SPACE / GEOINFORMATION SECTOR SKILLS STRATEGY (IN ACTION)

A document prepared by the EO4GEO Alliance

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Summary

This document presents the Sector Skills Strategy (SSS) of the Earth Observation (EO) and Geoinformation (GI) sector. It proposes a vision & mission and defines the goals that will guide the definition of a long-term action plan (LTAP) to address the skills needed by the sector. Specific strategic and operational objectives, and the major actions to reach those objectives are defined with the help of a diverse group of stakeholders, in order to establish an ongoing dialogue between all the partners of the space/geoinformation community and other interested stakeholders. The LTAP, which will be created based on the Sector Skills Strategy recommendations outlined within, and discussions stemming from, will then be updated as appropriate to take account of lessons learnt throughout the EO4GEO project, open discussions with stakeholders and also future technological, societal and policy developments. The Sector Skills Strategy is a mechanism for demonstrating leadership and developing capacity on skills development and workforce.

Keywords

Copernicus uptake; Knowledge, Skills and Competences; Earth Observation and Geoinformation (EO*GI); Long-Term Action Plan (LTAP); Mission, Vision and Goals; Supply and Demand; Gaps and Mismatches; Technology and non-Technology Trends; Strategic and Operational Objectives; Strategy.

Acronyms

Acronym	Description
AI	Artificial Intelligence
BoK	Body of Knowledge
CEDEFOP	European Centre for the Development of Vocational Training
CLIMATE-KIC	Climate Knowledge and Innovation Community (KIC)
CoVEs	Centres of Vocational Excellence
DG-DEFIS	DG for Defence Industry and Space
DG-EMPL	DG for Employment, Social Affairs and Inclusion
DG-GROW	DG Internal Market, Industry, Entrepreneurship and SMEs
DG-RTD	DG for Research and Innovation
EACEA	Education, Audio-visual, Culture Executive Agency
EARSC	European Association of Remote Sensing Companies
EARSeL	European Association of Remote Sensing Laboratories
EC	European Commission
EO	Earth Observation (inc. Meteorology)
EO*GI	EO and GI sectors
EQF	European Qualifications Framework
ESCO	European Skills, Competences, Qualifications and Occupations
EU	European Union
GEO	Group on Earth Observations
GI	Geographic Information
GISIG	Geographic Information System International Group
JRC	Joint Research Centre of the European Commission
MOOC	Massive Open Online Course
NEREUS	Network of European Regions Using Space Technologies
NGO	Non-governmental organisation
OECD	Organisation for Economic Co-operation and Development
OGC	Open Geographical Consortium
RS	Remote sensing
SME	Small and Medium Enterprises
SSS	Sector Skills Strategy
UAV	Unmanned Aerial Vehicle
UCGIS	University Consortium for Geographic Information Science
UN	United Nations
UNEP	United Nations Environmental Programme
UN-GGIM	UN Committee of Experts on Global Geospatial Information Management
VET	Vocational Education and Training

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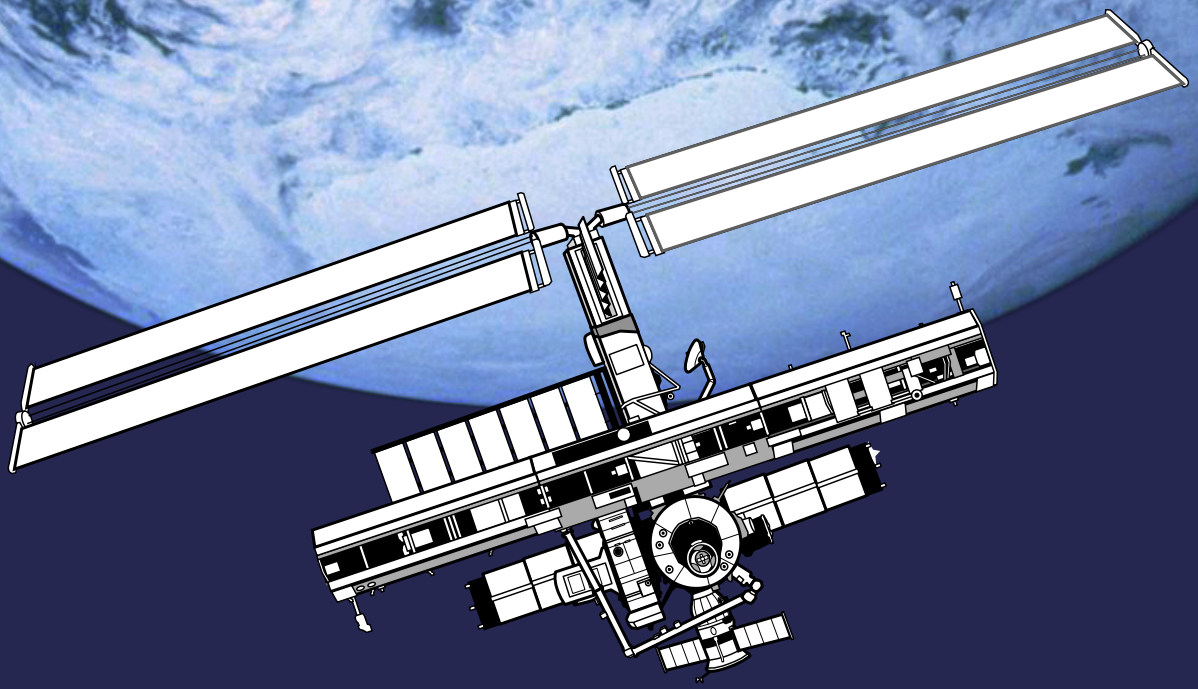
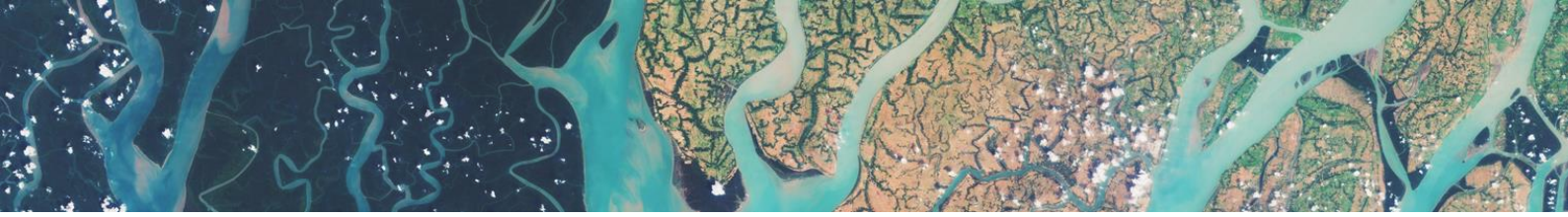




1. Introduction

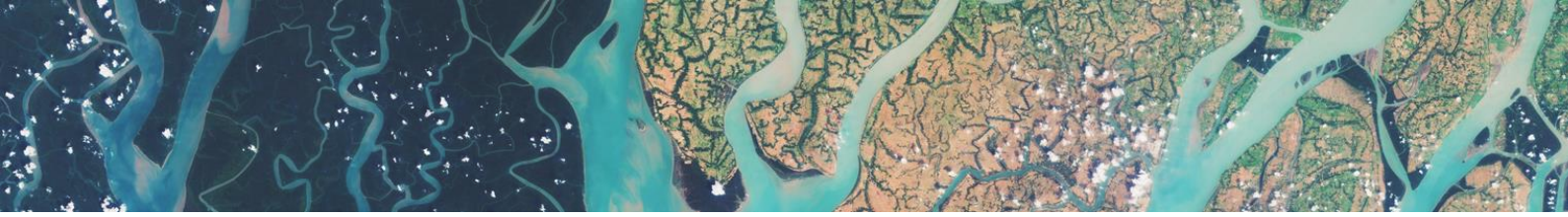
The Earth Observation (EO)[1] and Geographic Information (GI)[2] sector (EO*GI) is of strategic importance with great potential to support many European, national, and sub-national policy domains. The sector provides and/or is working with data from satellites, aircrafts, and drones. The data is used around the world for diverse applications, benefitting citizens and society and providing unrivalled information for agriculture, natural disaster management, climate change observations, marine weather forecast, etc.

Due to the large amount of data made available and accessible through data and information infrastructures at various levels, the uptake of existing data and services is not being utilised and their integration in added-value services for governments, businesses and citizens could be improved. The Space Market Uptake European Parliament report (Delponte et al., 2016)[3] revealed that the lack of specialised technical and scientific skills, knowledge and competences hinders this uptake by private companies, public sector and other actors. Furthermore, there is a gap between the offerings of academic and Vocational Education and Training (VET)[4] at both universities and private institutions, and the specific needs to make this uptake happen seamlessly.

The sector is developing dynamically and rapidly, resulting in an increased demand for qualified personnel. A skilled and educated workforce will enable the sector to attract high value, innovative and knowledge-based businesses, adapt more readily to the challenging technological environment and respond better to societal challenges. New trends are an opportunity to invest in skills and technology that will accelerate national EO*GI capabilities. There are numerous factors impacting skills demand and supply such as technological developments, changing customer demands, new business processes, growth strategies, globalisation, political and economic uncertainty, and others. It is assumed that understanding the drivers that influence the sector, (new) skills requirements will emerge. With these new and emerging technological and societal trends, new opportunities and challenges see light. The EO*GI sector is preparing the path to deliver solutions through other platforms that were not previously considered such as apps, cloud

[1] Earth Observation (EO) collects information about the Earth using sensors.
[2] Geographic information (GI) often combines data with non-spatial information.

[3] Source: http://www.europarl.europa.eu/RegData/etudes/STUD/2016/569984/IPOL_STU(2016)569984_EN.pdf
[4] VET is a key element of lifelong learning systems equipping people with knowledge, know- how, skills and/or competences.



computing and other technology platforms which give added value to the services and facilitate the uptake from different users in diverse business sectors. In this process, EO data from the satellites, combined with geoinformation data, help increase productivity, develop more efficient and environmentally friendly operations, and improve economic gains and quality of life, among others.

Related to the rapid technology change, one of the most important challenges faced by companies and public authorities dealing with EO*GI information is finding people with the right qualifications at the right time. The market not only needs remote sensing and geoinformation specialists, but also programmers, big data analysts, artificial intelligence and machine learning specialists and business developers.

The Sector Skills Strategy (In Action) is based on the preliminary EO*GI Sector Skills Strategy (M. Miguel-Lago et al., 2019)[5] and summarises the vision, mission, goals, and strategic and operational objectives. It also provides the major activities, milestones, and well-defined outputs to meet them.

To that end, the Erasmus+[6] EO4GEO Sector Skills Alliance[7], funded by the Education, Audio-visual and Culture Executive Agency from the European Union (EACEA)[8] under the Blueprint for Sectoral Cooperation on Skills[9] scheme, has developed this Sector Skills Strategy. EO4GEO is proposing skills development recommendations, preparing, and taking actions for education and training that will unleash students' and workers' potential to be the EO*GI sector innovators of tomorrow and the EO*GI adopters in other industry end-user sectors (agriculture, energy, transport, local government, maritime, etc.). User engagement is particularly important to allow the EO*GI sector to make a step-change in mass-market uptake of these services.

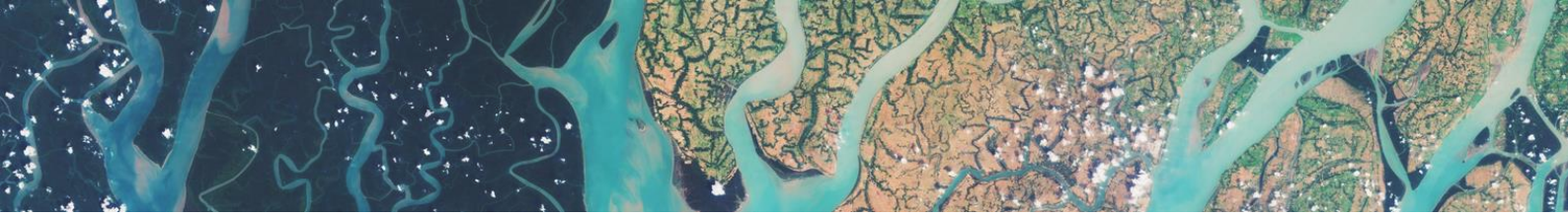
[5] http://www.eo4geo.eu/download/d-1-6-space-geospatial_sector_skills_strategy_v2-0/?wpdmdl=3800&masterkey=5ce6e2483a83c

[6] Erasmus+: EU's programme to support education, training, youth and sport in Europe.

[7] EO4GEO project (www.eo4geo.eu): An innovative strategy for skills development and capacity building in the EO*GI field.

[8] Education, Audiovisual and Culture Executive Agency from the European Union (EACEA).

[9] Framework for strategic cooperation in each economic sector between key stakeholders.

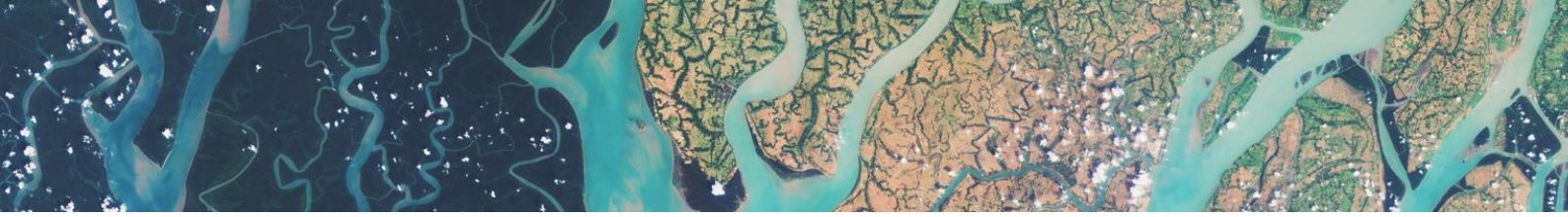


EO4GEO builds on the New Skills Agenda for Europe[10] which is designed to improve the quality and relevance of skills in order to meet the needs of a rapidly changing society and increase the mutual understanding of skills and qualifications in the European labour market. EO4GEO aligns with the spirit of the Copernicus Programme[11] to reinforce the European capacity in Earth observation, including geoinformation data, tools, and services, putting users in the driver seat.

EO4GEO also supports full and open access to EO data, information, and knowledge as a crucial element for better understanding social, economic, and environmental challenges. This includes full access to all the training resources and tools developed by the Alliance and made available to the public through the EO4GEO project website.

[10] The New Skills Agenda for Europe proposed 10 actions to make the right training, skills and support available to people in the EU: https://www.cedefop.europa.eu/en/news-and-press/news/skills-agenda-10-actions-help-equip-people-europe-better-skills

[11] Copernicus is the European Union's Earth Observation Programme, looking at our planet and its environment for the ultimate benefit of all European citizens. It offers information services based on satellite Earth Observation and in situ (non-space) data.



1.1. Setting the scene

The Council of the European Union[12] highlighted in June 2020 the importance for Member States, in cooperation with the private sector, universities and research organisations, as well as intergovernmental organisations, to increase efforts to develop skills and stimulate innovation and entrepreneurship. The Council also stressed the need to foster an attractive work environment and a viable space sector, and calls on Member States and the European Commission to facilitate a more integrated approach on skills development across the value chains of the space sector. The Commission is developing a comprehensive approach addressing skills at all levels – regional, national and EU. This strategy is implemented through the blueprint for sectoral cooperation on skills initiative, launched with the new skills agenda for Europe which directly applies to business sectors helping to develop more and better skills.

Following the EC communication on the skills agenda for Europe[13], skills are a pathway to employability and prosperity in any sector. In order to ensure that EO*GI programmes such as Copernicus deliver their benefits according to the set expectations reaching other market sectors, it is essential to deploy an effective Sector Skills Strategy (SSS) to stimulate the uptake of these EO*GI data, services and information, and thus stimulate the development of innovative downstream applications.

Despite a fragmented institutional and policy environment, the sector has evolved very fast in the last 10 years. A recent EO employment report from EARSC (2021)[14] indicates an estimation of the total number of EO[15] service employees in Europe close to 25.000 people. According to the PwC report "Extracting Value from Earth Observation Data" (Scatteria et al., 2019), the global EO economy was estimated to be between EUR 9.6 and 9.8 billion, divided between EO satellite sales and EO data acquisition, processing, and transformation into information products for end-users. The sector is predominantly driven by the upstream market, with the global EO downstream market estimated to be only between EUR 2.6 and 2.8 billion, mainly driven by governmental applications contributing between 50% and 60% of the revenues. That is contrasted with the European figures provided by the EO industry survey report (EARSC, 2019)[16] where the total revenue in the

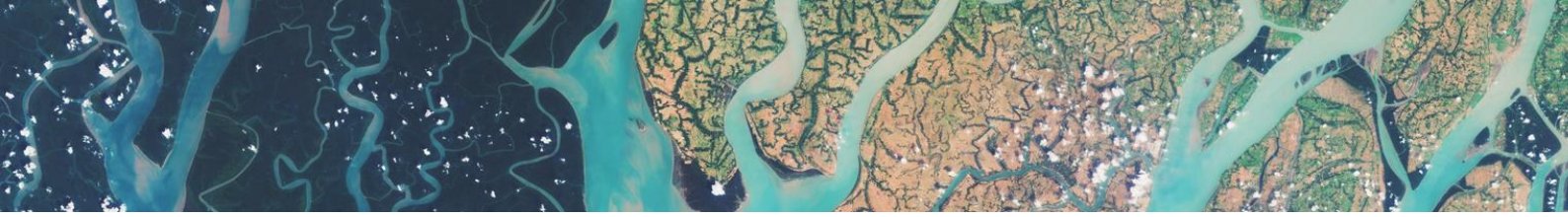
[12] Council of the European Union: https://data.consilium.europa.eu/doc/document/ST-8512-2020-INIT/en/pdf

[13] Skills are a pathway to employability and prosperity: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52016DC0381 and https://ec.europa.eu/eurostat/web/skills/policy-context

[14] https://earsc.org/wp-content/uploads/2021/03/EARSC-Employment-survey-v1-1.pdf The study shows that the National Public sector bodies and the EO services sector together represent the absolute majority of the workforce in this sector, with 83% of the total EO employees.

[15] *"All persons whose work relies on EO data or services. Any person working for an organization which is using EO data."*

[16] https://earsc.org/industry-facts-figures/

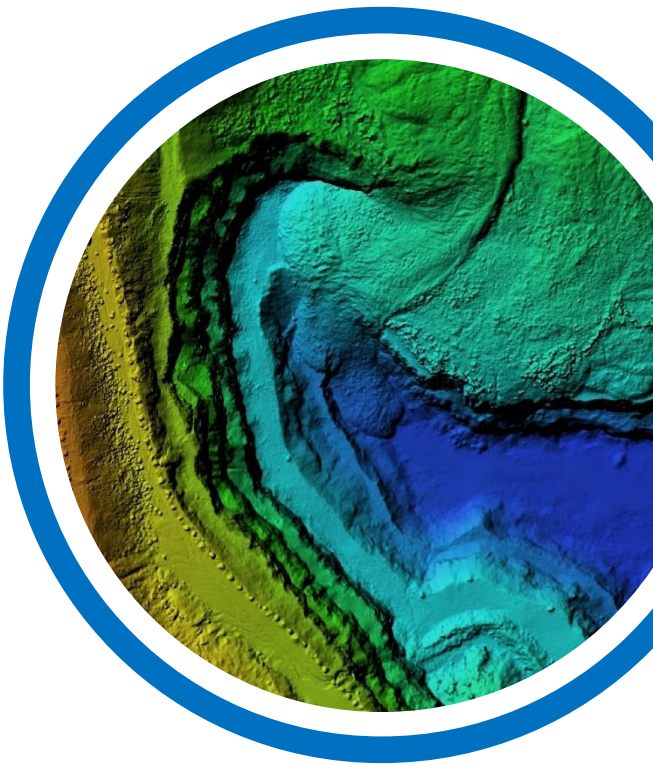


private sector in 2019 was €1.37b representing a growth of around 10% per annum for the last 5 years. Despite this growth, companies declared that they have problems finding suitable candidates in the labour market[17].

> "The EO*GI sector is healthy and sustains a 10% annual growth" (EARSC Industry survey, 2019)

While the EO*GI sector is evolving rapidly with the improvement and development of acquisition capability and online platforms to access data, infrastructure and analytics, the technological evolution is not seen as new but as an assimilation of the sector with these technologies. The risk is how the sector identifies and addresses these new challenges and opportunities, which generate new conditions for employment and have unpredictable impacts on job creation. However, in all senses we need to see it as an opportunity for economic growth and development. The rapid rise of on-demand data and the spread of platforms has a concrete impact on the EO*GI value chain.

Its ground segment faces disruptive changes in the way data storing and access is organised, in particular for Sentinel data, which is granted to be full, free, and open, and thus increasingly offered in the form of services. The new paradigm of big data ("bring the users to the data") has led to a shift towards the provision of analysis-ready data in central data infrastructures, and to an increasing cloud-based processing and information extraction.



[17] The vast majority of companies in this sector are micro and small businesses where 93% of them employ up to 50 people and 70% even less than 10.

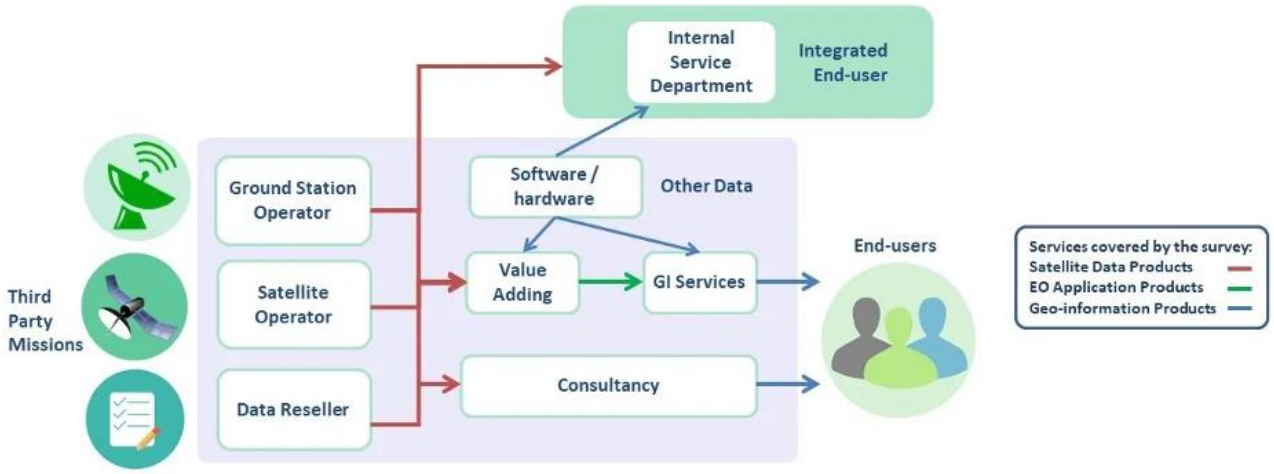


Figure 1: The EO value-chain (Source EARSC)

Another shortcoming in Europe is the insufficient crossover between the academic/research community on the one hand, and the business/industry community on the other. For instance, closer ties expressed in partnerships or collaborations, traineeships, internships or common research projects are underdeveloped. Although they could result in more effective outcomes for the EO*GI sector, raise awareness among students of opportunities in the sector and help to close the skills gap. One of the ideas to solve this mismatch between the need for skills and the supply is a closer cooperation between the private sector and universities & research centres. This can help develop appropriate solutions, including tapping into talent earlier in the recruitment cycle or helping to modernise the curricula.

The World Economic Forum (WEF) estimated that around 50% of the working population in many parts of the world will need reskilling in the next five years due to the impact of digital transformation and new technologies. This is a big challenge for the sector, as the lack of effective intervention could create a bottleneck in economic growth. This would require a greater emphasis on lifelong training, reskilling, and upskilling of employees for higher-value tasks in the use, creation, maintenance, and delivery of geoinformation services.

Besides these long-term trends and contextual factors shaping the European EO industry, the 2019-2020 coronavirus pandemic has come as a shock to the wider European and global economy and the EO*GI industry in specific. The COVID-19 pandemic has highlighted how EO*GI derived information has become an important component that can help us monitor and potentially mitigate against the impact of the coronavirus outbreak.

Defining a strategy in 10 steps

For an effective roll-out, it is essential to apply a step-by-step methodology to approach the Sector Skills Strategy at the national or regional level. It builds on 10 steps:

1. **Alliance's identification, consultation and agreement of the strategic vision and mission**
   for the sector growth base on skills development
2. **Mapping the sector**
   indicated by the analysis of the current sectoral status
3. **Defining goals and objectives**
4. **Monitoring the supply and demand and assessing the skills mismatch and requirements**
5. **Track skills gaps and shortages**
6. **Identifying the activities which support the strategy**
7. **Implementation of the defined set of tools created to address the supply and demand mismatch and gathering feedback from the Alliance**
8. **Validation cycle**
9. **Assessment and recommendations for the Long Term Action Plan**
10. **Institutional engagements to secure policy implementation**

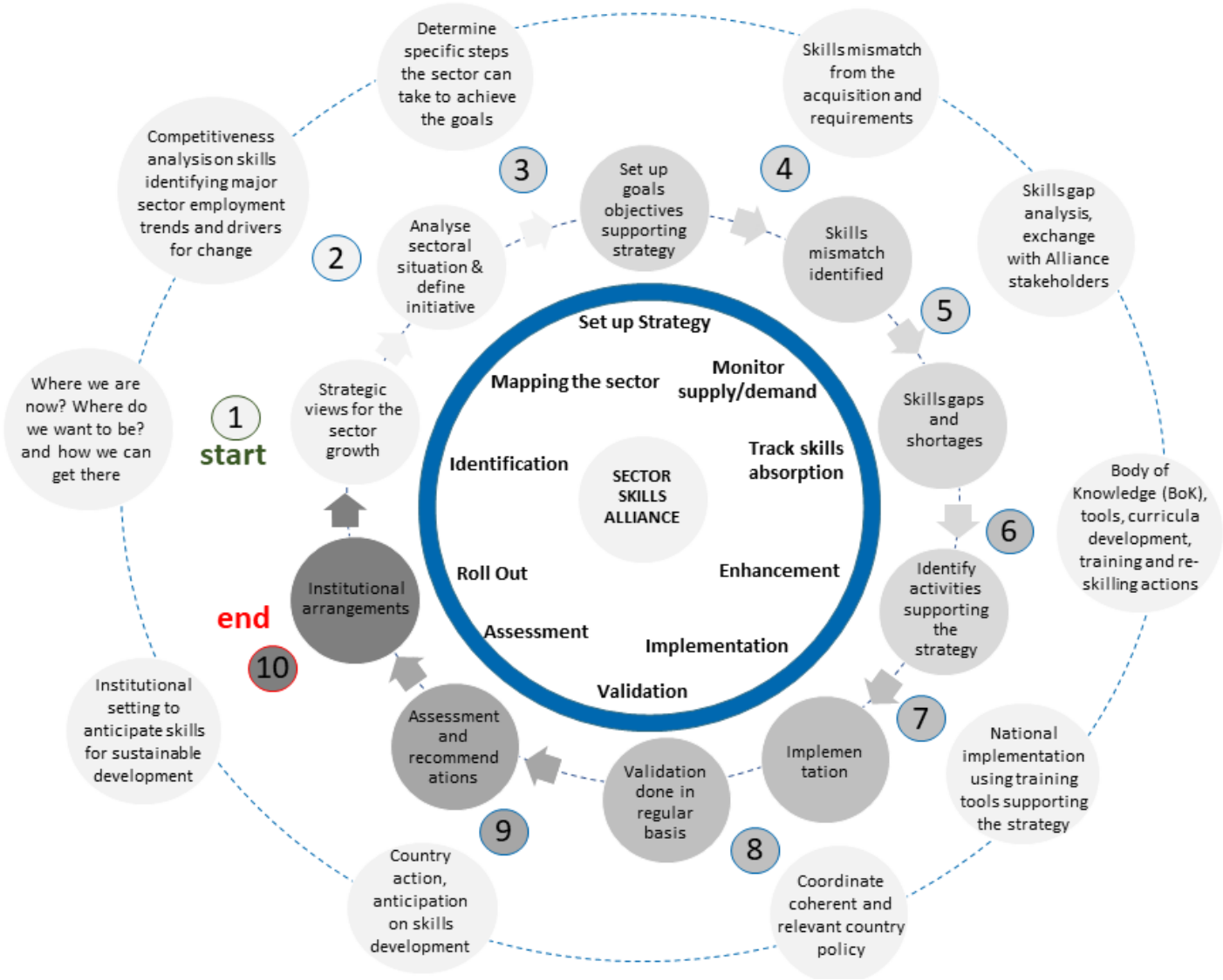
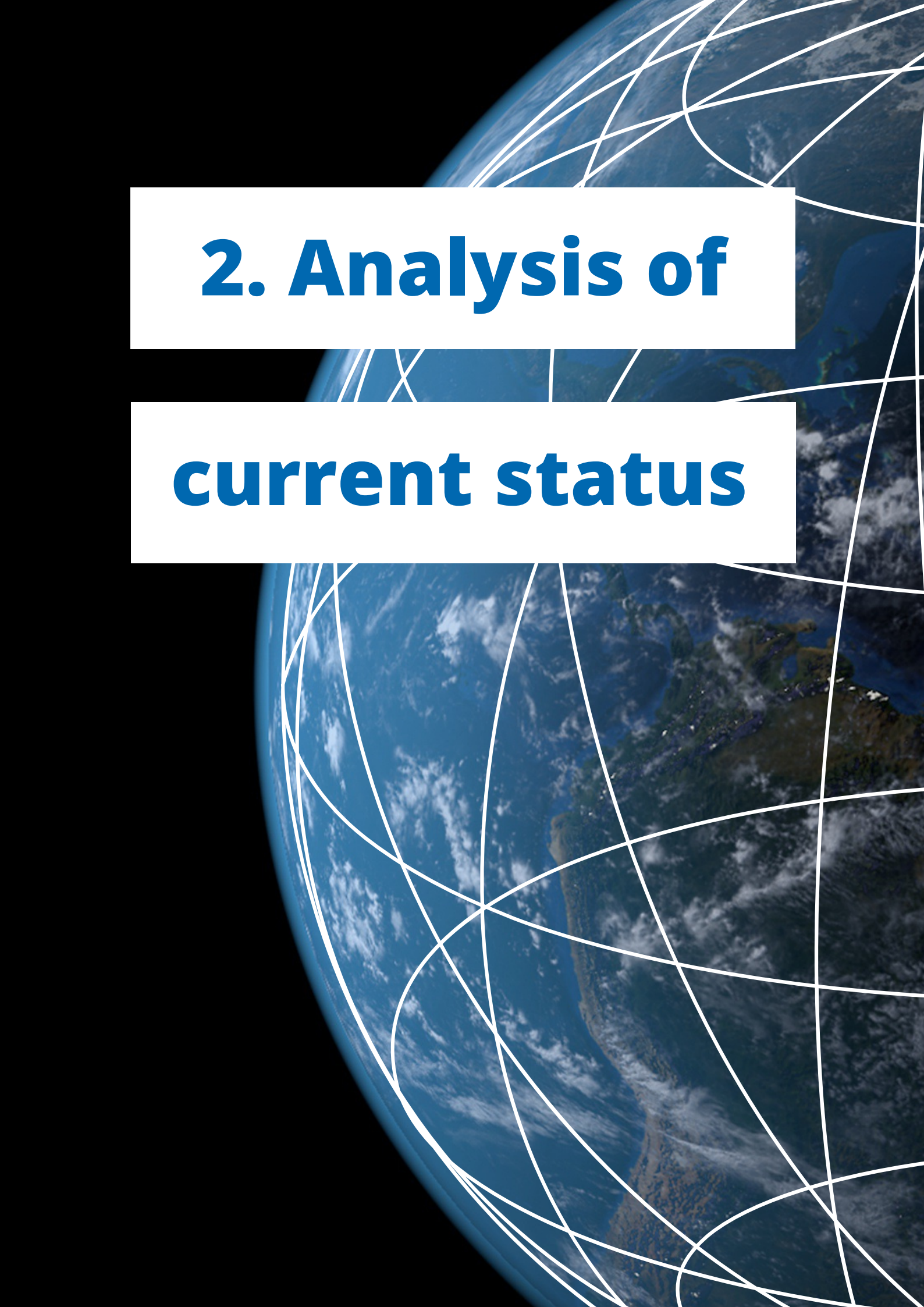
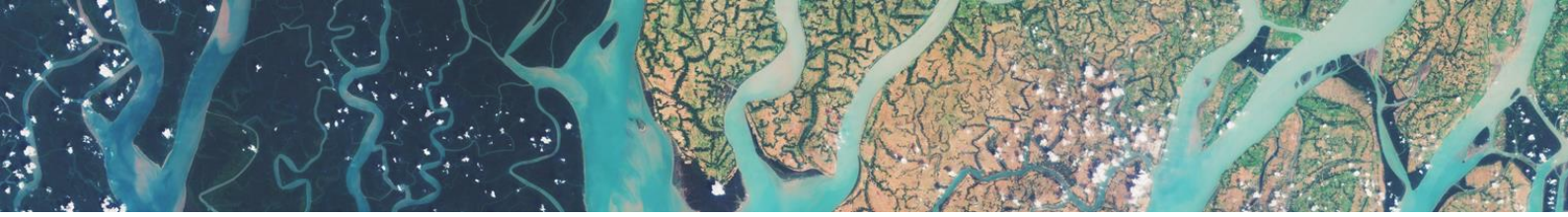


Figure 2: Sector Skills Strategy (In Action) methodology



2. Analysis of current status



2. Analysis of current status

A whole world of change: the disruptive evolution in the EO*GI sector

The EO*GI sector does not exist and evolve in isolation. The sector is by default linked to and intertwined with many other domains that influence each other: engineering, mathematics, physics, information science and many other fields and technologies and businesses (vertical sectorial activities such as maritime transport, insurance, agriculture, etc.) are very relevant and influence what happens in the sector.

Moreover, general developments in society have an impact on what the sector does, how it operates and the new technologies that are being embraced. Activities in the EO*GI sector are also more and more driven by the needs of different thematic areas and fields of application. In order to identify the (future) skills requirements, it is important to understand what these major drivers are and the related trends that have an impact on the sector.

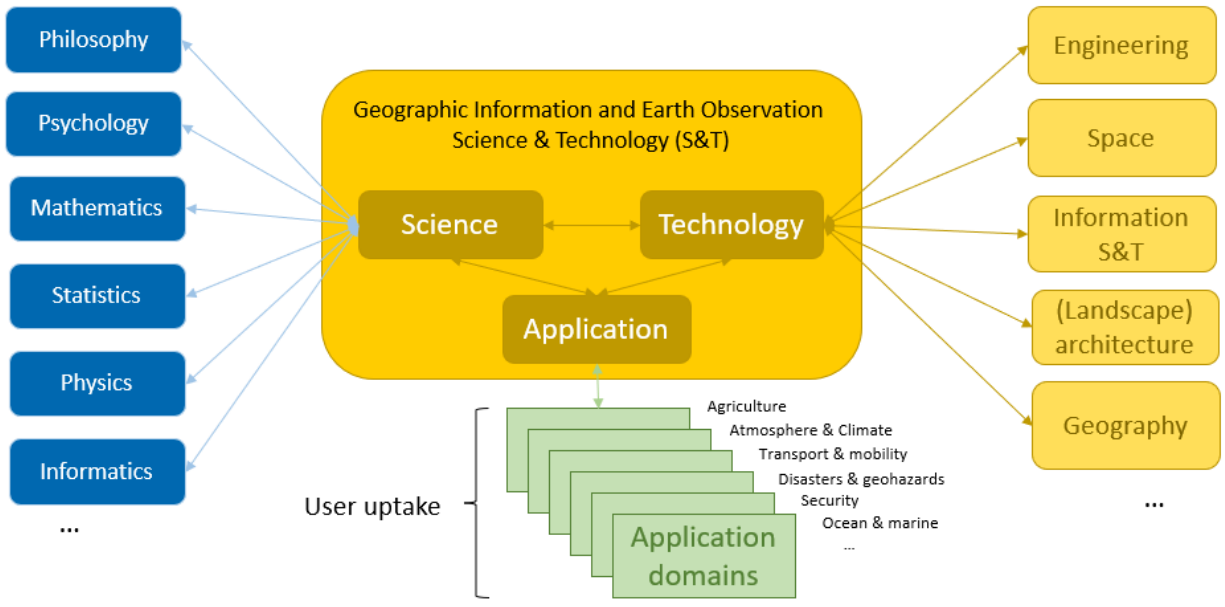
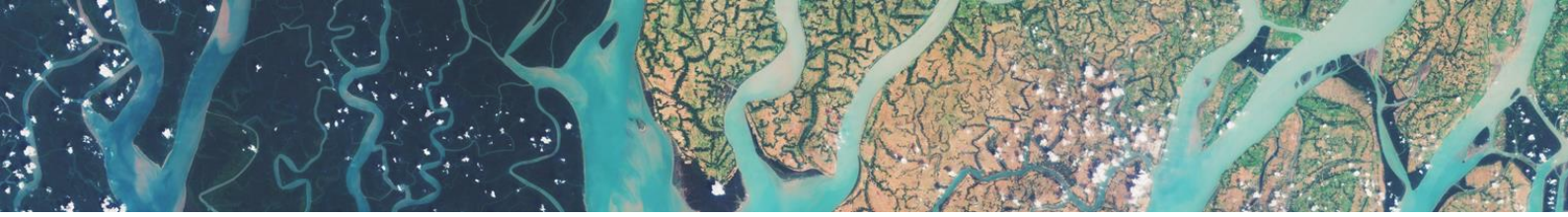


Figure 3: The EO*GI Science & Technology domain (Vandenbroucke, 2020, based on DiBiase, 2006)



2.1. Drivers and trends

The drivers and trends in our world are influenced by, and take place, in a general context of change. Different perspectives must be considered: economic ups and downs, political realities, technological developments, environmental pressures and climate disruption, social changes and new expectations, and of course dramatic events such as the COVID-19 pandemic[18]. Moreover, everything is interconnected: economies, people, technology, and the environment. What happens in one part of the world has an impact on other parts of the world. Everyone and everything is part of it. The earth observation and geoinformation sector is highly impacted by those mega-trends.

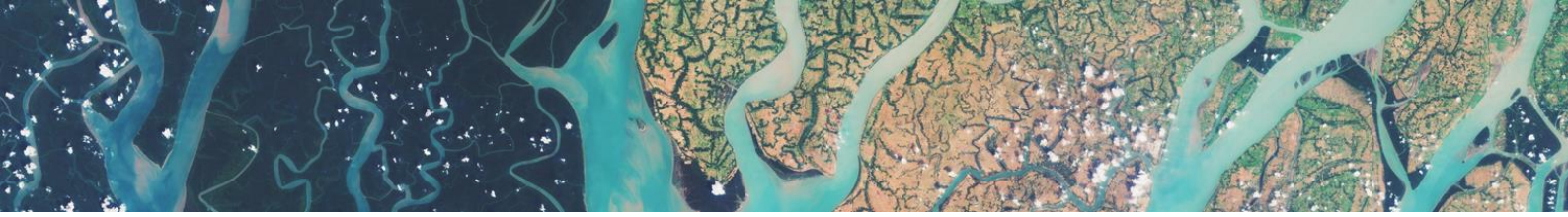
The United Nations Global Geographic Information Management (UN-GGIM)[19] initiative, which brought together representatives of the geoinformation and statistical communities from all countries across the world, identified 5 major drivers and 31 related trends that impact the EO*GI sector. The drivers are not only technological, but other aspects are deemed to be equally important. The related trends are also not occurring in isolation: drivers and trends are interconnected.

1) Rise of new data sources, and new analytical methods

The amount of data has grown exponentially over the past decades. In the EO*GI sector this phenomenon is very clear. The Copernicus programme alone generates over 15 TB of Earth Observation data daily, i.e., the third largest data provider globally. Moreover, the data is low-cost, high quality and updated frequently. In addition, the generation of data by mobile devices, crowdsourcing, and via social media is creating more factual and location-based information. Everyone and everything is a 'sensor'. What is particularly challenging is that the data is very diverse. Accessing, managing, analysing these huge amounts of data requires new techniques and technologies in order to digest them and to extract useful and usable information from it. One particular aspect of this is the push and demand for having current, near real-time data, not only static data.

[18] COVID-19 demonstrates systematic vulnerabilities and Copernicus provides much- needed information on the global situation, supporting the resilience and non-dependence of Europe. From analysis of air pollution data to trace people's movements; using contextualized data, monitoring environment impact on farming, or assessing how environmental changes may impact infectious disease transmission, the Copernicus Programme should be seen as a part of Europe's critical infrastructure providing data in times of emergencies and instability. Skills are vital for business recovery.

[19] Report from UNGGIM on future trends: https://ggim.un.org/future-trends/



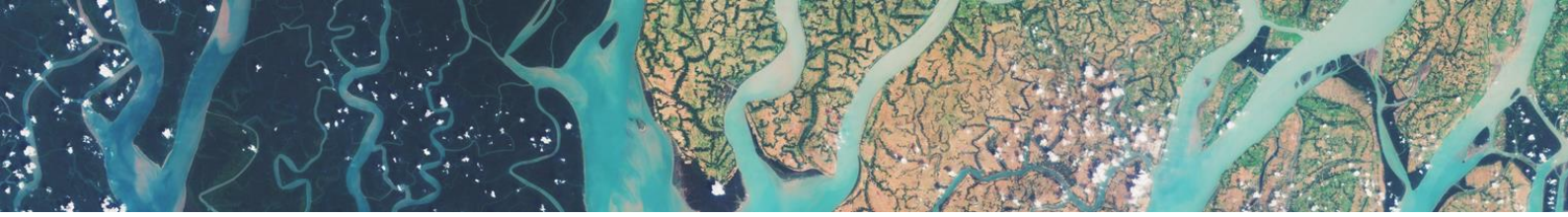
2) Technological advancements

Technological developments have never been so fast and disruptive as they are now, in all possible sectors. Especially in the information sector, there have been important changes in the way we capture, store and handle information. New types of computing[20] – providing ever more 'power' at our finger-tips – make new things possible: e.g., High Performance Computing (HPC) and Quantum Computing, but also different ways of storing and processing (centralised and decentralised). These developments have made the explosion of data volumes and the currency of data possible. Computing power is also becoming available at a low cost, so many, including Small and Medium Enterprises (SME) and even individuals, can access and use it. The fact that devices are connected with each other through high-speed networks allows different devices to talk to each other and work together on common tasks. These developments make technologies possible (such as Artificial Intelligence, Sensor Web Enablement, Internet of Things, etc.). Automation and autonomy of devices are becoming a reality, not only computers, but also e.g., the vehicles that are making Intelligent Transport Systems (ITS) a reality.

3) Evolution of user requirements

Against this background, users, and other business sectors (that are incorporating EO*GI into their business workflows) have ever higher expectations since they have become part of the networked society. They closely live together in mega-cities but are also close to their peers in other parts of the world. Users do not want to be passive consumers of information delivered by governments or commercial enterprises. They want to have instant access to data that is relevant for them, when they need it, but they also want to contribute to the debate, to take part in decision making, and they want to provide their 'own' information and insights. Traditional policy and decision making are also shifting, from more static approaches and (complex) processes to fast and continuous monitoring, modelling, simulating, and predicting all the possible positive and negative impacts of those decisions on the environment, the economy, our health. Cities and communities become smarter and smarter and intertwined.

[20] Fog computing is a combination of traditional centralized data storage and processing and cloud computing

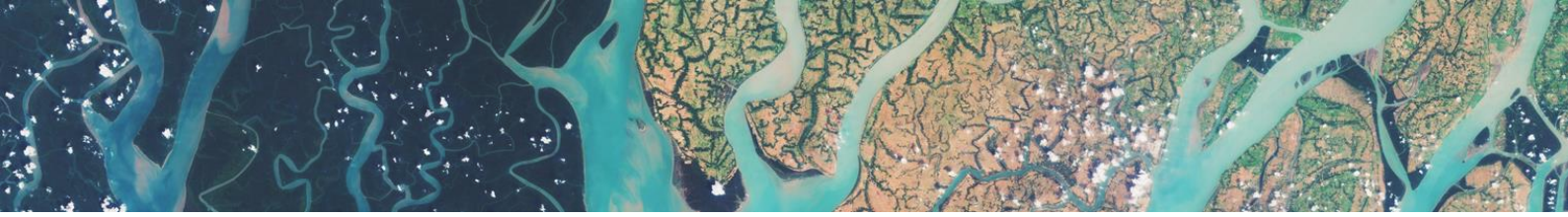


4) Structural shift of industry

Various industries are evolving rapidly. The automotive industry is seeing important changes towards increased autonomy, and the tourism industry is modernising at a fast pace, making tourists active participants in a visual world where they can experience how a city looked like a few hundred years ago through augmented reality techniques. Spatial and urban planning, transport, and mobility, are becoming more location-enabled, including the use of simulation techniques and applying agent-based modelling techniques to improve planning and to manage dense traffic flows. Industries are becoming more and more participative, while they are also more digital and automated. The EO*GI sector itself has become more automated and is more involved in the digital transformation of Government and Society. There is a push towards improved collaboration between industries, and public authorities, academia, and individuals alike.

5) A changing legislative environment

The new possibilities that come with the emerging technologies, the streams of data and the ever-demanding user needs also come with new challenges and a driver that counterbalances with it to a certain extent. Although people want more information, including its location component, and share their own information with many, risks related to that are becoming a central topic of discussion. An increasing number of connected devices and data sources also require an increased focus on data ethics.

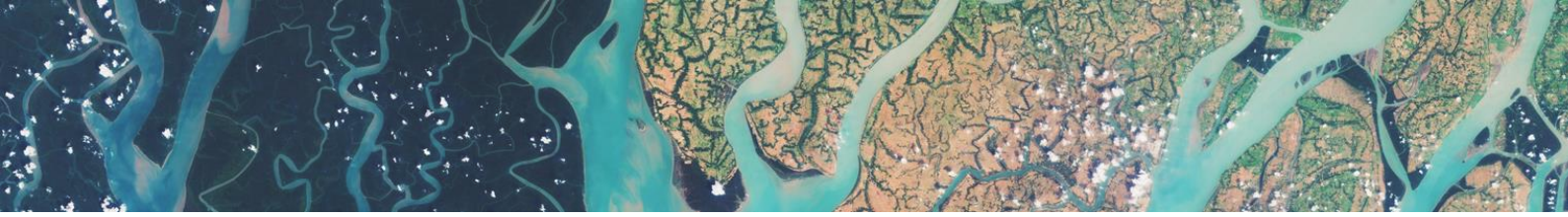


2.2. Skills requirements

EO*GI is a key economic sector where skills development plays an important role

In past studies, the gap and mismatch between the educational and training system and the requirements of the market were already evident (e.g., smeSpire[21], BESTSDI[22], giCASES[23]). EO4GEO analysed the supply and demand side, as well as the impact of the technological trends on skills requirements and the occupational profiles of the future[24]. The lack of qualified personnel is considered by all to be a major bottleneck for the further development and advancement of the sector. The following findings should be considered when defining the skills strategy.

[21] A European Community of SMEs built on Environmental Digital Content and Languages: http://www.smespire.eu/
[22] Infrastructure for spatial information in Europe Directive.
[23] giCASES eLearning training material of the six giCASES Cases Studies, with 14 Training modules in 37 training units, is freely available on the giCASES training platform: http://www.gicases.eu/
[24] Skills requirements. New projects such as GEOBIZ provide also useful insights. The UN-GGIM initiative also discussed and assessed the issue.



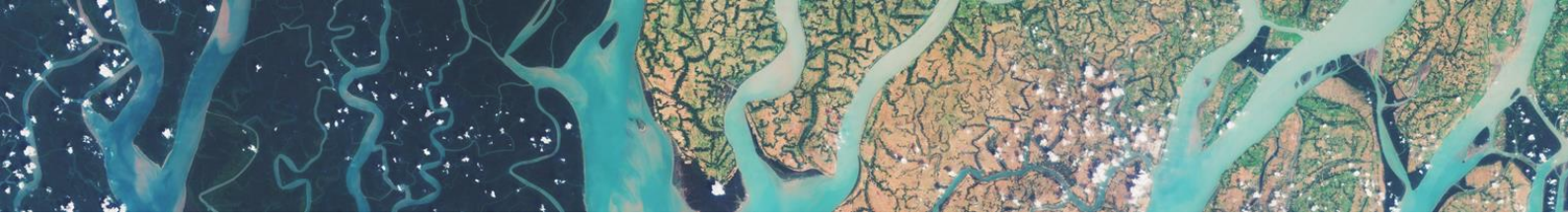
Skills and skills-sets

The EO4GEO survey on demand confirms previous findings that geoinformation data handling skills remain key. Other skill-sets, related to the first one, are analytical methods, visualisation and cartography, and programming & development skill-sets. Individual skills that are stressed are: the extraction, transformation and loading of EO*GI data; the interpretation of EO*GI data; geo-referencing and resampling of data; and the evaluation of data quality. This is not surprising due to the increased importance of (geoinformation) data in policy making and in society in general. UN-GGIM stresses the refocusing on and increased importance of skillsets related to data science and analytics, computer science, and data visualisation. In particular, the use of AI and Machine Learning techniques for data analytics will become predominant, while also particular skills are required, e.g., the handling of Unmanned Aerial Vehicles (UAV's) for surveying. The visualisation skills required are much broader now than what is usually covered in cartography or web mapping. The focus is shifting to advanced visualisation techniques for decision making that can also easily be understood by citizens (presenting decisions e.g., in case of emergencies, but also to monitor decisions and predict potential impacts). Repetitive tasks and skills for data collection, storage and management will diminish.

Occupational profiles

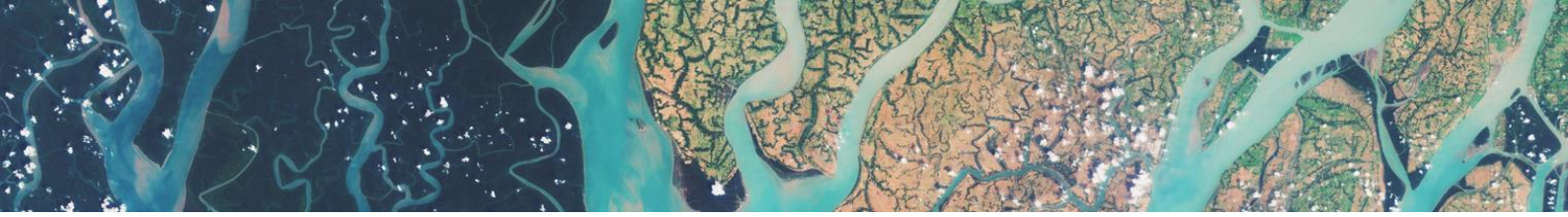
The changing needs for skills have of course had a huge impact on the occupation profiles required by the market. Over the past decades, the organisation of work has changed dramatically and that has an impact on the occupational profiles needed: it is a mixture of skill-sets, both highly technological as well as transversal that is defining the profiles. The EO4GEO survey and interviews among experts identified 3 major profiles: EO*GI developers, EO*GI data analysts and EO*GI project managers. Analysis of job advertisements revealed the need for more traditional profiles such as cartographers and remote sensing experts, but also various types of EO*GI related profiles, such as developers, (data) specialists, analysts, and technicians. While geographers, cartographers, EO*GI analysts, remote sensing scientists, surveyors, photogrammetrists, and EO scientists still make up a large part of the current workforce, the range of geoinformation career paths has diversified and incorporates expert groups previously not covered (UN-GGIM, 2020)[25].

[25] Source: https://ggim.un.org/documents/DRAFT_Future_Trends_report_3rd_edition.pdf



Learning approaches

Continuous learning and regular reskilling/upskilling are required in this rapidly changing world. The UN-GGIM even states that around 50% of the working population in many parts of the world will need reskilling in the next five years due to the impact of digital transformation. Moreover, reskilling and upskilling should focus more on skills related to higher value tasks such as data analysis, modelling & prediction, using information to make well-balanced decisions, etc. Even more importantly, learning and development of education and training offerings should not only focus on the graduate and post-graduate levels, but include initiatives for the primary and secondary levels. With the increasing exposure of geoinformation data through smartphone devices and wider integration within the gaming industry, learning – in an adapted environment – should start with young people, stimulating their spatial thinking and behaviour. Finally, the way we offer education and learning is shifting: it is more and more experimental, case-based, and especially collaborative. The latter is crucial since it is almost impossible to have the knowledge, skills, and competencies to cover all aspects of geoinformation data technology, and to apply it to resolve real-world problems; the set-up of multi- and inter-disciplinary teams comes to the forefront.



2.3. Stakeholders' analysis: a complex ecosystem

The current EO*GI alliance consists of a network-of-networks, but it is also linked to and embedded in the Copernicus ecosystem. The latter in turn is also connected to the broader space and geoinformation ecosystem. The alliance formed in the context of the EO4GEO project taps already (partially) into this large and complex ecosystem through its 47 associated members, its network of individual experts, its advisory and editorial board, etc. The project analyses and tries to animate this complex ecosystem in a collaborative way and to further develop it as part of the Sector Skills Strategy.

In addition to the stakeholders directly related to the EO*GI alliance from its formation, a number of key stakeholders are being identified and engaged. This exercise presents a forward-looking approach which is essential to guarantee the uptake of the tools and other outcomes developed within the alliance, and to engage the right stakeholders that will play an important role in its future development as well as in the full implementation of the strategy.

The complex ecosystem of stakeholders necessary for the successful implementation of the strategy is composed by members from the space and geoinformation sector as well as organisations dedicated to the provision of skills and training. In addition, the EO*GI alliance has also engaged organisations from sectors such as climate change, food systems, land management and many others. The EO*GI alliance pays special attention in the engagement of stakeholders from other sectors, as the training actions developed in the alliance will support the uptake and further use of geoinformation in sectors addressing key societal challenges.

Figure 4 illustrates some of the stakeholder groups and organisations that have been identified and that are currently being engaged to support the work of the EO*GI alliance.

Table 1: Representation of the main stakeholders' groups

Companies	Research centers	Academia	Associations	Local/ Regional Administration	National Administration	International Organisations	Supranational Entities	Students	Professional (business workforce)
									

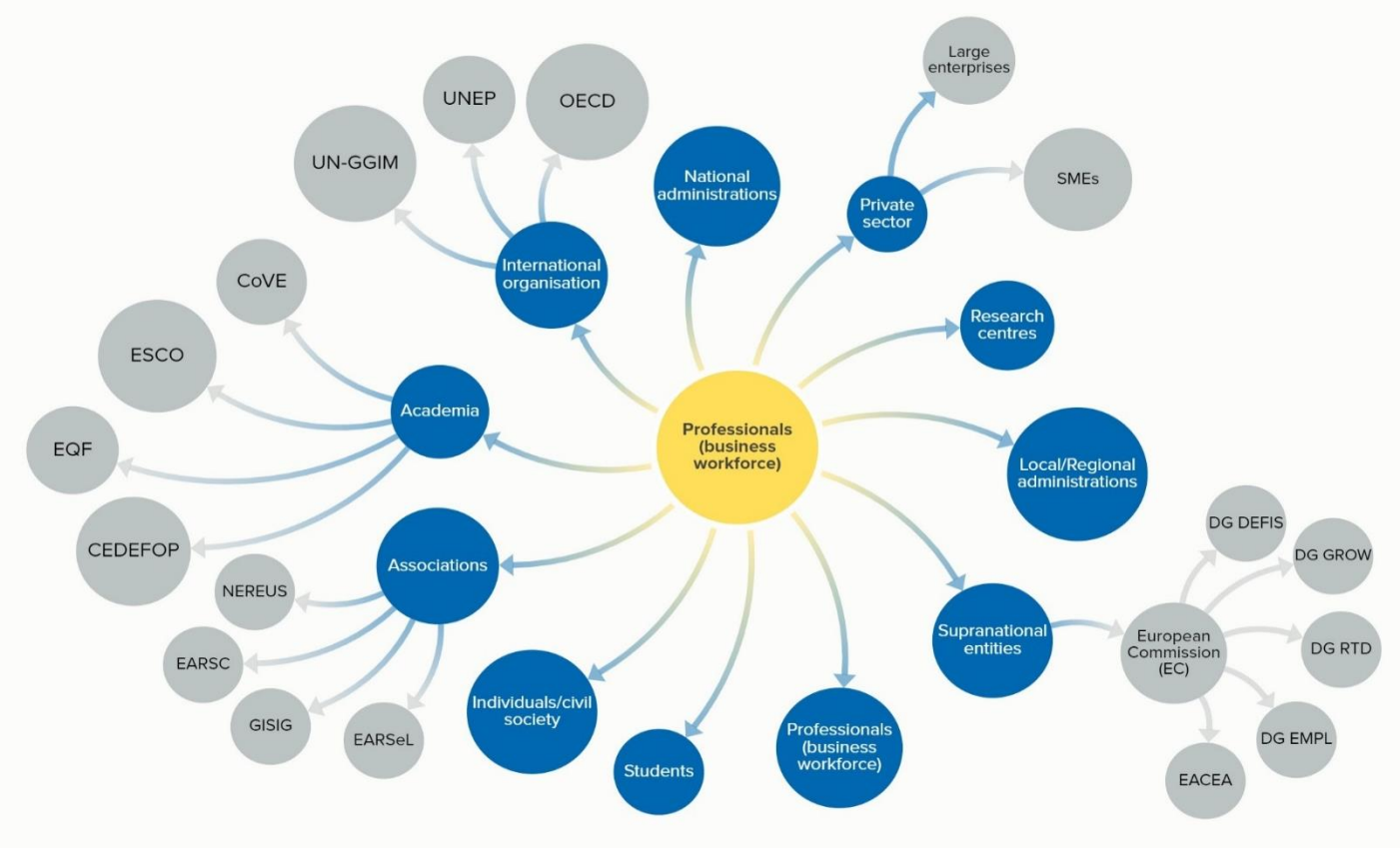


Figure 4: Example of the stakeholder's ecosystem mapping

Initiatives such as CoVE, ESCO, EQF and CEDEFOP mapped under the category "Academia" will be relevant for the integration of the educational courses and curricula into existing frameworks. Organisations that will facilitate the regional and national uptake results of the Alliance will be mapped under the groups' associations, local/regional administrations, and national administrations. The stakeholders identified under the group "International organisations" will be essential in building bridges with existing initiatives globally and through agencies of the

United Nations, the World Bank and the OECD, just to name a few. The private sector, a key player defining job offers and occupational profiles are mapped under the sub-categories "Large enterprises and SMEs".

The analysis and mapping of stakeholders are of paramount importance to effectively engage and disseminate the outcomes of the project, and through this collaborative process build a rich alliance of stakeholders that will contribute to its long-term sustainability.

3. Vision and mission

Vision and mission

Unlocking value through skills

Vision

The vision statement looks forward and creates a mental image of what the EO*GI Sector wishes to achieve in the medium and long term regarding the need for skills EO*GI to achieve a maximum impact.

The VISION of the EO*GI Sector is to foster its growth by ensuring a workforce with the right skills, in the right place, at the right time.

It recognises the responsibility of the EO*GI community to plan for sector growth covering aspects of the industry challenges in relation to skills gaps and finding a skilled workforce. It keeps the pipeline of talent flowing and enforces a skilled and innovative workforce.

Mission

The mission statement describes how it is intended to contribute to the vision of enforcing a capable, and innovative workforce and serving to communicate purpose and direction. It is designed to stimulate action towards skills development.

The MISSION of the EO*GI Sector is to ensure strategic cooperation among stakeholders on skills development.

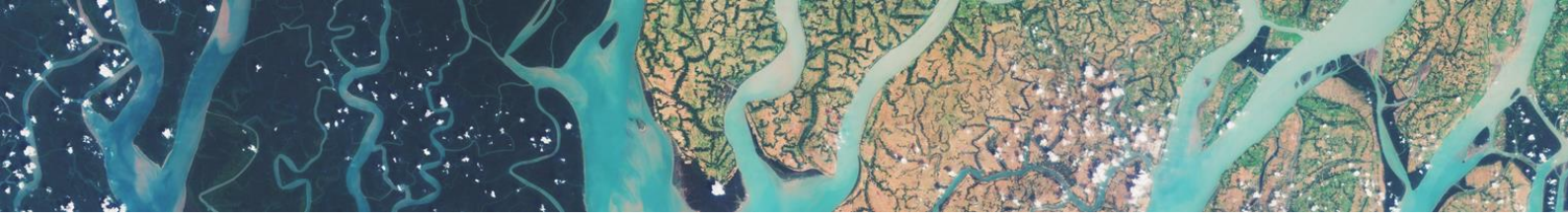
The mission is designed to stimulate action towards bridging cooperation among the EO*GI community. The Alliance is committed to ensuring the right skills are available to improve the competitiveness in the sector, ensuring its growth. Facilitating and coordinating skills development programmes to respond to sectoral challenges.

Goals

The EO4GEO Sector Skills Alliance aims to operate as a “Leader” for EO*GI skills development in Europe by providing insights and intelligence on the demand for and offer of education and training (coordinated with other stakeholders) relevant for the sector, and the skills required by the market.

With this in mind, EO4GEO aims to harmonise curricula, and to give recommendations and develop training materials (when needed) at academic and vocational levels, directly linked and adapted to the European classification of Skills/Competences, Qualifications and Occupations (ESCO).

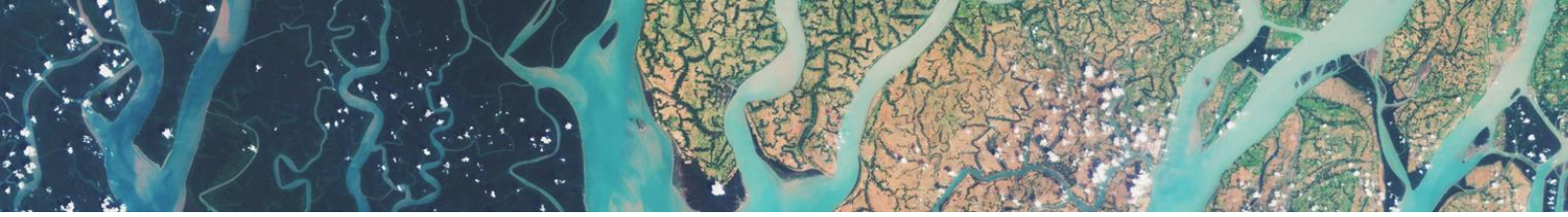
By adopting this forward-looking perspective, **8 GOALS** have been identified, providing a compass to all stakeholders for contributing to the successful implementation of the Sector Skills Strategy.



> "Skills intelligence developed through collaboration, engagement and political commitment will lead to modern curricula and a training offer that is aligned with market needs" (Danny Vandenbroucke, KU Leuven, 2021)

Table 2: Sector Skills Strategy Goals

Goal 1 – Monitoring market intelligence A coordinated effort is needed to improve competitiveness in the sector and to penetrate other sectors by monitoring and understanding market intelligence and embracing new trends.	
Goal 2 – Mapping skills needs Skills needs are identified and mapped against the supply of academic and vocational education and training, with the aim to align them, hereby focusing on flexible learning paths for different occupational profiles.	
Goal 3 – Harmonised curricula designed Harmonised curricula are designed and recognised, and mobility activities and training offers are developed and implemented at the Pan-European level, leveraging skills transferability.	
Goal 4 – Key qualifications identified A set of key qualifications is defined, described, and promoted according to a standardised approach, in line with the European classification of Skills, Competences, Occupations and Qualifications (ESCO), and accepted by all stakeholders involved.	



Goal 5 – Provide innovative context The use of EO*GI data and services as an inspiring and innovative context for learning across all age groups and value chains is encouraged and supported.	
Goal 6 – Political commitment Political commitment is ensured at EU, national, regional, and local levels, to stimulate innovative skills development and translated in governance, financial and other ways of support.	
Goal 7 – Strategic collaboration A strategic collaboration between the skills alliance, private sector, government, academia, and "end-user" sectors is established. Stakeholders collaborate in an efficient and effective manner, taking conscious actions to support the political commitment for skills development.	
Goal 8 – Awareness and engagement The EO*GI awareness of, and engagement with "end user" sectors is improved, leading to increased uptake of EO*GI data and services. Continuous outreach and awareness raising through the promotion of the use of EO*GI in learning and innovation activities.	

These 8 goals reflect a future state where skills development and workforce are leveraged to anticipate the skills mismatch advancing on key policies.

4. Objectives and expected impact

4. Strategic and Operational Objectives, and expected impact

The vision, mission and general goals need to be translated into Strategic Objectives (SO), which are derived from and linked to the challenges and drives identified in the State of Play. The SO are then further detailed in a series of Operational Objectives (OO) which are measurable and can be detailed as actions and activities which will form the biggest part of the Long-Term Action Plan (LTAP). Both the SOs and OOs will lead to a certain impact that contributes to bridging the skills gaps and mismatches, and an improved user uptake of EO*GI.

Figure 5 provides an overview of the challenges, the SOs and OOs, as well as expected impact. In the following sub-sections, the different SOs are presented, including their timeline and stakeholders involved.

4.1. Overview

The objectives have been specifically formulated to address missing elements in the training and skilling of the EO*GI workforce, as well as creating the training capacity to bridge the EO*GI skills gaps in other domains. The implementation of the OOs combined with the activation of a LTAP will be a significant step forward in bridging the existing skills gap of the sector.

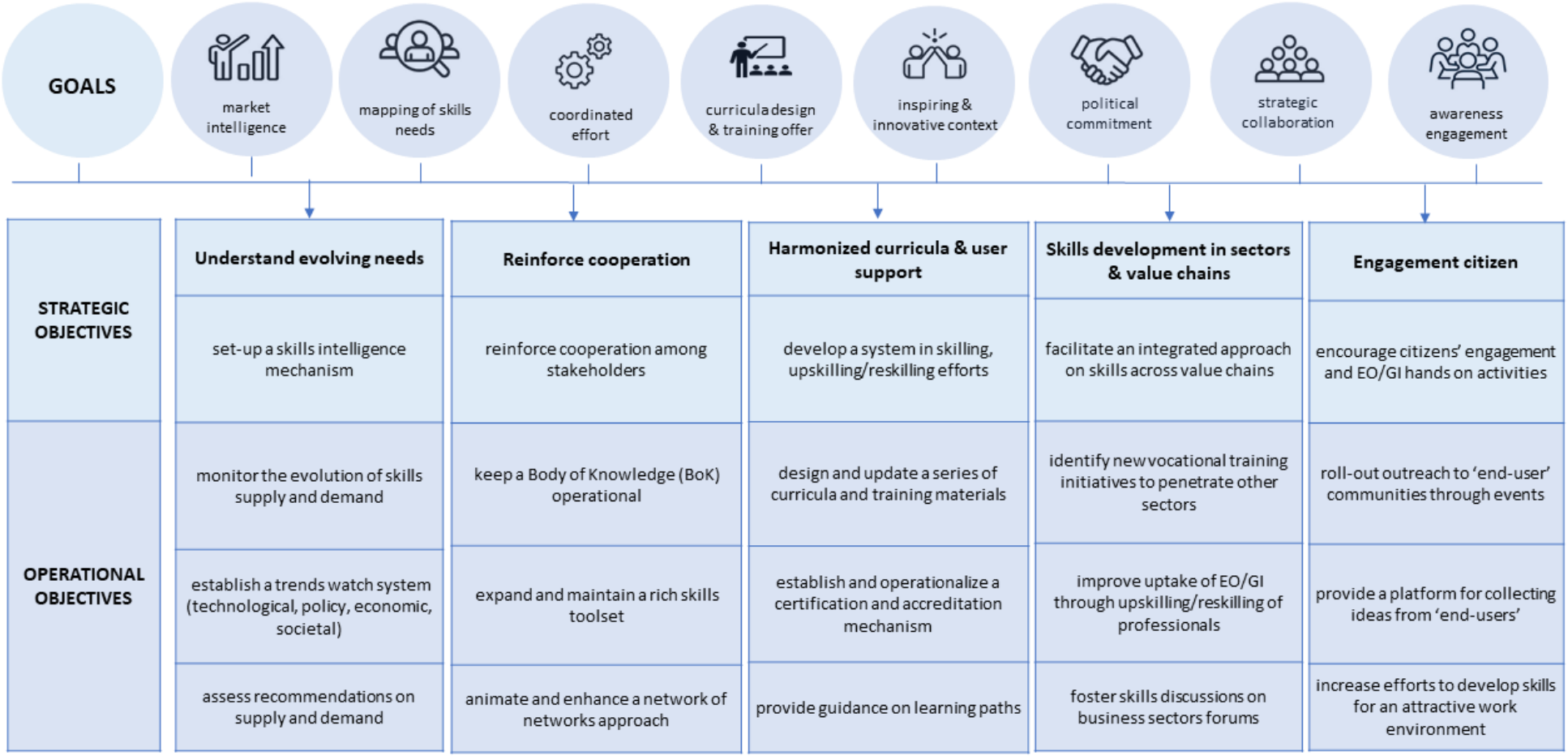
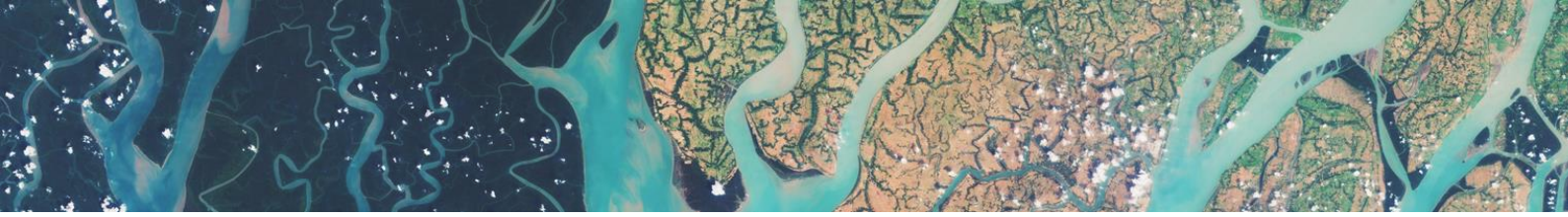


Figure 5: Goals, Strategic and Operational Objectives



4.2. Understand evolving needs

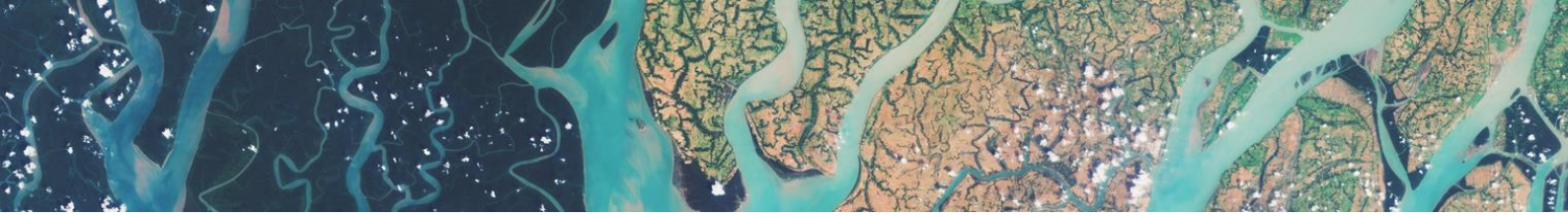
Strategic Objective 1: To set up a skills intelligence mechanism to identify the skills and competences required and provide feedback on the evolving sector needs.

Rationale – Currently, the academic and vocational education and training offered are lagging behind the continuously evolving needs of the industry, the individual businesses, public sector actors and society at large. The actual offer is focusing too much on the upstream part of the space sector, while the downstream EO*GI sector, and especially the different application domains and the connection/synergies with the user communities, such as other business sectors (agriculture, infrastructure, insurance, etc.), are under-represented. Moreover, requirements are evolving continuously, and due to technological trends and user expectations, the education and training offer needs continuous updating of existing curricula, and the development of new curricula reflecting new skills requirements. Therefore, it is of utmost importance that the sector systematically monitors and assesses these evolving needs through a well-organised observatory that will significantly contribute to the "Pact for Skills"[26] and contributes as a tool to monitor the competitive environment in the EO*GI sector in the digital economy worldwide.

Operational objectives and actions

1. *To monitor the evolution of supply of, and demand for education and training on a regular basis (OO11)*. The monitoring of the supply side can occur through desktop studies, surveys or even by using semantic technologies (automated processes) resulting in a catalogue of education and training offered by the sector. The demand can be captured by organising regular surveys among stakeholders.

[26] More info on the "Pact for Skills" can be found at the following address: https://ec.europa.eu/social/main.jsp?catId=1517&langId=en



2. *To establish a "trends watch system" that alerts the community on emerging developments (e.g., technological, policy, economic, societal) (OO12).* A technical system should be set-up, together with stakeholders, to collect – if possible, in an automated way – emerging technological, political, and societal trends, to group/cluster and analyse their impact on the EO*GI sector in terms of skills, and to define a roadmap on how to integrate them in curricula.

3. *To assess supply and demand at regular intervals with the view to draw recommendations for the stakeholders of the sector (OO13).* The supply, demand and new trends should be assessed together to find gaps and mismatches, and to identify priorities for integration of (new) topics in existing and new curricula. The aim is to have the findings regularly published, broadly distributed, and recognised by the whole community.

Outcome(s) – Operational Sector Skills Intelligence Observatory

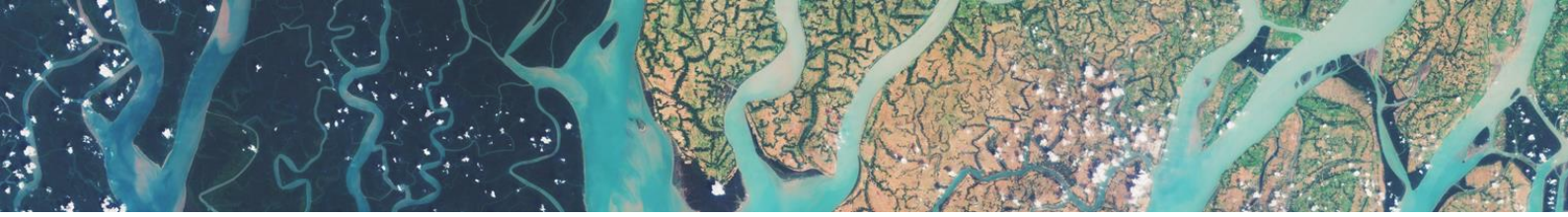
Expected impact – Improved awareness of where skills development should go, which will help the future updates of the sectoral skills strategy and the future Pact for Sectoral Skills, and will allow for the improvement of vocational training, the upskilling and reskilling of professionals and newcomers on the job market, and ultimately employment. This approach would also give the EO*GI sector the necessary intelligence and understanding of the latest trends and needs to effectively support companies, workers, students, and other stakeholders obtain the training, skills, and competences they need to succeed.

Timeline – OO11 and OO13 are foreseen to be organised every two years, while OO12 is conceived to be continuous leading to an assessment every semester.

Target public – Academic sector, businesses workforce, public sector actors, VET providers.

Stakeholders – Key education and training providers, as well as organisations that are currently already involved in monitoring technology trends, should be involved, among others in the supranational scope (ESA, JRC), international bodies such as UN-GGIM, associations representing the sector such the Open Geospatial Consortium (OGC)[27], EARSC, other business professionals, EO*GI private services providers companies, VET providers, etc.

[27] In the last version of the OGC Tech Trends Mind map, 48 trends are identified (some of the previous trends were split, others are new).



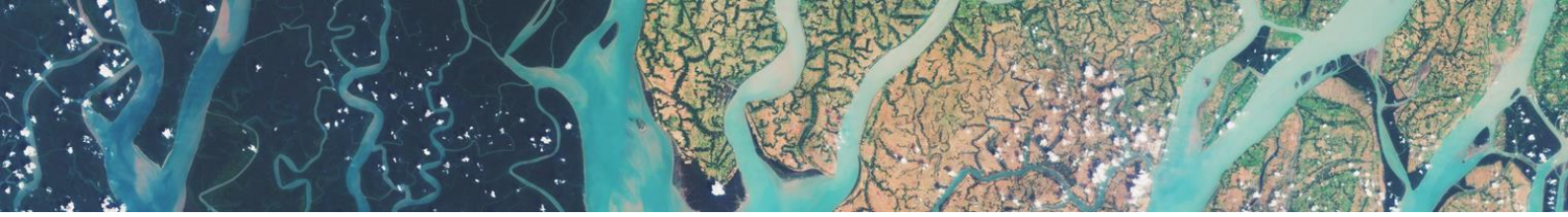
4.3. Reinforce cooperation

Strategic Objective 2: Reinforce cooperation among stakeholders from the academic, private, and public sectors on skills development and requirements.

Rationale – Businesses and academic stakeholders of the sector have their own language(s). The Earth Observation companies have long agreed on a taxonomy for the EO services (EARSC)[28] which help service providers and users have a mutual understanding of the types of services that can be offered and the benefits that can be delivered, while the community has also its Body of Knowledge (BoK) for EO*GI Science & Technology[29]. Other BoKs, vocabularies and ontologies exist, but are not linked to each other. A BoK defines (related) concepts and terms used in the sector, but also the related skills, learning resources available and much more. Because of new technological and non-technological developments, it is necessary to update the shared language continuously, adding or updating learning outcomes and skills related to new and evolving concepts. The continuously evolving BoK is connected to a range of different tools and functionalities fostering the development of skills, training materials and job profiles. In the context of the Copernicus programme, data policy provides full, open, and free-of-charge access to data and information, in line with the international data sharing principles of the Group for Earth Observation (GEO). To establish a global vocabulary as a best practice, international cooperation should be of significant importance to the BoK development.

[28] EARSC taxonomy: https://earsc-portal.eu/display/EOwiki/EO+Taxonomy

[29] The EO4GEO project has integrated the EARSC taxonomy user uptake definitions into the BoK.



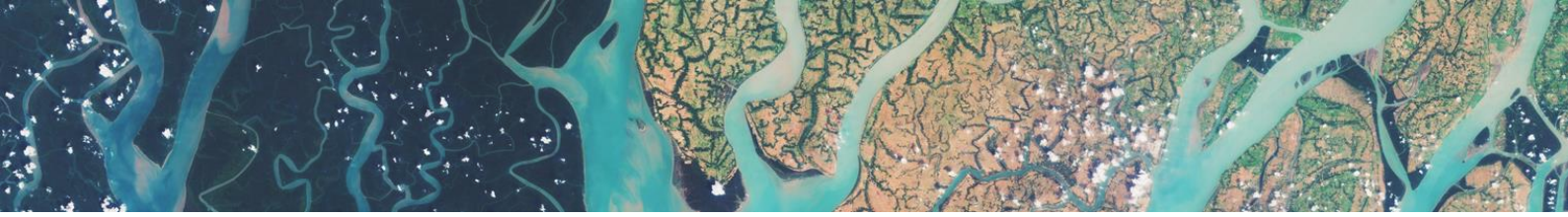
Operational objectives and actions

- *To keep a Body of Knowledge (BoK) for EO*GI*[30] *operational, feed it with the results of the Technology Trends Watch and link it with other relevant BoKs, vocabularies and ontologies (OO21).* This will require the continuous improvement of its content by adding new concepts (theories, technologies, EO*GI applications & services oriented to user communities, etc.), revising and defining skills, adding reference materials, etc. Many other BoKs, taxonomies and ontologies are being developed and will become operational in the future, e.g., from ESA, OGC, etc. but require actions and good coordination with their owner to be able to use them as input to the EO*GI BoK.

- *To expand and maintain a rich toolset to support skills development, and to make it accessible and re-usable for all stakeholders (OO22).* The maintenance of the BoK, and its exploitation for curricula design, the definition of job offerings and other activities conducted by many stakeholders of the EO*GI sector, requires an ecosystem of tools that make use of the BoK and that are continuously maintained, upgraded, and expanded with new functionality.

- *To animate and enhance a network-of-networks and avoid fragmentation and negative side effects, bringing together stakeholders and user communities (OO23).* The EO4GEO core and associated partnership already consist of around 70 organisations of which many are networks in their own right. This network should be continuously managed, animated, and involved in future activities. This also includes the worldwide network of individual experts and a user group that can collect user requirements and feedback.

[30] EO4GEO BoK: http://www.eo4geo.eu/bok/



Outcome(s) – An operational EO*GI BoK that serves as an engine for skills development, supported by an ecosystem of open tools, used by all stakeholders, and supported by the network-of-networks.

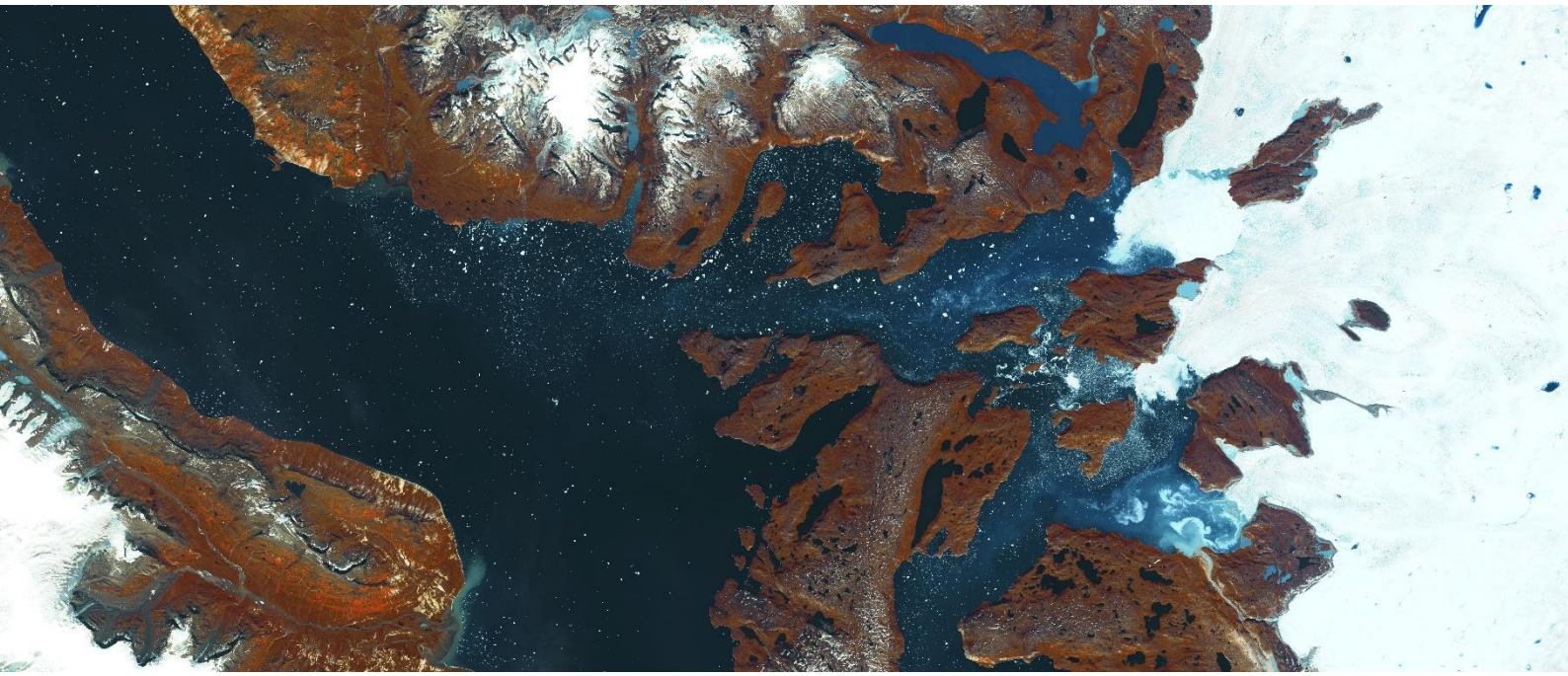
Expected impact – Will lead to a common understanding of what the sector covers, its challenges and opportunities, the elements to be covered in skills development, the liaison with the user uptake, etc. It will define curricula in a standard way based on this common language, but also support Human Resource Management (HRM) activities in the sector.

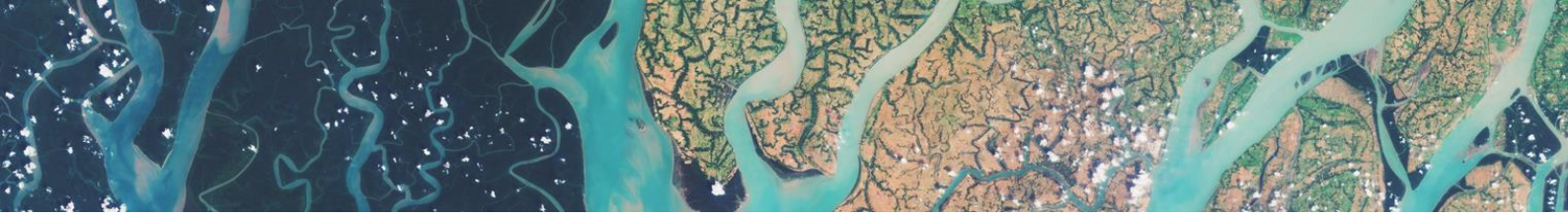
Timeline – Continuous updating of the BoK, with special attention to updates each semester when the trends watch is updated. Development of new tools during the first 3 years after EO4GEO ends, while linking to other BoKs and ontologies will be spread over a 3 to 5 year period.

Target public – EO*GI experts from the academic, as well as the public and private sectors.

Stakeholders – Collaboration with international organisations such as ESA, ICA, OGC, UCGIS, surveyors and organisations managing other existing BoKs or specialised taxonomies on the EO services such as EARSC.

Public-private academia partnerships play a fundamental role in skills development.



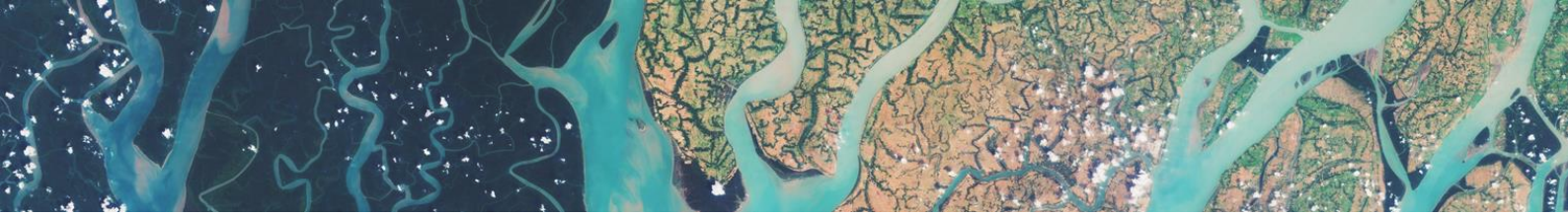


4.4. Harmonised curricula and user support

Strategic Objective 3: To set-up a mechanism for helping and guiding candidate learners in their skilling, upskilling and reskilling efforts.

Rationale – A rich offer of academic training exists in universities, especially with regard to the theoretical and scientific elements of space, and the EO*GI sector. The skills development part is usually less developed. Formalised vocational education and training offers in the sector are also less developed and not standardised, and in many cases no certification mechanism exists. They are usually part of projects, summer schools or just organised as a training offer, but in an ad-hoc manner. The downstream sector needs particular attention, especially the many sectoral or thematic application domains that (can) make use of EO*GI data and services. From this perspective, more practical, case-based learning curricula could and should be designed in a collaborative effort by academic, EO*GI service companies, the public sector, and other business sector actors.

Moreover, it is very difficult for candidate learners from the EO*GI or other business sectors to find their way through the offer and receive the support they need to define a personalised learning path. Europe has a strong and diversified EO*GI service industry capable of providing many products and services derived from satellite observations, other platforms and various geoinformation data across a wide range of applications. Many countries lack the skills to develop products on their own. This presents opportunities for the European service industry to provide tailored products and services for local and regional markets in third countries, potentially through partnership programmes and joint ventures. Before promoting the EO*GI sector abroad, it is important to ensure the required skills and competencies to succeed abroad are



available/developed[31] in the skills development setup such as internal adoption of common innovative practices to increase internal uptake of EO-technology, and help to build the required expertise and credibility to effectively develop international markets.

Operational objectives and actions

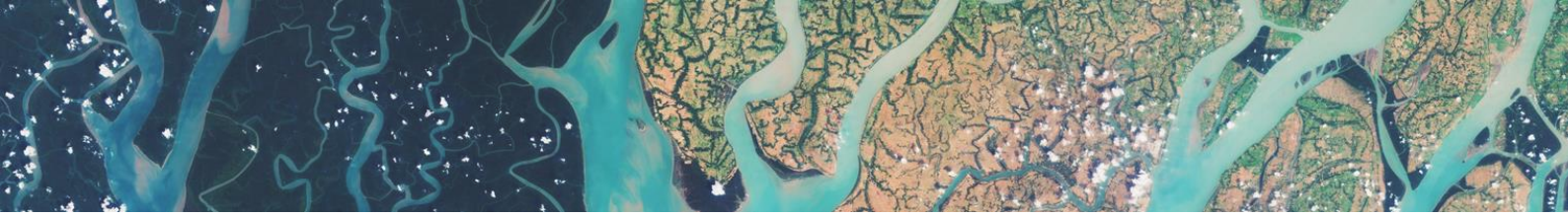
- *To design and regularly update a portfolio of curricula and training materials, notably for added-value services and applications, covering different occupational profiles, and make them accessible to all stakeholders through a one-stop portal (OO31).* The training offer should be organised logically and cover many different domains, introductory topics as well as full learning cycles and programmes. The training offer can also vary in format: from webinars over MOOC's to more extensive training programmes. The first step to facilitate access and sharing is to have one entry point, even if some offers might be hosted elsewhere. The description of the offer should be available in one area and be easy to understand for learners.

- *To establish and operationalise a certification and accreditation mechanism for the training offered (OO32).* Together with the relevant bodies, the curricula should be harmonised as much as possible in order to form a kind of recognised baseline shared by all stakeholders. They should go through certification and accreditation mechanisms where appropriate and coordinate with European Skills/Competences, Qualifications and Occupations (ESCO) presenting the EO*GI skills cross-horizontal to other business sectors.

- *To provide guidance for learners to define their own learning paths and to follow training actions (OO33).* Users should be supported in assembling personalised learning paths, based for example on a series of questions. Also, more standard training programmes, offered to cover a learning path for a clearly defined occupational profile, should be made available. Users should be able to interact with tutors and with their peers.

Outcome(s) – A set of standard curricula for different occupational profiles is defined and a rich portfolio of training offer is available, open for and accessible by all through a one-stop portal.

[31] EARSC 2020: https://earsc.org/2017/11/21/earsc-position-paper-on-earth-observation-services-industry-internationalisation-economic-diplomacy/

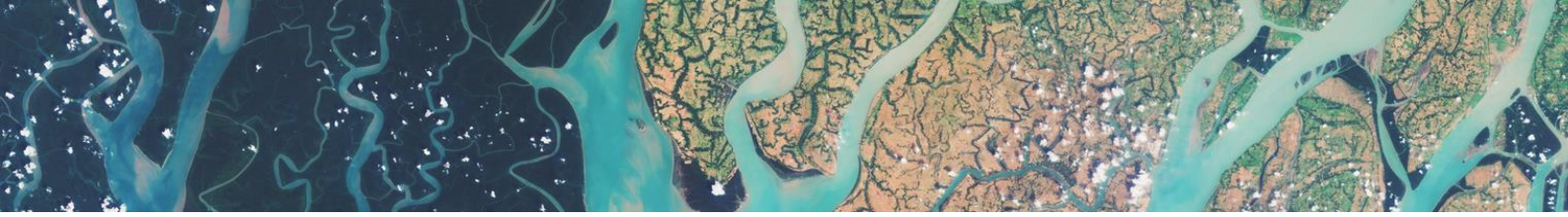


Expected impact – Training offers are recognised at EU level, and more easily accessible and personalised according to individual needs, supporting the development of the pool of talents for the sector. This will lead to skills recognition & transferability for a series of occupational profiles. This will in turn facilitate comparability between countries, regions, but also between stakeholders that offer VET courses. It will in that sense make it easier for professionals and people entering the job market to compare and select different offerings.

Timeline – Within the first three years after the end of EO4GEO, key curricula are designed for key occupational profiles as identified during EO4GEO. The setup of the one-stop portal, including the guidance mechanisms, should be developed in the first two years after EO4GEO ends. That also includes an operational catalogue of training offers (training materials and actions). After that period, the offering will be extended gradually.

Target public – Education and Training providers from the academic, private, and public sector at the offer side. Professionals that want to upskill and reskill, young people who want to enter the job market, people who want to reorient their career.

Stakeholders – Agencies and bodies specialised in certification, accreditation, etc., both at the European and national/subnational levels.



4.5. Skills development across sectors and value chains

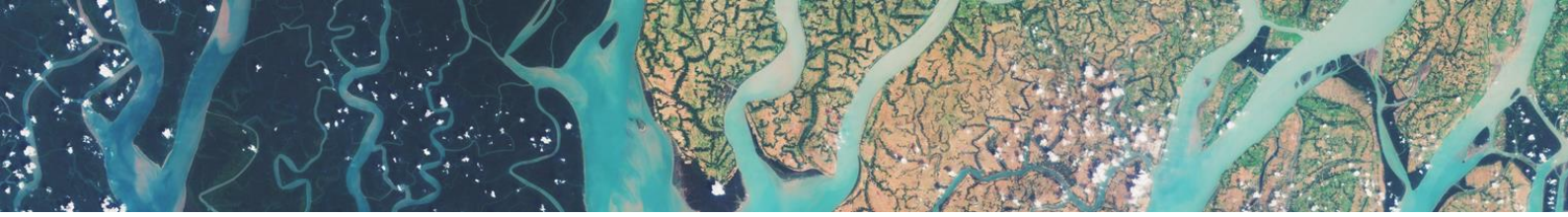
Strategic Objective 4: To facilitate and stimulate a more integrated approach on skills development across different value chains.

Rationale – The benefits and opportunities for other business sectors are not fully taken into account and exploited. Focus in the EO*GI sector should be on reaching out to the public sector as customer and application domains to highlight the potential value of EO*GI for their domain, or to discover new opportunities in a collaborative way demonstrating how the benefits are driven along a value chain. This would contribute to a better understanding and help to identify market needs, allowing geoinformation and space data & services to boost job creation and speed up a mass market uptake. Reskill and upskill activities in different business sectors are required to support the adoption of EO*GI as part of the digital agenda implementation, encouraging them in the uptake of skills development to better perform business sectors' challenges and needs. It is particularly important to create the conditions for integrating EO*GI data and services into other sectors, and allow the EO*GI sector to make a step-change in mass-market uptake of these services. Actions are needed to help develop and foster EO*GI skills in the end-user sectors (agriculture, energy, transport, local government, etc.) as this is where the "pull" for EO*GI data and services eventually comes from.

In a context of increasing international competition, a broad uptake of EO*GI is critical to fully exploit the sector potential. For example, the development of smart cities, smart farming, smart logistics, construction, extractive industries, etc. can all be positively impacted through a further adoption and inclusion of EO*GI based services, enhancing their international competitiveness and thus export potential.

Operational objectives and actions

- *To identify new vocational training initiatives to penetrate other sectors and application domains with a focus on societal challenges and the needs of citizens' daily life (OO41).* Together with representatives and professionals from the public sector and these other sectors and application domains, the EO*GI skills identified and developed for other domains can become relevant and adapted to those domains. Specific training initiatives can be set up, e.g. to support particular work processes and new user services in those domains.



- *To improve the uptake of EO*GI data and technologies through the upskilling and reskilling of professionals (OO42).* The education and training initiatives should help improve the user uptake of the massive amount of data, services, and applications. Professionals from these other domains (marine, agriculture, transport and mobility, tourism & cultural heritage, etc.) must be offered training actions that will enrich and upgrade their current skills, and that will open up new opportunities in their own sector as well.

- *To foster industry forums with other business sectors where skills development and transfer are considered (including digital skills, (big) data and analytics) (OO43).* Shaping the research and innovation from EO*GI through open dialogue with industry experts from business sectors establishing a user community across different sectors. Open dialogue with the demand side will guide the development, delivery, and uptake of EO*GI services in Europe.

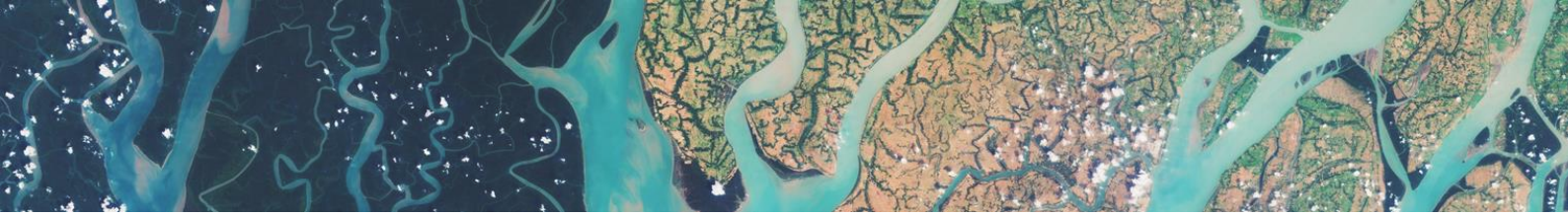
Outcome(s) – A series of skills development/ skills transfer initiatives and training activities for other business sectors and value chains sees light.

Expected impact – Will lead to new innovative initiatives and start-ups driven by reskilled, upskilled, or newly skilled people in other business sectors. More individuals and organisations from these other sectors will enter the EO*GI market. New innovative joint ideas will emerge, and a cross-sector approach will support integrated decision-making. Roadmap for business leaders in planning and realising EO*GI relevant innovation across a range of sectors (what does EO*GI mean for your business).

Timeline – It is proposed to start the identification of new end-user communities and application domains from the first year. The first skills development initiatives with/for other sectors will start from the second year.

Target public – Public and private organisations from different application domains and their professional staff, young people that want to enter the job market. Innovative people from other sectors such as ICT, insurers, urban developers, energy, etc. Those experts that want to dive into the EO*GI market.

Stakeholders – Associations representing other sectors.



4.6. Citizen focus

Strategic Objective 5: Encourage citizens' engagement, citizens' science practices and hands-on activities enhancing the inclusion/recognition of EO*GI applications' value in everyday aspects of life.

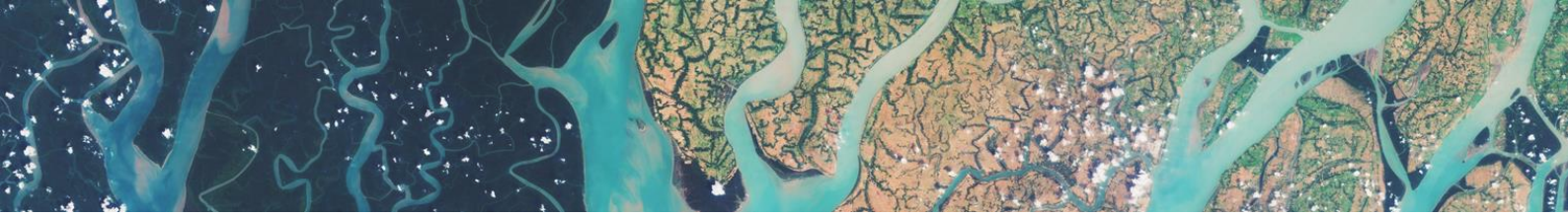
Rationale – Individual user needs and the search for new talent should be better taken into account ensuring a strong knowledge base in the sector. So, it is not only about other sectors (see SO4) but also about citizens, youths as well as experienced people that need to be involved in a dynamic way and/or use EO*GI as consumers. Individuals can have great ideas and they can learn from the sector, the wealth of information, services, and applications to support their daily activities. From that perspective, a more dynamic learning environment in the form of sandboxes or living-labs which can learn from the experience of others i.e., the gaming sector is probably the most appropriate format. Gaming can be used in a positive way as an opportunity for educational, skills development and public awareness where EO*GI could be used as a tool to collect data linked to agriculture, cultural heritage and other applications where local data enhances the results.

Operational objectives and actions

- *To promote and reach out to 'end-user' communities, and to engage citizens through various events, especially at the local level, on job opportunities, internships and apprenticeships, roadshows (OO51).* These events[32] could be organised at the European and international levels, but also at the national and sub-national levels with support from local authorities. They can attract young people that want to enter the job market, but also professionals that want to reskill/upskill. Companies and public sector organisations can explain and demonstrate what type of skills they need.

- *To provide a platform/forum for collecting and testing ideas from 'end-user'*

[32] References of events where secondary and high school are addressed: SpaceEU, Our Space our Future, EUCYS.



communities (OO52). Such a platform can become part of the one-stop portal that offers access to learning materials and training initiatives. It could be provided in the form of an innovative sandbox or living-lab through which new ideas for applying EO*GI data and technologies are shaped and tested. The platform would also serve as a user and discussion forum. This can in turn provide input to skills development. This platform will bring together a specific market representing all business-sector interested communities (downstream market actors, EO innovators and researchers, end-users).

- *To increase efforts to develop skills and stimulate innovation and entrepreneurship, to foster an attractive work environment (OO53).* Specific efforts are needed to support citizens to start new businesses, to shape new ideas that make use of EO*GI data that can lead to new products and services, helping them embrace new technological developments.

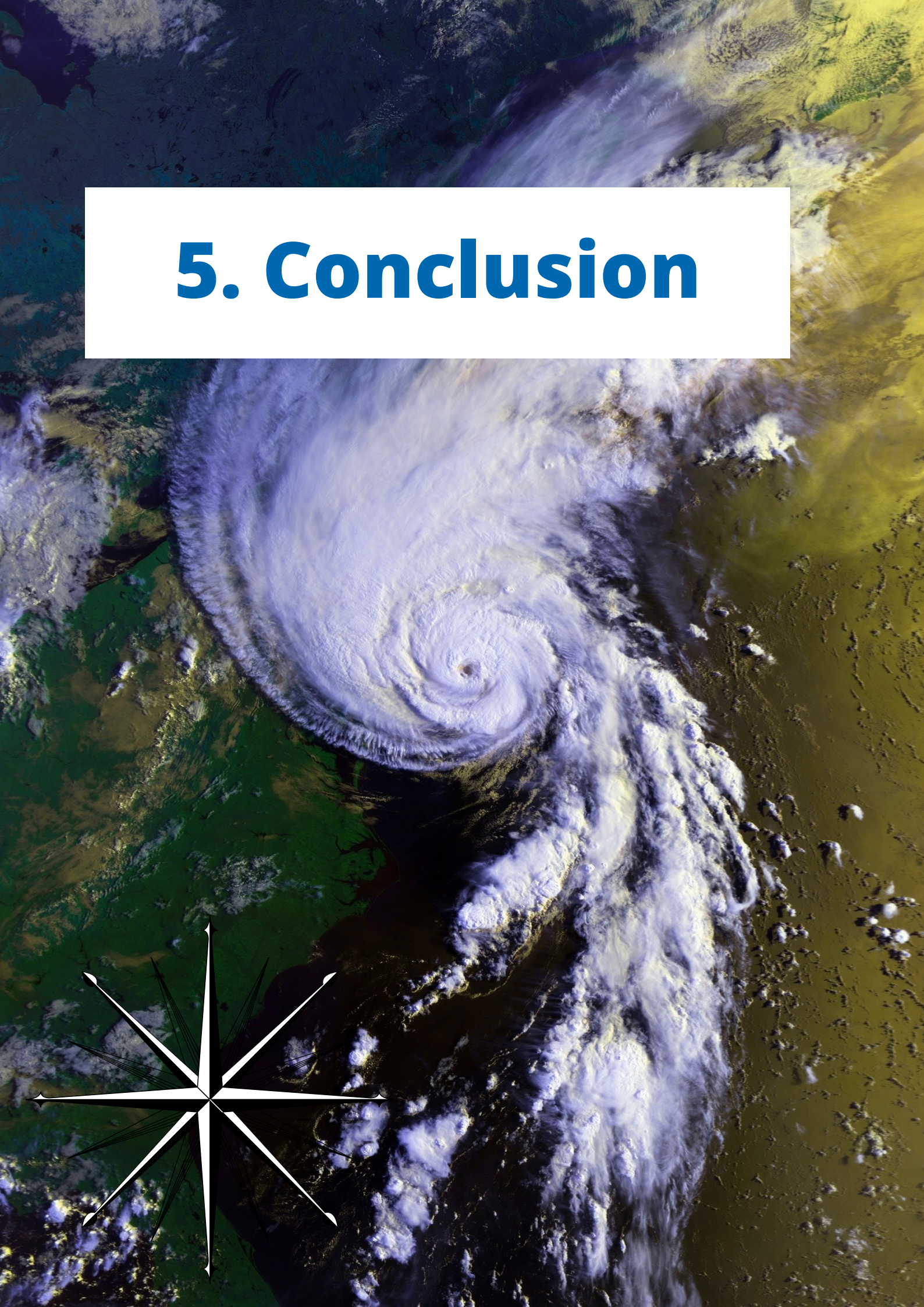
Outcome(s) – A series of events and a collaborative platform in the form of a sandbox.

Expected impact – A regional/local hubs network would allow citizens to raise awareness, develop individual skills and cooperation among all, leveraging knowledge across society and supporting the development of a pool of talent with space and geoinformation specific skills for industry.

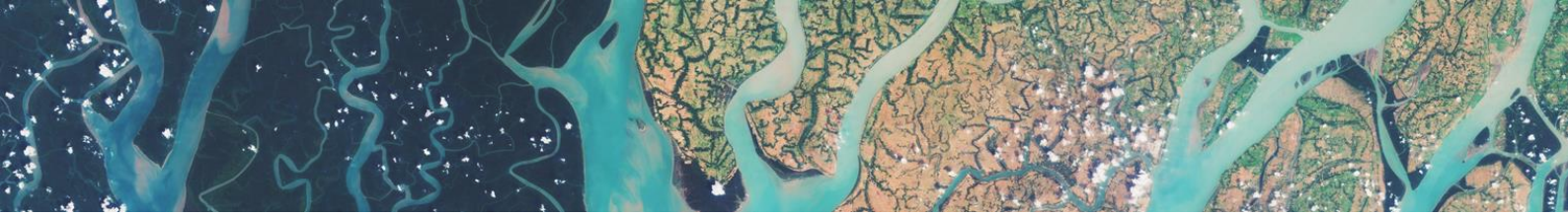
Timeline – The bigger events at the European level should be organised, e.g., every two years, starting in 2023. The setup of a sandbox can start in the third year or so, as it requires a thorough preparation.

Target public – Young people that want to experiment with new EO*GI technologies, and that eventually want to enter the EO*GI job market. Innovative people from other sectors such as ICT experts that want to dive into the EO*GI market.

Stakeholders – Schools, youth organisations, professional organisations.



5. Conclusion



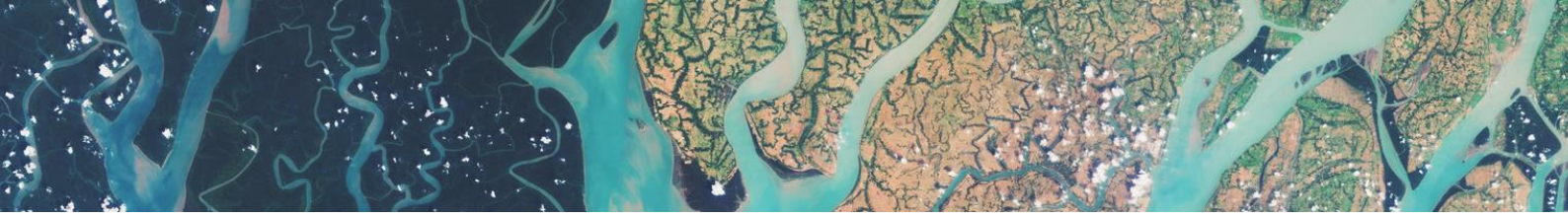
5. Conclusion

As we move towards digital transformation of society (impacting business, governments, and citizens alike), EO*GI data and services are rapidly becoming mainstream. They are used in many sectors to improve, among others, agriculture outputs, infrastructure, transportation, and more broadly, quality of life. Moreover, EO*GI should be seen as a part of the European Commission's Green Deal and the Digital Strategy, which will contribute to achieving the objectives of the twin transition, i.e. being green and digital. First, EO*GI data and service contribute to the digital transformation by offering the solutions to enable reduced cost, faster production, and diversification of business models. Second, EO*GI based services and applications can play a critical role in the achievement of the goals of the EU Green Deal.

Recent trends are stimulating the demand for EO*GI data, allowing a steady growth for EO*GI-based products & services, increasing its reach into downstream industries and associated value chains. Understanding EO*GI capabilities will be an interesting "skillset" that other sectors should be looking for, seeing EO*GI knowledge as an important asset in other domains.

The EO*GI sector is following new processes and business models driven by disrupting technologies in data collection and exploitation such as big data, cloud computing, artificial intelligence, machine learning, data fusion or predictive analytics. With this evolution in quality, quantity, and cost of data, thanks to the movement toward open data policies, emerging platforms and change in the market dynamics, EO*GI is now serving other value chains in other vertical sectors. It is providing new business opportunities for the EO*GI market, especially thanks to the fusion of EO*GI data with other sources of data covering the needs for actionable intelligent solutions which require a skilled workforce.

An educated workforce will enable the sector to attract high value, innovative and knowledge-based businesses and adapt more readily to the challenging technological environment that the EO*GI sector is experimenting with. Some degree of misalignment between the supply and demand for skills is inevitable, particularly in the short run, and in the context of dynamic transformations. This requires changes in the education and training system, as well as reskilling of the workforce to retain knowledge.



There is a gap between what the industry is looking for in their workforce and the education/training model prepared by universities and VET to meet that desire.

EO4GEO is working collaboratively with stakeholders in the sector, leveraging influence over the skills development. The Sector Skills Strategy (SSS) serves as a comprehensive document that outlines the skills demand and supply, and observes the skills gaps that exist in the EO*GI sector. The key objective of the SSS is to identify the skills priority focus areas by investigating skills mismatches, to assess which critical skills and occupations are required in the sector. The SSS informs European and national programmes that may allocate adequate resources to ensure that interventions addressing the needs, priorities and drivers of change are met to reduce the gap.

The sector is shaping this strategy with a concrete vision, mission and goals that are used as a basis for the definition of a long -term action plan (LTAP). Its vision is to foster the growth of the European EO*GI sector, ensuring the development of the workforce with the "right skills, in the right place, at the right time" and the mission is to ensure strategic cooperation among stakeholders on skills development in the EO*GI sector.

The main objective of the Sector Alliance is to help bridge the skills gap between supply and demand of education and training in the EO*GI sector by reinforcing the existing ecosystem and fostering the uptake and integration of EO*GI data and services in end-user applications. This document is the starting point for the LTAP.

Following GOALS have been identified:

- Establish a forum of discussion led by the Sector Skills Alliance, contributing to understand and identify market needs and allowing EO services to boost job creation and speed up a mass market uptake.
- Adopt a partnership approach based on anchor tenancy, helping to develop skills and stimulate innovation and entrepreneurship.
- Facilitate a more integrated approach on skills development across value chains and cross-sectoral building on other policies (EU Green Deal, Digital Agenda).
- Increase involvement of regional and local authorities in skills development to boost job creation across the EU.
- Intensify investments in upskilling, capacity building initiatives and education

programmes at all levels, ensuring a strong knowledge base in the EO*GI sector.

- Continue to review and monitor the skills needed by the sector and help develop the strategy to address these needs, working with those responsible for the development of training to ensure that materials on training are easily accessible.
- Develop and implement wider outreach programmes to improve awareness and engagement with other EU programmes.
- Encourage and support the use of EO*GI as an inspiring context for learning across all age groups.

By analysing the challenges and drivers impacting the EO*GI sector, the following Strategic Objectives (SO) have been pencilled:

- (SO1) Set up skills intelligence competences required and provide feedback on the evolving sector needs.
- (SO2) Reinforce cooperation among stakeholders from the academic, private, and public sectors on skills development and requirements.
- (SO3) Develop a system to help and guide candidate learners in their skilling, upskilling and reskilling efforts.
- (SO4) Facilitate and stimulate a more integrated approach to skills development across different value chains.
- (SO5) Encourage citizens' engagement, citizens' science practices and hands-on activities enhancing the inclusion/ recognition of EO*GI applications' value in everyday aspects of life.

There is strong potential for earth observation and geoinformation data and services to support EU policymaking by offering improved means for policy implementation and validation. Public sector commitment, as an active user (anchor tenancy approach[33]), is needed to continue facilitating access to the data, support research and innovation as well as access to finance, while stimulating demand through Copernicus services procurement contracts. It is recommended that an annual exchange on skills development and workforce is organised to contribute to the understanding and identification of sectoral and other business sector needs, allowing EO*GI services to boost job creation and speed up a mass market uptake.

The Sector Skills Strategy advocates the European Commission work alongside the main stakeholders from industry, academia, and research to have a clear program on skills development across other market sectors to maximise the results of its

[33] Anchor tenancy approach which has underpinned the business: https://earsc.org/wp-content/uploads/2020/09/EARSC-views-on-a-European-Space-Strategy.pdf

uptake efforts and highlight the importance for Member States to increase efforts to develop skills to foster an attractive work environment for the EO*GI sector.

The EO*GI Sector Skills Alliance looks forward to engaging with stakeholders in the public and private domain to keep fostering the skills development and workforce of the European geoinformation sector, therefore engaging with the Pact for Skills as a contribution to the recovery to other vertical sectors.

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EO4GEO – Towards an innovative strategy for skills development and capacity building in the space geo-information sector supporting Copernicus User Uptake

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