steps for a comprehensive approach
- Creating governance instances and tools to manage DestinE strategic, tactical and operational plans on this matter
- Measuring the environmental negative impact of DestinE
- Dedicating a specific plan to onboard service providers on Digital Responsibility topics
- Raising awareness of the users through the implementation of several means
- Integrating environmental criteria in data management guidelines

- Communicating adequately on Digital Responsibility objectives, strategy and actions taken

Recommendation #24

State the ambition of DestinE in terms of Digital Responsibility and define a clear strategy following the ACT methodology.

Year 2024 marked not only the opening of DestinE to the public, but also the realisation of the need to match the platform's objectives with the means of achieving them. The ACT method should enable to convert this ambition into an actionable strategy by 2025, so that Digital Responsibility topics take on real scope from 2026 onwards, bringing the entire ecosystem into a virtuous circle.

A version of the ACT, adapted to the context of the DestinE Platform, is proposed to frame the various stages of the three streams (Strategy, Measurement and Governance). An overview is available in the figure below with the different stages detailed, stream by stream.

The *Strategy stream* groups together activities that are linked to the definition of DestinE Platform's ambition in terms of Digital Responsibility. It is then shared by the entire ecosystem, and gives rise to commitments which, in turn, serve to define a decarbonisation strategy and associated action plans. These steps are largely based on the method and tools provided by ACT.

The definition of governance, as well as management and reporting activities, are included in the *Governance stream*, while the *Environmental data stream* details the data collection and management actions required to measure the platform's emissions and steer the decarbonisation trajectory.

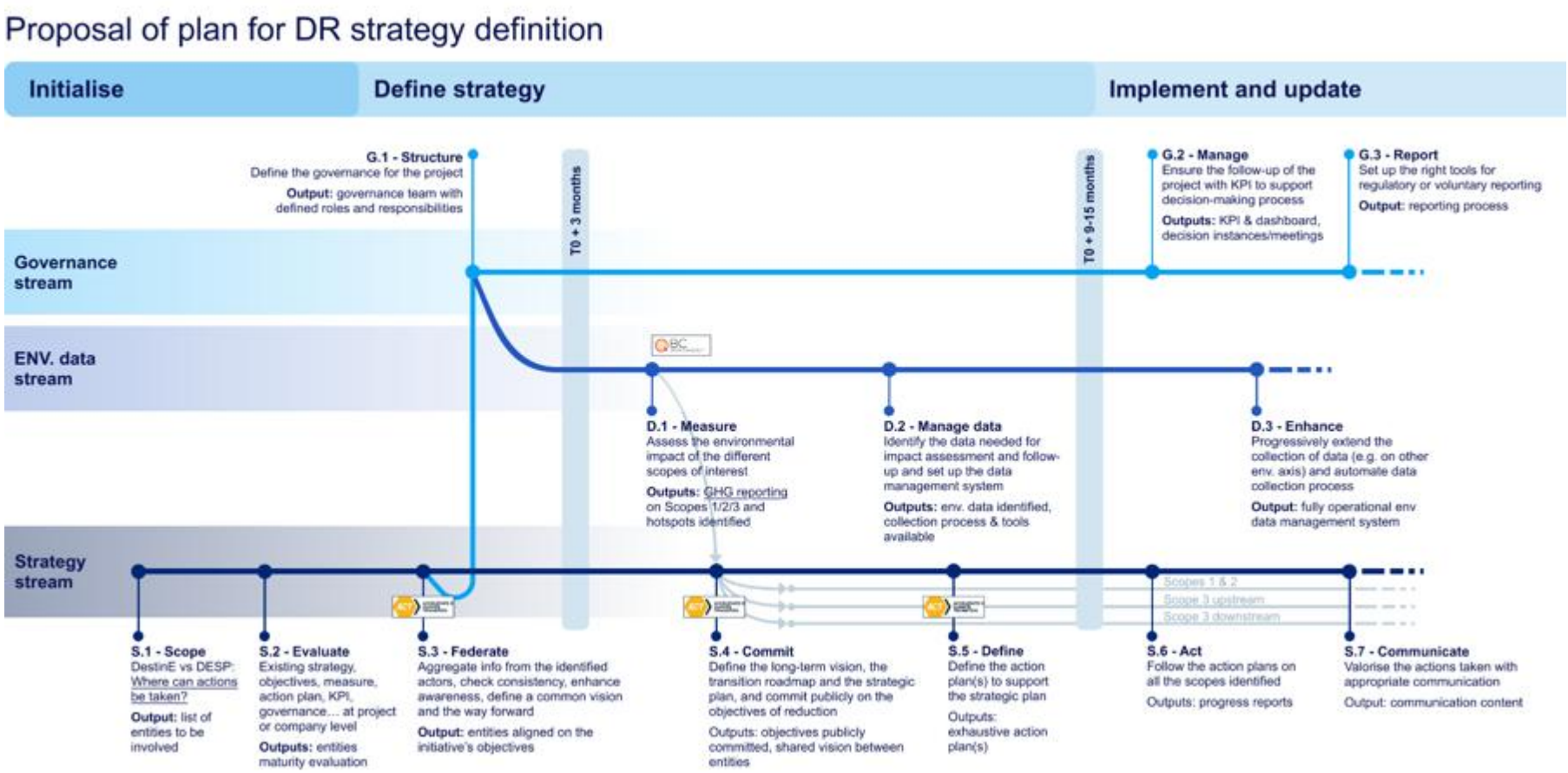


Figure 16: Tactical plan proposal for Digital Responsibility strategy definition

Recommendation #25

Create a dedicated Digital Responsibility governance structured, supported by tools to measure DestinE Platform footprint, monitor the progress of the action

As with any project, defining the DestinE Platform's Digital Responsibility strategy, along with its environmental assessment, action plan and monitoring activities requires the setting-up of a dedicated governance structure. As Digital Responsibility is one of the key topics identified to support the attractiveness of DestinE, extending the roles and responsibilities of the current DestinE Platform's portfolio management governance, to include Digital Responsibility management, appears adequate.

To this end, several key roles must be established: a **sponsor** should support the approach at the strategic level, while a "**DestinE Platform Digital Responsibility coordinator**" would play a central role, acting as a bridge between strategy, tactic and operations as a overall lead on this topic. The coordinator should be supported by **advisors** during the initial ramp-up phase and on specific subject areas as needed. A **project team** should be set up around the coordinator, to carry out actions that cannot be covered by existing teams, with designated **representatives at the main contractors**, to act as focal points for exchanges between ESA and these entities on the subject of Digital Responsibility.

To support decision-making and monitor implementation of the action plan, KPIs will be required. They might come from different sources, with some of them already identified as contributors to the platform's attractivity measure.

Recommendation #26

Assess the environmental impact of DestinE, by choosing the appropriate perimeter of measure for negative externalities and improving it gradually.

As detailed in section 4, measuring environmental impact is the key to selecting the appropriate level of action and identifying the most effective reduction levers. This measurement will provide a starting point but must then be regularly reviewed and expanded to assess the effects of the decisions taken.

Measuring internal emissions (Scopes 1 and 2, linked to GHG emissions of offices or energy consumption of data centers for instance) and providing an estimate of indirect emissions (Scope 3, due to DestinE's upstream and downstream value chain, including hardware suppliers, but also service providers and users) could be considered the minimum level DestinE should aim for in the short term to build a meaningful action plan, as occulting the usage of the hosted services would prevent to ensure that the benefits outweigh the negative externalities. Investigations on specific themes could also be carried out on an ad hoc basis:

for example, a risk analysis would help to identify critical dependencies on certain suppliers, as the materials needed for IT components are becoming increasingly scarce. A continuous improvement approach could further be put in place, so that the analyses would progress over the years and become more accurate and exhaustive, and the levers for action could be adapted accordingly.

Combined with an evaluation of the environmental benefits of the services hosted on the platform, this would help to assess the global balance between DestinE`s ambition to address environmental challenges, and the cost to provide such decision-making technologies.

Recommendation #27

Accompany the ecosystem on its Digital Responsibility path, with specific strategy and actions towards service providers

Because of its position in the ecosystem and its European character**, DestinE should act as a locomotive for its value chain**, helping it to grow in maturity on environmental issues. Notably, service providers should be involved, following a dedicated strategy to ensure their commitment to DestinE's decarbonisation objectives, and thus to the success of the Digital Responsibility's action plan.

DestinE has the means to impose environmental criteria as **one of the entry criteria for service providers** in its service registry. As things stand, a restrictive approach is likely to be counterproductive. It may be more appropriate to focus on supporting service providers as they progress in terms of their environmental impact, by gradually introducing increasingly high expectations in this area. Adopting **an approach both restrictive and supportive** seems useful: on the one hand, service providers should be asked to provide data on how they take environmental issues into account in their activities; on the other hand, they should be offered guidance and incentives to progress and reach individual and collective goals.

To this end, a successful approach for DestinE towards its service providers could consist of a two-phase method: first setting up a pilot project to define and test the approach and content before going to scale. Several tools could be created to support the method, such as (self-)evaluation questionnaires on environmental maturity, sustainable IT awareness, training sessions on digital eco-design or labels for best-in-class service providers.

Recommendation #28

Stimulate user commitment by making Digital Responsibility accessible, concrete and motivating through personalised, high-impact interactions.

With regards to users, all actions should aim to raise awareness of the impact of their use of the platform, to encourage more resource-conscious behaviour. Involving users in an eco-

responsible approach is essential to catalyse real change. That said, this awareness-raising must be built on a supportive and inclusive approach, avoiding any constraints that might hinder users' commitment or limit their use of the platform. Such an initiative is designed to engage users in a constructive mode, giving them the means to understand, act and get involved according to their own motivations and abilities, by providing them with action levers tailored to their needs.

To encourage this approach, a variety of engaging content around Digital Responsibility issues could be generated. By making these resources accessible and attractive, a constructive dialogue with the final users can be established. It fosters a sense of belonging to a broader process, where their individual actions contribute to a collective impact. The aim is to stimulate curiosity and provide concrete reference points by offering interactive tools, case studies, practical advice and inspiring initiatives, such as Digital Cleanup Day. Five examples that could be mentioned are eco-tips to promote eco-conscious digital habits; website labels to showcase DestinE's eco-design principles; Sustainable IT events to encourage user action on special occasions; user dashboards to deliver personalised insights; and gamification to foster active participation in environmental learning pathways.

Recommendation #29

Integrate environmental impact as a criterion for data management rules

As the volume of data on the platform will continue to grow, some principles of sustainable data management need to be defined. If further studies remain to be conducted to establish extensive and contextualised best practices in line with the existing guidelines on digital eco-design, two axes of work can already be proposed:

- **Regulate data duplication**: data duplication has become commonplace in the Cloud, driven by the need for high performance data access and security. While these constraints must be maintained, it is also necessary to combat systematic duplication of data by users. To this end, designing a data catalogue (including user-created datasets) is one way to address the problem, provided that the search functionality is efficient—aligning with the FAIR principles. Indeed, if users can easily browse the available datasets and quickly determine whether the data they seek exists (especially for post-processed data), they are more likely to make use of them. Conversely, if searching for such datasets is cumbersome or inefficient, users may be inclined to generate the data they need without first checking whether it already exists, thereby increasing duplication.
- **Clean up data regularly**: Once again, this is an approach relatively uncommon in the Big Data world, where storage resources are vast. However, a great deal of data may need to be deleted because it is no longer useful or up to date; this can be achieved by simply identifying it, or by setting up systematic clean-up rules by default. This will be particularly true if free data storage quotas are introduced, as users are

likely to be less careful than if they had to pay storage fees. The greater the number of “free” users, the greater the need for a cleansing policy.

Recommendation #30

Communicate broadly but with precision to make DestinE’s Digital Responsibility a competitive advantage

The definition of a communication plan on this subject is essential to promote DestinE's activities, improve its attractiveness to users who are increasingly attentive to these signals, and position itself as a spearhead on this subject. This plan is all the more important as numerous initiatives of the Digital Responsibility’s strategy will be launched in parallel, and the communication channels are likewise multiple. A rapidly accessible section on the platform's website is the minimum requirement, to share the objectives of the initiative, its progress, key commitments and potential partners.

It is also essential to ensure that every message conveyed about DestinE's Digital Responsibility initiative respects certain best practices, to avoid the risk of greenwashing. A brief guide, aimed at communications teams as well as all employees and suppliers likely to communicate in some capacity about this initiative, could therefore be made available, emphasising the need to share concrete, specific and verified figures.

6.5.1.2. Accessibility of the platform

Recommendation #31

Propose accessibility awareness and trainings for service providers.

To improve DestinE’s accessibility for all, including people with disabilities, two key recommendations can be developed:

Firstly, proposing comprehensive training and awareness programmes for future service providers seems to boost attractiveness for both service consumers and service providers. These programmes should aim to deepen the understanding and knowledge of accessibility issues among all stakeholders involved in the development and maintenance of the DestinE platform. Training should cover the principles and practices outlined in the Web Content Accessibility Guidelines (WCAG 2.1), emphasising the importance of creating content that is Perceivable, Operable, Understandable, and Robust (POUR). This training could be delivered through a combination of online courses, workshops, and webinars, tailored to the varying levels of expertise among service providers. By fostering a culture of inclusivity and equipping developers with the necessary skills, DestinE can ensure that accessibility is integrated into the design and development process from the outset, rather than being an afterthought.

> **Recommendation #32**
>
> Enforce accessibility requirements and assessments for future service providers.

Secondly, enforcing stringent accessibility requirements for all new service integrations and updates to the platform is essential. This entails establishing clear, mandatory accessibility criteria that must be met before any content or service is launched on the DestinE platform. These criteria should be aligned with the WCAG 2.1 guidelines and include specific benchmarks for elements, such as alternative text for images, colour contrast, keyboard navigation, and logical heading structures. Regular audits and testing should be conducted to ensure ongoing compliance with these standards. Additionally, a feedback mechanism should be implemented, allowing users to report accessibility issues and suggest improvements.

6.5.2. Interoperability recommendations

Interoperability is the ability of systems to exchange and make use of information. It requires cooperation across the different internal and external systems composing the DestinE ecosystem around several criteria as presented in section 3.4. For each of these interoperability axes, a maturity level can be targeted in the mid-term:

Interoperability axis	Target maturity recommended
Data and metadata common ontology and semantics	Ontology is available in a common model for all data hosted in DestinE (data lake), other input datasets from the AAS and for external ecosystems (e.g. Copernicus Data Space)
Consistent data quality	Temporal validity, thematic validity and usability scope with Uncertainty quantification (UQ) especially for simulated or predicted data through digital twins or AAS is defined in documentation
Data policy and privacy	Access to DestinE data without redistribution (incl. data from service providers) is managed in the same way in the complete ecosystem
IT interoperability through standardised APIs	APIs are available to execute codes & services, with related documentation and versioning for DestinE Platform and AAS. An API gateway is implemented
Standardised documentation	Centralised & standardised documentation for all DestinE features & components (incl AAS) from system architecture managed at platform level. An interoperability framework is available providing requirements for users & developers
Reuse and reproducibility	Interoperable services are stable and made sustainable for reuse. Searching features are available for users.

Interoperability axis	Target maturity recommended
	Interoperability of services can be evaluated in a test environment (sandbox)
Harmonised governance	Harmonised & visible contacts points with associated roles & responsibilities are available for all DestinE features & components. Data governance is established
Accessibility / multilingualism	Automatic translation in all EU languages is implemented
User centricity	All services & components publish training capabilities (e.g. tutorials, user guides, etc.). Centralised helpdesk to dispatch support requests (L1/L2) is set-up. Continuous feedback integrated for services portfolio evolution & services upgrades (e.g. public comments & ratings) is in place
Reliability and sustainability	SLA applies on all services, with a proactive management of critical services (building blocks) relying on a mapping of dependencies

As a summary of this overall analysis, the following priority recommendations can be presented:

Recommendation #33

Publish and maintain a standard data directory with the DestinE Platform Information Model covering all data accessible through DestinE to ensure data interoperability.

All data provided and exchanged within the frame of DestinE should be **described and comply with standard ontology and semantics**. It applies to data and metadata (including data quality / validity indicator) of each data set published in the DestinE Data Lake (DEDL), data managed within the DestinE Service Platform with core services (DESP) as well as data provided by services through APIs.

It is recommended to create an upper ontology that describes all data accessible through DestinE in an organised format regardless of individual dataset. Whether data is included in the DEDL, in DESP, in Service providers databases or coming from other interoperable data sources, this upper ontology should cover the different ontology domains of accessible data.

Connecting to **Simpl Programme**, by integrating Simpl features in a core service, in sandbox and in collaborative services, could also be an interesting solution to interoperate

with other data domains and enrich DestinE data portfolio while limiting (environmental) costs of hosting new datasets.

Moreover, to facilitate the usage of data by non-expert users, the sources of data should also be indicated: in which data sets information is found, which is(are) the service(s) used to provide them. This ontology should be formalised in a common standard data catalogue. This data model should be maintained and published in DestinE.

The DestinE Platform Information Model seems to be an adequate means to achieve these interoperability objectives. However, it requires development to first be efficiently used by service providers and then to comprehensively represent the DestinE data portfolio.

> **Recommendation #34**
>
> Rely on sustainable APIs supported by their developers with a SLA, and manage the ecosystem of APIs to enable technical interoperability of services.

Each service developer should commit to sustainability and reliability of their services through **Service level agreement (SLA)**.

In addition, tracking the impact of service upgrades or decommissions could be valuable for service providers. It is recommended to formalise and maintain the services ecosystem architecture, to map interfaces and usage of APIs among AAS. Graph databases or specific **API management** tools could be useful to achieve this objective.

> **Recommendation #35**
>
> Promote user centricity in all DestinE components, by enabling accessibility to all users with standardised documentation and communication means. Enhance access to DestinE platform by integrating European Digital Identity Wallet in DestinE Identity & Authentication Management (pilot on Education sector)

All DestinE services and components should be **user centric**. Standard information about user segmentation, user needs and expectations, user feedback, ratings and experience should be made available for the entire ecosystem. Moreover, allowing users to interact directly with service providers and developers (in collaborative services for instance). The introduction of a feature to collect service ratings and user feedback would help to ensure that user-centricity is truly reflected in practice

Beyond pure service design, enabling users onboarding in a service and in the platform is highly recommended. This could be achieved with:

- **Standardised documentation** for both services and their APIs.
- Embedding **translation capability in all European languages** within the platform is an interesting feature for non-English speakers.

- **Harmonised Helpdesk and support models**, with Level 1 support managed at DestinE Platform level, and Level 2 support ensured by each service provider.

The European Digital identity Wallet also appears as an opportunity to attract users in DestinE and interoperate with other European systems. Reuse of EUDI Wallet credentials in DESP IAM should be implemented to facilitate access to these users, while ensuring adequate personal data protection. The example of 'France Connect' showcases the potential of user identification interoperability across public services (e.g. Taxes, Retirement, Healthcare, etc.). This has been extended to private services such as Enedis or Klesia. Security has recently been reinforced through 'France Connect+' and 'France Identité'. Collaboration should be set on the EUDI Wallet pilot project in the Education sector, which aligns with DestinE priority target population.

Recommendation #36

Ensure interoperability of services and with other programmes in European Union through a harmonized governance, compliant with European Interoperability framework, for the management of all DestinE Platform technical and non-technical components

The Base registry principle is largely implemented in DestinE, through the Service Registry and the onboarding process. However, these processes should be enriched by portfolio management as described in section 6.5.3 to complete the "information steward body" and cover all items under ESA scope.

Service and data registration pace must be ensured and controlled by portfolio management / lifecycle management. It should allow us to simplify the way to master content and upgrade the architecture of the services ecosystem (AAS and data).

Moreover, **harmonised roles** should be set within service providers: commercial, technical support (Level 2), trainers, etc.

This governance should be **compliant with the European Interoperability Framework (EIF)** to enable interoperability with other European programmes.

Recommendation #37

Publish interoperability principles and requirements for DestinE end-users, service providers and data providers.

Interoperability principles and concepts applicable to DestinE, should be published as a **standard specification for service providers**, with standard templates and roles description, in particular for Open Competitions.

Data directory (upper ontology) should be published in a simple web solution (such as DestinE Platform Information Model) for all users.

6.5.3. Attractiveness driven Portfolio Management recommendations

Recommendation #38

Set-up a sustainable governance involving key stakeholders in DestinE ecosystem to select and manage lifecycle of all the relevant DestinE Platform capabilities and activities (AAS, Collaborative services and sandbox, Core platform features including core services and non-technical features) and their influence on other DestinE components (DEDL, DTs).

Destination Earth Service platform development and operations gather a wide scope of projects and activities dispatched among several contributors (ESA DestinE contractors) and influenced by a complex ecosystem (EEs, key users, EC and member states). Involving representatives of this ecosystem as observers and informants in governance of the portfolio is a strong enabler to **accelerate and endorse decisions made at ESA level** regarding lifecycle of these items from ideation to decommissioning. This governance is operated at three levels: strategic / tactical / operational.

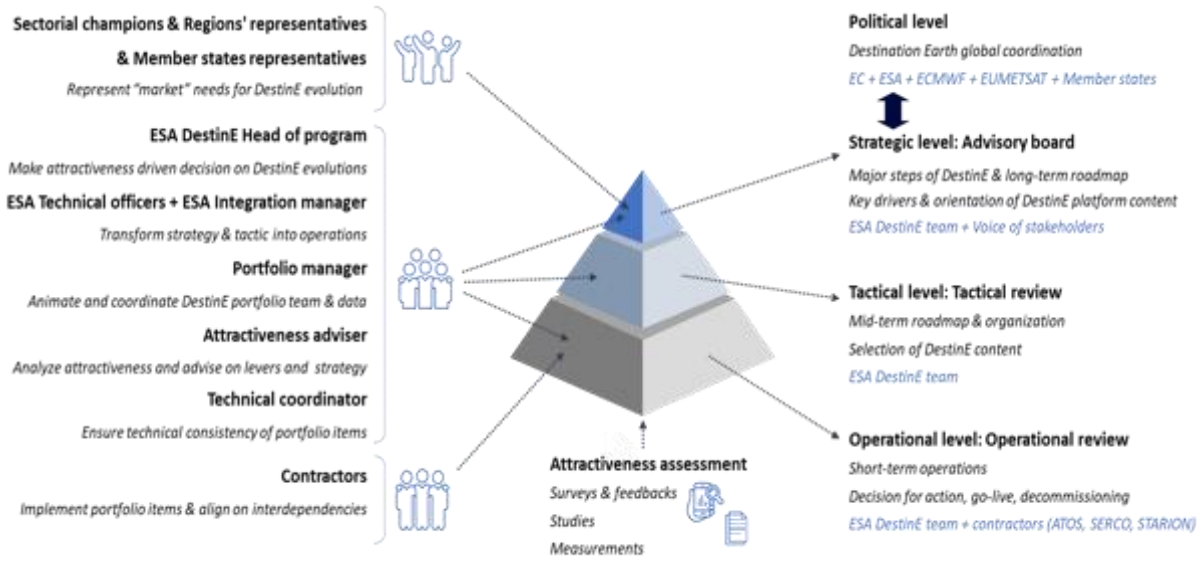


Figure 17: Overview of DestinE portfolio management

This portfolio comprises a set of items with varying natures and life cycles which **must be guided, coordinated and synchronised to maximise the attractiveness** of DestinE:

- Registered application and services (with different sponsorship level by ESA)
- Collaborative items (either enabling services or user artifacts)
- Core platform features (platform and data management services) with related documentation

- Non-technical features, such as communication activities, user support or general requirements
- Recommendation and need expression for external capabilities

Note that content of this portfolio will evolve during the platform development, and that "External services" developed by other entrusted entities are out of scope.

Recommendation #39

Include DestinE attractiveness monitoring using dashboard based on actual and live metrics, completed by regular deeper analyses (market sectors, techno trends, users satisfaction surveys, etc.) at the core of DestinE evolution strategy, tactic and operations.

The objective is to implement the attractiveness information **at the core of decision making at the three levels of portfolio management** (strategic / tactic / operational). This information, to build a common understanding of actual and potential DestinE attractiveness, relies on:

- **Regular and deep analyses of DestinE attractiveness** and potential for evolution. It could be based on technology landscape, sectoral analysis, as an update of this report, completed with users' feedback regarding DestinE platform.
- Development of a **"DestinE footprint" dashboard** to report attractiveness KPIs following a three layers tree structure, captured ideally in real time (through API) in the platform or in services. See the following image for more information.

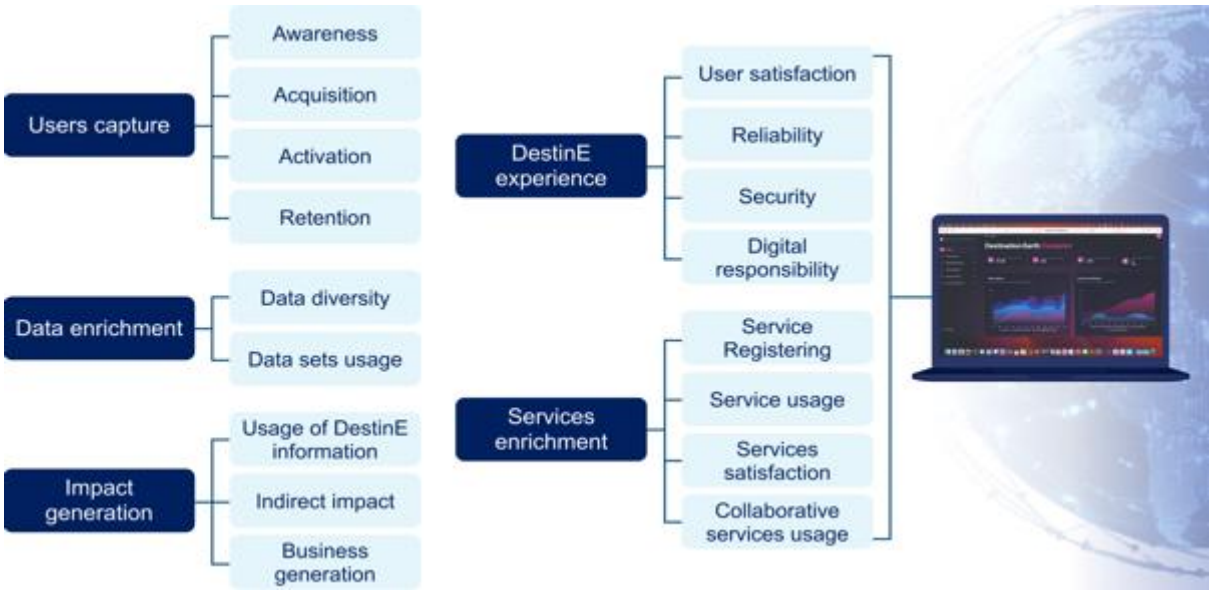


Figure 18: Attractiveness KPIs for DestinE footprint dashboard

6.5.4. AI Roadmap recommendations

Recommendation #40

Derive a clear short-, mid-, and long-term action plan from the AI roadmap, ensure its implementation in coordination with ECMWF and EUMETSAT AI initiatives.

It is recommended to prioritise the identified opportunities across short-, mid-, and long-term horizons, and to manage them through the portfolio management. Furthermore, these initiatives should remain closely connected to the ongoing AI roadmap efforts of ECMWF and EUMETSAT. Sustained coordination and strategic engagement are vital to unlock shared opportunities and foster joint innovation.

To support the development of a time-phased implementation strategy, the figure below restates the AI roadmap's strategic pillars and corresponding objectives, serving as a starting point for defining concrete actions.

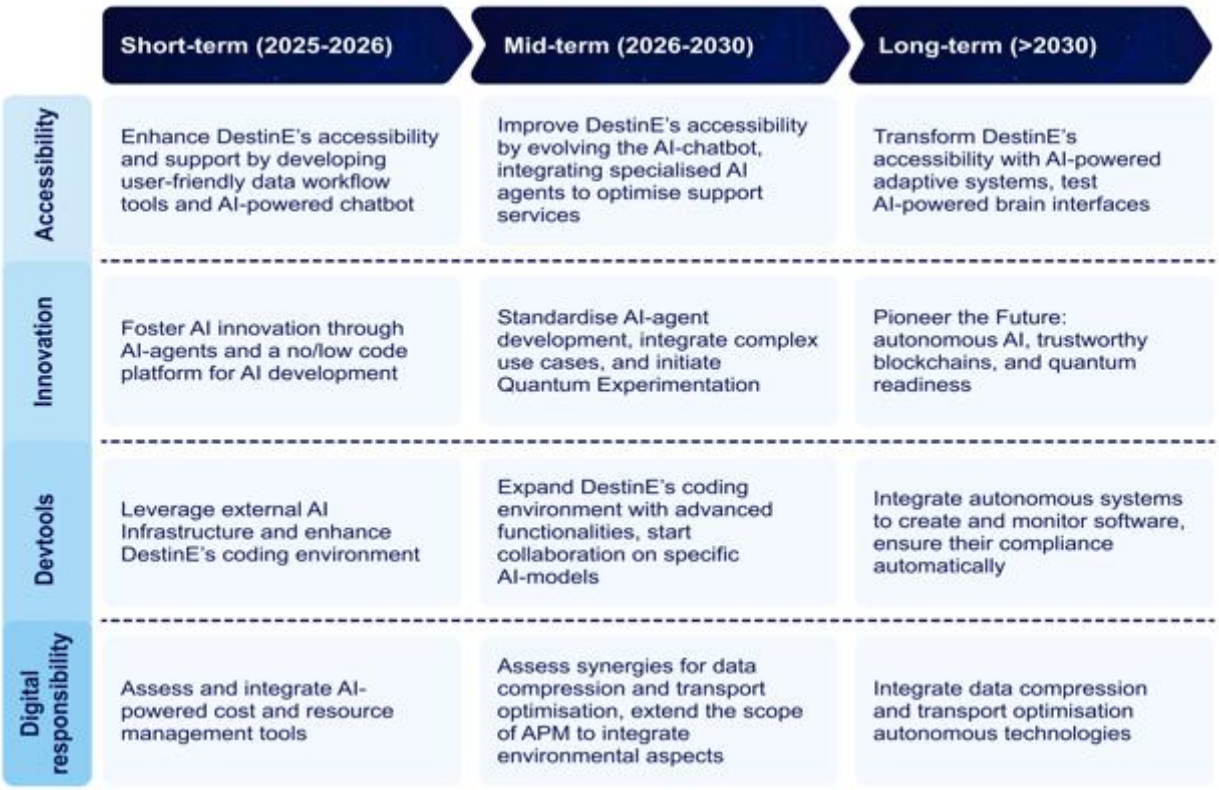


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Acronyms

AAS	Advanced Application Services
AI	Artificial Intelligence
API	Application Programming Interface
AWS	Amazon Web Service
CAGR	Compound Annual Growth Rate
CPU	Central Processing Unit
CSRD	Corporate Sustainability Reporting Directive
DEDL	DestinE Data Lake
DEDT	DestinE Digital Twin
DESP	DestinE Service Platform
DestinE	Destination Earth
DG CNECT	Directorate-General for Communications Networks, Content and Technology
DIAS	Data and Information Access Services
DT	Digital Twin
DTaaS	Digital-Twin-as-a-Service
EC	European Commission
ECMWF	European Centre for Medium-Range Weather Forecasts
EO	Earth Observation
ESA	European Space Agency
EU	European Union
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAIR	Findable, Accessible, Interoperable, Reusable
FI	Financial Institution
GAFA	Google, Apple, Facebook, Amazon
GHG	Greenhouse Gas
GPU	Graphics Processing Units

IDE	Integrated development environment
IR	Implementing Rules
ISO	International Organization for Standardization
IT	Information Technology
KPI	Key Performance Indicator
LCA	Lifecycle Analysis
ML	Machine Learning
NASA	National Aeronautics and Space Administration
NGO	Non-governmental organisations
PaaS	Platform as a Service
SaaS	Software as a Service
SLA	Service-Level Agreement
SME	Small and medium-sized enterprises
STEM	Science, Technology, Engineering and Mathematics
SWEET	Semantic Web Earth & Environment Technology Ontology
TCFD	Task Force on Climate Related Financial
TRL	Technology Readiness Level
UI	User Interface
VaaS	Visualisation-as-a-Service

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