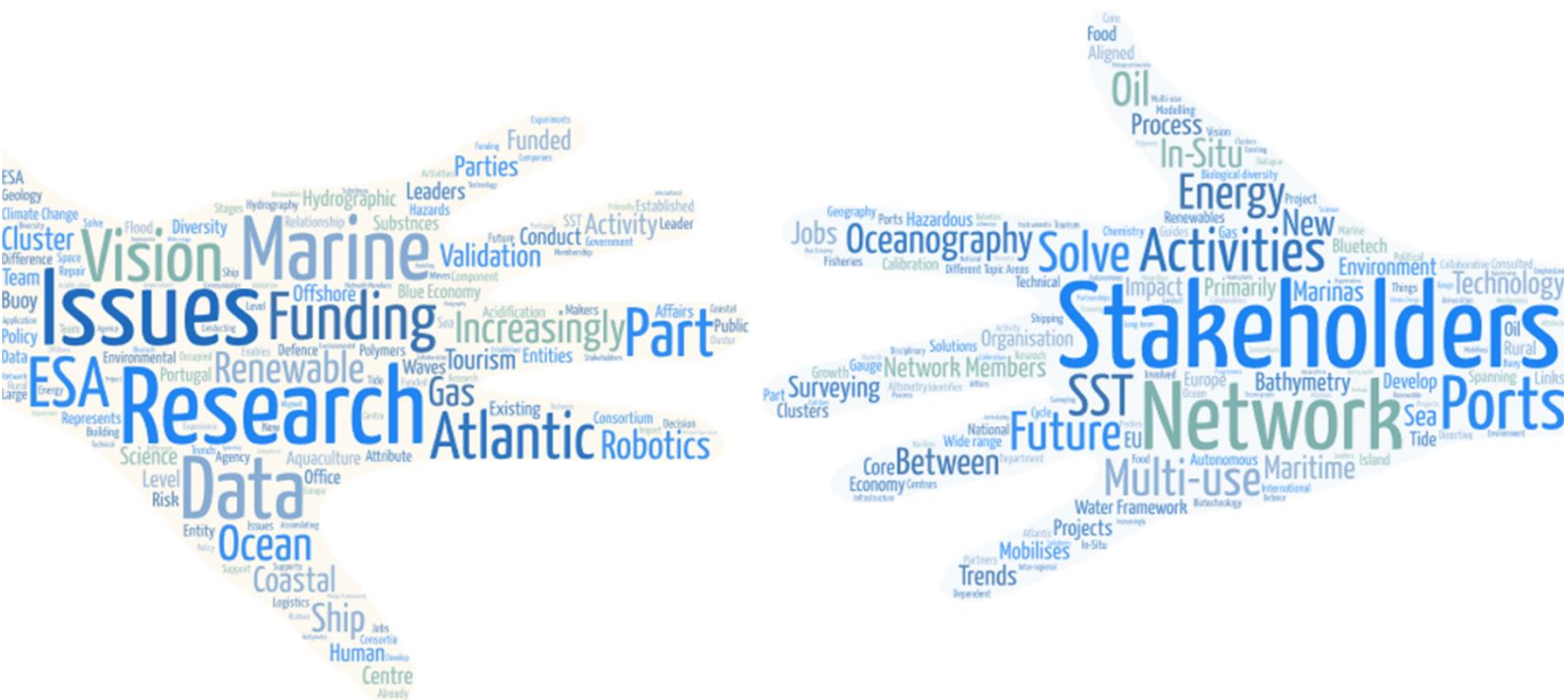


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INNOVATION CLUSTERS ROADMAP

Atlantic Regional Initiative

Blue Economy: Innovation Clusters, Atlantic Natural Resources Management and Maritime Spatial Planning

Prepared by:	UCC, GMV With inputs from NOC, WOC and SpaceSur
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EXECUTIVE SUMMARY

"We need to understand the sea so everybody can use it"

(ESA Blue Economy Stakeholder. 2021)

Space Agencies such as the European Space Agency feature a long-term perspective that could help address global grand challenges and achieve sustainable development. However, this perspective is under-utilised, and does not quite synergise with the fast-paced short-term demands of the commercial maritime innovation sectors. The challenge for the space sector in both governance and space agency competencies, is how to best support and enhance knowledge transfer, innovation, and commercial opportunities in fast-paced, and rapidly expanding arenas. The Atlantic is one such rapidly changing arena. Blue Economies along both Eastern and Western seabords feature a long and rich history of maritime tradition and innovation, and rapidly expanding and diversifying commercial sectors. However, a path for ESA to support this region with Space-enabled technologies/data is unclear, which hinders their ability to quickly respond to the needs of the maritime sector, and support the nurturing of Blue Growth.

Technological Innovation Clusters are vehicles to rapidly identify and address potential bottlenecks in the innovation ecosystem, and realise EO-maritime solutions. They can form a bridge, which links long-term vision and strategy, with short-term commerce and opportunity. The ESA-funded *Blue Economy: Innovation Clusters, Atlantic Natural Resources Management and Maritime Spatial Planning* project built on its suite of three demonstration activities, to chart a way forward for knowledge transfer from EO into sustainable Blue Economies across the Atlantic. The demonstrations are examples of the far greater potential that EO-based services provide. With this in mind, the consortium worked with a wide range of governance, private industry, education, and Atlantic observation stakeholders to develop the suite of recommendations presented here to the ESA. These would enable the ESA to strategically target future animation efforts, marrying short term opportunities with long-term vision.

Structured discussions and stakeholder data analysis have identified exciting innovation avenues, cutting-edge knowledge transfer opportunities, and a series of restraints on innovation and commercial development, which targeted investment, and coordination with Innovation Clusters could overcome. This roadmap presents the culmination of the first iteration of this research, providing unrefined guidance and recommendations to ESA on how it can strategically harness the potential of Innovation Clusters to maximise EO-derived data opportunities and uptake by the Atlantic maritime sector.

While unrefined, the roadmap does provide an overview of Blue Economies, Innovation Clusters and the Earth Observation opportunity. It presents a brief outline of the approach used in the Blue Economy project with regard to the Innovation Clusters road-mapping, and aspects which could be integrated as good practice in other initiatives going forward. It then explores the range of recommendations concerning Innovation Clusters, produced by the stakeholder engagement and quality control analyses, presenting them under four themes:

- Recognise regional constraints and current realities ESA must operate within ;
- Establish a clear role for Innovation Clusters in the ESA element of the Atlantic innovation ecosystem;
- Establish connections between the ESA and Innovation Clusters within the Atlantic Regional Initiative;
- Build the Atlantic network of networks with Innovation Clusters as hubs;
- Use Innovation Clusters to connect to Atlantic stakeholders;
- Fund activities that secure connected Innovation Clusters;
- Address all three elements of the communications triangle - Outreach, engage, educate;
- Ensure funded clusters connect to and collaborate with key external actors (WOC and GEO Blue Planet).

In addition, the road-mapping process has provided insights into three deep-dive thematics, which are also provided. These deep-dives are:

- (i) Deepening ESA-OSPAR collaboration and synergies on data use;
- (ii) Deepening collaboration and synergies between ESA EO activities and Argentinian stakeholders;
- (iii) Shaping ESA's Atlantic Regional Initiative

In many cases, the recommendations contained in the deep-dive thematics align with, synergise with, or complement those in the core Innovation Clusters roadmap.

Recommendations are presented to the ESA in the form of Action Areas. Detailed information on how ESA could implement these higher-level action Areas are also contained in this document as the pool of baseline recommendations. These are presented along with the context information which is essential to truly understand them.

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ACRONYMS

ARI	Atlantic Regional Initiative
BIC	Business Incubation Centres
CNES	Le Centre national d'études spatiales (Fr)
CONAE	Comisión Nacional de Actividades Espaciales, the Argentinian national space agency
DMEC	Dutch Marine Energy Centre
EASRC	European Association of Remote Sensing Companies
ESA	European Space Agency
EU	European Union
EU-MSFD	European Union's Marine Strategy Framework Directive
EU-WFD	European Union's Water Framework Directive
EU-MSPD	European Union's Maritime Spatial Planning Directive
IC	Innovation Custers
ICES	International Council for the Exploration of the Sea
INIDEP	(Ar) Instituto Nacional de Investigación y Desarrollo Pesquero
MaREI	Marine and Renewable Energy Ireland: Centre for Marine, Energy and Climate.
MAST	Marine Alliance for Science and Technology
NASA	(U.S.) National Atmospheric and Space Administration
OECD	The Organisation for Economic Co-operation and Development, based in Europe
ORE	Offshore Renewable Energy (also termed Ocean Renewable Energy)
ROMA	(Ar) la Red de Observación Marina de largo plazo (ROMA), part of the Pampa-Azul initiative in Argentina.
SABIA-MAR	Satélites Argentino-Brasileño para Información Ambiental del Mar, originally called SAC-E by CONAE (Ar)
SAOCOM	Satélite Argentino de Observación CO n Microondas, operated by CONAE.
SIDS	Small Island Developing States
SME	Small and Medium Enterprise
UCC	University College Cork
USA	United States of America
WOC	World Ocean Council
WOCE	World Ocean Council Europe

GENERAL DEFINITIONS

Space Sector	A wide range of activities and enterprises related to Earth's orbit and beyond. These encompass activities including space exploration, satellite deployment, research, Earth Observation and commercial.
Earth Observation	This refers to the use of satellite and other sensor technologies to collect data and information about Earth's surface, atmosphere, oceans, and other features from space.
Maritime Sector	A wide range of activities and enterprises related to the use of the world's oceans and seas. These include activities such as shipbuilding, Offshore Renewable Energy, fishing, aquaculture, marine biotechnology amongst many others.
Innovation Cluster(s)	An Innovation Cluster (IC) refers to a Maritime Technology Innovation Cluster. Often termed a "Blue Tech Cluster," an IC is a geographical concentration of interconnected companies, organisations, and institutions that focus on technology-related industries and innovation. There are a wide range of IC structures evident globally. However, only ICs which feature a Triple Helix structure (founded on a partnership of academia, governance and industry), are considered as ICs in this roadmap.
Innovation Network(s)	An Innovation Network, also known as an Innovation Ecosystem or Innovation Community, is a group of organisations, individuals, and resources that work together to foster innovation, creativity, and the development of new ideas, products, or services. In many cases, these networks create an environment where innovation can thrive, and they play a crucial role in driving economic growth and solving complex challenges in various fields.
Atlantic Regional Initiative	The Atlantic Regional Initiative is a targeted effort by the European Space Agency, to actively connect maritime and coastal stakeholders to Earth Observation data. It is operated under the EO Science For Society programme.
European Space Agency	The European Space Agency (ESA) is an intergovernmental organization dedicated to the exploration of space. It is focused on advancing space science, technology, and applications for the benefit of its member states and the global community. Through the ESA, its member states and their academic, industrial and commercial actors work together on various space-related projects, including satellite launches, space exploration missions, Earth observation, and scientific research. Note that the ESA is an independent organization that is separate from the European Union (EU), although there is collaboration between the two entities.
Offshore Renewable Energy	Offshore renewable energy is the name given to non-fossil fuel-derived electricity which is generated using ocean-based resources. In-line with the European Commissions definition this includes electricity generated from wind, wave, and tidal energy sources. It may be nearshore-based, or farther offshore, but will have a marine element to its location. It may be referred to as Ocean Renewable Energy as well in this document as there are various terms used by the consulted stakeholders.

SCOPE OF THIS RESEARCH

The Blue Economy: Innovation Clusters, Atlantic Natural Resources Management and Maritime Spatial Planning project aims to complement the ESA Regional Atlantic initiative by providing insights and solutions in the Blue Economy thematic. ESA's actions to coordinate, establish, and assess efforts demonstrating how EO can support meeting the aspirations and requirements of EU marine policy, are timely. Atlantic-facing EU and ESA states are implementing a suite of new EU-based marine planning and management regulations (such as the Maritime Spatial Planning Directive -MSPD-, the Marine Strategy Framework Directive –MSFD-, Blue Economy measures, and the Integrated Maritime Policy). This EU-level policy landscape also extends into national policy.

In this context, consolidating EO and IT experience to design and build well-framed services that support information delivery to address the needs of new marine legal frameworks is an important step. This information delivery must be guided by three principals:

- The developed system simplifies the acquisition of information by the user, requiring a fit-for-purpose design focused on the user;
- The developed system does not require the end user to be an expert in EO, though can be reassured that the information they are acting on is transparent, quality assured, and actionable; and
- In the short term, developed systems fit within existing legal frameworks and information needs, whilst promoting and opening avenues to the development of new legal frameworks, capable of harnessing more novel advances.

Together with these principals, the consortium that is developing this project is aware of the challenges and combines a range of complementary skills within the marine science, EO data analytics, processing paradigms, legal frameworks, and community development. The project team also possesses advanced knowledge in relation to the blue economy, innovations clusters, the Maritime Spatial Planning Directive (MSPD) and associated governance arrangements.

This background, together with a very relevant list of stakeholders and users, allowed the definition of specific use cases that covered detailed, well-identified and operational needs of key project stakeholders.

In addition to the “engineering perspective” provided by these key stakeholders there has also been a wide stakeholder engagement during the project duration, looking to gather their perspectives on keys topics that can foster the development of the Blue Economy sector.

These perspectives are now being used on the preparation of this technological roadmap report and to found a seed Community of Practice of maritime-EO technology innovators for the Atlantic, focused on developing EO solutions to address Marine Strategy Framework, and Marine Spatial Planning ambitions.

The final goal was to identify key priorities and delineate a plan of actions to be materialised in the form this report, to foster the full exploitation of EO data in the Blue Economy value chain at international level.

STRUCTURE OF THE DOCUMENT

This report aims to provide a way forward to guide ESA in its interactions with Innovation Clusters, and its use of them to animate Blue Economies with satellite data and technology applications.

In Section 1 of this document, we present the context for this roadmap. An overview of Blue Economies is given, outlining the potential role of Earth Observation technologies to support and energise Blue Economy development. Following this, a definition of Innovation Clusters and how it is perceived for the purposes of this document is supplied. An overview of the European Space Agency, and its remit for animating innovation in non-space sectors is then provided.

Section 2 outlines the approach taken to collate and refine the roadmap of recommendations. It describes the stakeholder pool, data-gathering methodologies, and the analysis implemented to extract recommendations.

Section 3 contains the main Innovation Clusters Roadmap, collating the 84 systemically-focused recommendations into key Action Areas that would maximise Innovation Cluster's potential to enhance EO uptake by Atlantic Blue Economies. Each summary frames a list of targeted action recommendations where ESA may opt to take action.

Section 4 contains summaries of the three deep-dives into related Atlantic topics – guidance for the ESA Atlantic Regional Initiative, guidance to enhance engagement with OSPAR, and guidance to enhance engagement with Argentina. Again, the Action Area approach is used, with more detailed recommendations underpinning each Action Area.

Finally, policy briefs for ESA staff and member state representatives are then provided in the Annexes to this document.

1. ATLANTIC BLUE ECONOMIES, INNOVATION CLUSTERS AND EARTH OBSERVATION POTENTIAL

1.1. BLUE ECONOMIES

“Blue economy” is an economic term linked to exploitation and conservation of the maritime environment and is sometimes used as a synonym for “sustainable ocean-based economy”. There is, however, little consensus on the exact definition. The field of application depends on organization that uses it (UN-RIC, 2022). For example, according to the World Bank, the blue economy is the “sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem.” Meanwhile, the European Commission defines it as “All economic activities related to oceans, seas and coasts. It covers a wide range of interlinked established and emerging sectors.” The Commonwealth of Nations considers it “an emerging concept which encourages better stewardship of our ocean or ‘blue’ resources.”, while Conservation International adds that “blue economy also includes economic benefits that may not be marketed, such as carbon storage, coastal protection, cultural values and biodiversity.” The Center for the Blue Economy says “it is now a widely used term around the world with three related but distinct meanings- the overall contribution of the oceans to economies, the need to address the environmental and ecological sustainability of the oceans, and the ocean economy as a growth opportunity for both developed and developing countries.” With such a wide range of interpretations, it is important to clarify what “Blue Economy means, and represents within the context of this roadmap.

Here, the European Commissions definition is used as a basis. A region’s “**Blue Economy**” pertains to all economic activities related to oceans, seas and coasts within a defined geographical region. It covers a wide range of interlinked established and emerging sectors. Basically, it is understood that a sustainable Blue Economy aims to ensure that economic activities in the ocean are conducted in a way that respects the environment (WOCE, 2023). Here, a region’s Blue Economy can be described by its resources (both direct, and indirect), technologies (both existing and future), its societal knowledge base and its technological expertise. Every Blue Economy is context dependent. For example it depends on aspects such as its available resources, its economic and technology base, and/or its community’s capacity to uptake new technologies and practices.

In terms of what they present in terms of opportunities, the value of Blue Economies can be substantial. It varies from one region or country to another based on a combination of factors such as the size and health of their marine ecosystems, the types of industries and activities related to the oceans, and the level of sustainable management in place. For example, the European Commission reported that for 2020, the established sectors of the EU Blue Economy (marine living resources, non-living marine resources, marine renewable energy, port activities, shipbuilding and repair, maritime transport, and coastal tourism) generated a gross value added (GVA) of €129 billion in 2020, with €43.6 billion of profit and a total turnover at €523 billion (European Commission, 2023). The OECD conservatively estimated the global Blue Economy to be valued at \$1.5 trillion by 2010, projecting it to grow to \$3 trillion by 2030 (OECD, 2016). This \$3 trillion figure is one that the U.N. Conference on Trade and Development estimated the global Blue Economy had already hit by 2015 (UNCTAD, 2015). For the Atlantic region, estimates for 2017 indicate it generated €73.4 billion of Gross Value Added (GVA) and employed 1.29 million people in 2017 (European Commission, 2020). At the national scale figures are more difficult to source. However estimates from Ireland (Norton et al., 2022) indicate the country’s Blue Economy made a direct economic contribution, as measured by GVA, of €2.1 billion, and an indirect contribution of is €3.8bn to the nation’s economy (representing approximately 1.6% of national output). This was taking into account a total 2021 turnover of €4.98 billion.

*“The ocean economy is huge
- and growing.”*

The Ocean Foundation, and TMA BlueTech, 2021

It is clear that despite the variability in estimates, the value of these economies to coastal societies along the Atlantic seaboard is impressive. However, interestingly, it was generally agreed by consulted stakeholders that space to maritime innovation is currently underperforming, and not contributing as much as it could. This re-affirms the sentiment recorded by Scarrott et al. (2017) who noted the perception that EO services in the maritime domain, with the exception of some niche areas, remain the preserve of research scientists and state authorities, with limited uptake by private industries. The core goal of this roadmap, is to equip the ESA with a set of recommendations that can help it tackle this under-utilisation by Blue Economies across the Atlantic region.

1.2. INNOVATION CLUSTERS

Space agencies such as the ESA can benefit from their involvement in Innovation Clusters by gaining valuable insights, fostering collaboration, and aligning their satellite data and services with the specific needs of the maritime industry. This collaboration can lead to the development of innovative solutions, economic growth, and the expansion of space agency services into new markets. However, there is considerable confusion surrounding the terms Innovation Cluster, Innovation Network and Innovation Ecosystem which must be addressed for this roadmap to be actionable.

Here, an **Innovation Cluster (IC)** refers to a Maritime Technology Innovation Cluster. Often termed a "Blue Tech Cluster," an IC is a geographical concentration of interconnected companies, organisations, and institutions that focus on technology-related industries and innovation. There are a wide range of IC structures evident globally (Ferreira et al., 2016). However, only ICs which feature a Triple Helix structure (Figure 1), are considered as ICs in this roadmap. A typical triple helix IC is a collaborative framework involving three key entities: academia, industry, and government. Establishing a triple helix IC is typically a policy-led (top down) approach to foster regional economic development through stakeholder engagement. It brings together research institutions, businesses, and government agencies, with each "helix" playing a distinct role. Universities and research organisations contribute knowledge and research expertise. Industry partners provide market-driven innovation and resources. Meanwhile, government agencies offer regulatory support and funding. These ICs are (i) geographically confined (i.e. they are regionally-focused) and (ii) sector-focused (i.e. they prioritise their focus on a number of marine sectors seen to be key to their region). They are characterised by a collaborative ethos, emphasizing the importance of cooperation and mutual support among member organisations.

Innovation Clusters exist within Innovation Networks. An **Innovation Network**, also known as an Innovation Ecosystem or Innovation Community, is a group of organisations, individuals, and resources that work together to foster innovation, creativity, and the development of new ideas, products, or services. In many

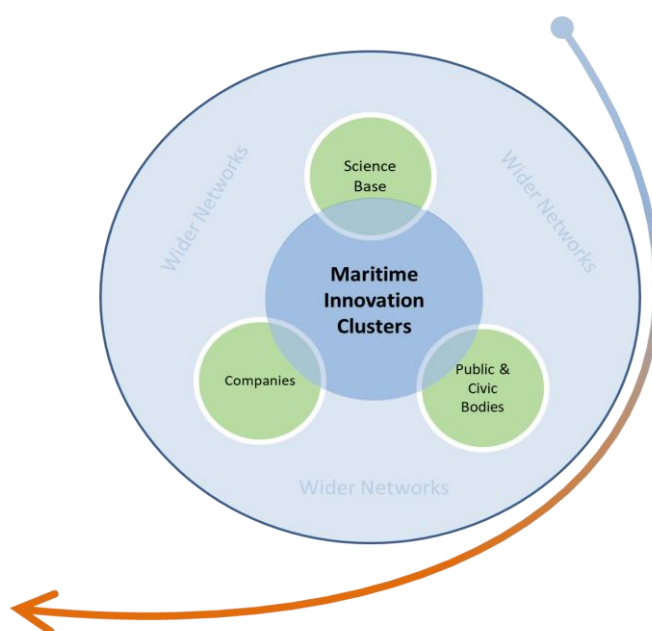


Figure 1: The triple helix structure of Innovation Clusters, and how they are embedded in wider networks of stakeholders. The arrow indicates how the commercialization pathway of an innovation can be accelerated through engagement with an Innovation Cluster.

cases, these networks create an environment where innovation can thrive, and they play a crucial role in driving economic growth and solving complex challenges in various fields. In Europe, Innovation Networks have become a fundamental part of the modern economy. They play a key role in advancing technology, solving complex problems, and driving economic progress. They create an environment where the collective efforts of diverse stakeholders can lead to groundbreaking innovations and solutions. The Atlantic Regional Initiative envisions the creation of a Network of Networks. From the socio-economic perspective, this is effectively an Innovation Network, comprised of Innovation Clusters, collaborative interest groups such as the World Ocean Council, interconnected Clusters and regional actors such as the All-Atlantic Robotics Consortium, and key state and international agencies and players such as OSPAR, the European Union, Enterprise Boards and research institutes.

1.3. THE POTENTIAL OF EARTH OBSERVATION

Earth observation is a powerful tool for monitoring, managing, and sustaining the Blue Economy. It can provide essential data for informed decision-making, resource conservation, and environmental protection, making it a potentially crucial information provider to Blue Economy activities. The potential uses are varied and diverse, ranging from monitoring marine resources for management, weather monitoring for operations and infrastructure design, information to support maritime navigation and safety, environment and pollution monitoring, and critically data (and the contained information) for research and decision-support.

Here “**Earth Observation**” (EO) refers to satellite Earth Observation, i.e. the use of satellites and other space-based platforms to collect measurements of the earth’s atmosphere, land, oceans and surface features, from which we can extract information and deliver it to users.

Within the ESA-funded Blue Economy project, three demonstrations of the technologies potential have been implemented. These have been in the areas of:

1. **Integration of EO data into the Coastal Monitoring Programmes of England** – working with the Channel Coastal Observatory (CCO), this use case developed and demonstrated EO services that could be integrated into the strategic coastal monitoring programmes of England, to better target site revisits for monitoring.
2. **Waves, Tides and Currents from EO for Ocean Renewable Energy Production** – working with the European Marine Energy Centre (EMEC), this case study explored services that support the development of the ocean renewable energy sector, focusing on resource characterisation and risk management, but also considering the wider potential of EO to help drive down LCOE (Levelised Cost Of Energy i.e. full lifecycle cost).
3. **Exploitation of EO to support marine pollution dynamics surveillance** – This use case developed services focused on the detection and monitoring of marine pollution on the form of plastics (marine litter) and / or marine spills. The services used EO-data to verify and appraise models focused on marine litter dynamics surveillance, in support of Maritime Spatial Planning Directive (MSPD) implementation. Analysis of merged data streams can provide evidence about the impact of MSPD, and whether or not the evidence suggests negative trends are being improved. EO complemented such work here by providing a means to analyse the outcomes of these models in terms of impact (e.g. concerning tourism, or the environment environment) and survey looking for new contamination spots that can feed the models.

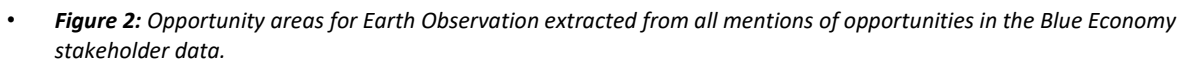
Earth Observation (EO) data products offer a versatile solution for various policy, action, and activity areas that require an ecosystem approach. The adaptability of EO data makes it applicable to diverse maritime sectors. In particular, stakeholders noted it is suited for Maritime Spatial Planning (MSP) applications, due

to the sensor's of large transboundary areas¹. It is also recognisably important to the Ocean Renewable Energy Sector². It is clear from the data that the maritime sector is actively exploring the potential of EO data to benefit them. This is reflected by a growing appetite for EO-maritime applications and innovative solutions, however small companies need to be given the space to trial out, test, and build trust in these data solutions. The volume and scale of data available is a considerable challenge for stakeholders, they simply do not know where to start. This is a key area where ICs can again be harnessed, using their networks and capabilities to connect maritime stakeholders with space opportunities and provide the space training and advisory they need. In terms of this consultation, the following have been clearly identified as key opportunity areas (Figure 2) for EO involvement:

- Support resource prospecting
- Surveillance & monitoring
- Transboundary monitoring and ecosystem-based approaches
- EO and Digital synergies
- Coasts versus Oceans
- Sediments, erosion, turbidity, habitats
- ORE expansion
- Information for planning
- Climate Change adaptation

¹ While aspects of the WOC report on Earth Observation for MSP have been integrated into the stakeholder data underpinning this roadmap, the authors strongly encourage readers interested in MSP to consult the WOC report (World Ocean Council Europe, 2023) itself.

² See Sams, C., Bell P (2024) Roadmap for Successful Uptake of EO Data and Applications in Ocean Energy Projects. Version 1. National Oceanography Centre, UK. Technical report delivered under the ESA Blue Economy project, ESA ESRIN Contract number contract 4000131726/20/I-DT.



2. DEVELOPING THE STAKEHOLDER-LED ROADMAP

This section outlines the process for developing the suite of recommendations, and key considerations that should be kept in mind when using the recommendations.

2.1. APPROACH TO DERIVE RECOMMENDATIONS

The analyses and recommendations which formed the basis of the actions suggested in this Roadmap are based on qualitative data – interviews of both individuals and groups, using a semi-structured interview approach. The Blue Economy research team do not aim to make generalisations from our sample to a larger population. However, these interview-data outputs are ready for appraisal against literature studies to supplement their findings and to ensure that the findings are more than anecdotal.

The consultees (see Section 2.2) were a heterogeneous group, consisting of top levels in the consulted enterprises, BICs, cluster and network managers, relevant actors from leading European international coordination organisations with an interest in the Atlantic region, and researchers in space/maritime sector. SMEs are represented in the material as well as leading European maritime Innovation Clusters, external stakeholders from overseas (U.S.A.) and the Pacific Ocean basin. The selection of consultees was based on their relevance for the study and they are identified on the basis of knowledge and network. A combination of the Blue Economy consortium's network and knowledge was used, along with the consultees' knowledge and network (by asking cluster and network managers, BICs contact points and some of the enterprise consultees, to recommend 1-2 relevant enterprises for interview). This sampling method has some similarities with respondent driven sampling. One of the disadvantages of this form of approach to sampling is the risk of strong bias and lack of control of the sample. This should be kept in mind when interpreting the results, noting that the consultation coordinators controlled the sample by evaluating the suggested consultees in relation to the study's needs based on available knowledge.

Bias is a challenge the consultation team encountered (Section 2.3). Strong participation from some groups and absence from others can create bias in interview data in that the absent do not provide data. For version 2.0 of this roadmap, supplementary data from documents that specifically gave information on gap areas, or recommendations gathered from larger stakeholder events to appraise possible bias, and verify the consultee data and findings were more than anecdotal. The consulted stakeholders were also given the opportunity to quality check the findings while a deep dive into the Ocean Renewable Energy sector was ongoing for addition as a separate section.

The interviews were conducted using a semi-structured interview approach with five themes of knowledge being sought;

- Innovation, Innovation Clusters and Innovation Networks;
- ESA programmes;
- Perception of Earth Observation;
- Opportunities for EO synergies;
- Barriers/challenges to EO uptake in their area.

The data were collected through online and in-person structured meetings, broadly based on discursive interviews. To maximise harmonisation across different national pools of interviewees, an conversation guide was devised. Each of the aforementioned themes could be broached through the conversation subjects, which to some extent was adapted to the informant and discussion situation. The use of the semi structured approach ensured that critical information points were broached during the conversation, whilst maximising the opportunities for following up relevant and useful topics that arose, omitting non-critical questions which were not of relevance for the informant.

Consultee confidentiality was a core measure implemented, deemed crucial to maximise the participation of consultees. Whilst they all agreed to be acknowledged in the reports generated from their pool of interview data, neither the data, recommendations made in each of the reports contributing to the Roadmap, nor actions derived are linked to the consultees. The collected data provides, amongst others, a picture of how enterprises and perceive satellite-derived Earth Observation data, the space sector, or the maritime sector, and support mechanisms which facilitate inter-sectoral innovation and EO data uptake.

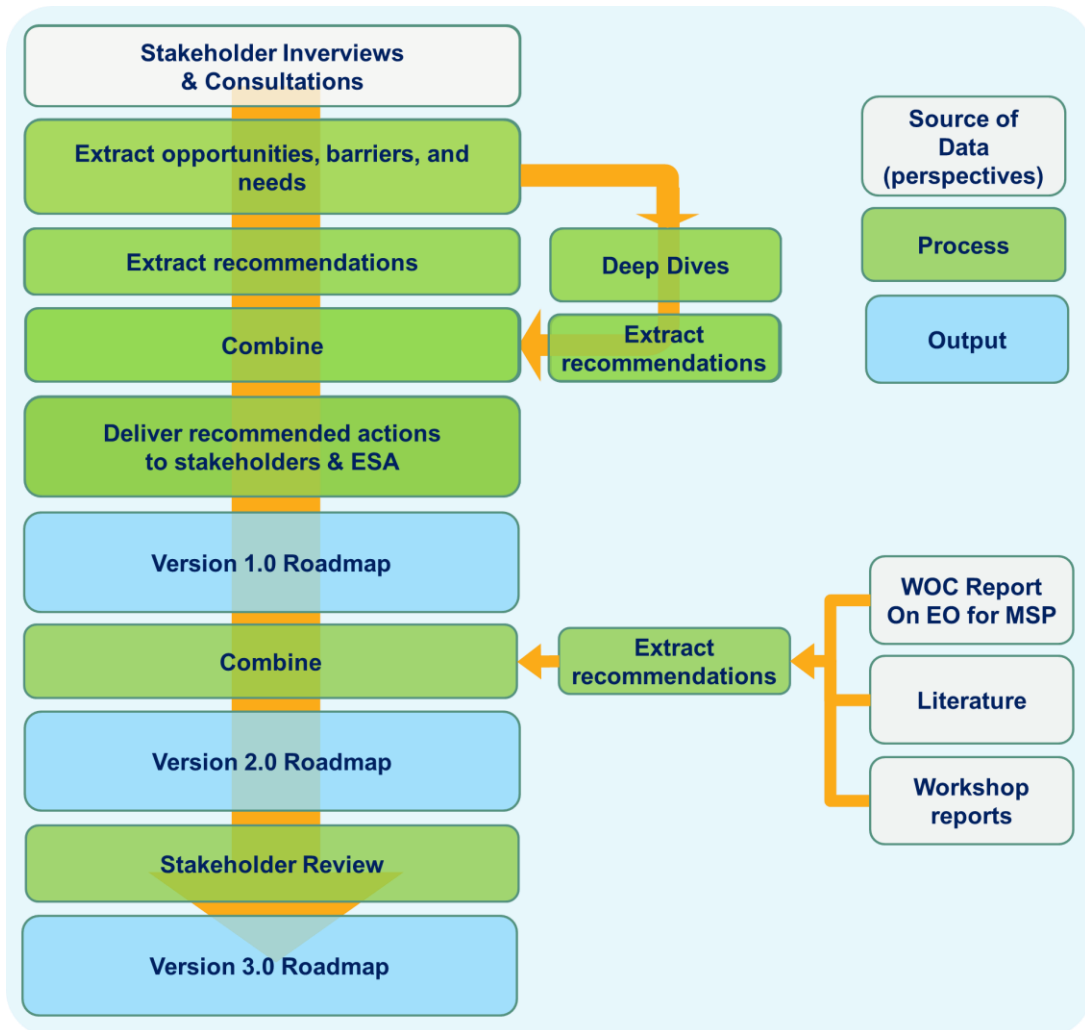


Figure 3: Approach to derive recommendations from stakeholder data, for this Version 3.0 Roadmap.

Overall, 22 stakeholder groups were interviewed, resulting in over 600 discrete data points. The first round of the analysis expanded these data points into over 1100 data notes to be interpreted within the context of 5 thematically-focused deep dives focused on:

- the project activities
- the Atlantic Regional Initiative
- the role of Innovation Clusters in enhancing EO uptake in the Atlantic region
- enhancing engagement with OSPAR
- enhancing engagement with Argentinian stakeholders.

The process of deriving the Version 3.0 recommendations presented in this document is shown Figure 3. Action recommendations were either given by stakeholders themselves, or derived by the analysts in response to needs noted by the stakeholders. Not every recommendation aligned with the 5 core deep dive categories, and were classified as miscellaneous, forming a sixth pool of recommendations. 101 recommendations were extracted which related to the Blue Economy project activities, and were dealt with internally within the project. The remaining 255 recommendations provided guidance on how to better connect EO to the maritime realm in the Atlantic region and were categorized as the Version 1.0 recommendations.

These Version 1.0 recommendations were diverse in both scope and context. To aid their uptake and application going forward, recommendations within the Atlantic Regional Initiative and enhancing engagement with OSPAR thematics were grouped with others in the same deep dive thematic. A higher-level action statement was then derived from each of the groups, which structured and contextualised their presentation and interpretation. Note that the 101 project-focused, and the miscellaneous recommendations were excluded from the grouping analysis and are not included in this document.

The Version 2.0 recommendations were derived by supplementing Version 1.0 with perspectives drawn from sectorally-targeted literature (e.g. the industry perspectives in WOCE 2023), additional wider consultations (e.g. an ESA AGORA session at the 2022 Living Planet Symposium, a, EO-focused series of discussion sessions at the TMA-BlueTech-organised Blue Tech Week) and engagement event literature (e.g. the Geo Blue Planet 2022 Symposium report). This either (i) added to the recommendations pool, or (ii) was used to amend existing recommendations as a limited element of bias-correction. Recommendations were then assigned to either the Innovation Cluster (IC) grouping, the ARI grouping or one of the three deep-dive categories. If it was an IC or ARI recommendation, it was assessed against all the other recommendations in its group and the decision made to either merge it with an existing recommendation, or add it to the pool. The recommendation code was then updated with either a new code number, or by appending the original recommendation code with an “a” for those which were merged. In the event a new recommendation was created to address a bias or omission, it was given a new code number.

Finally, the Version 2.0 recommendations and their briefs were open for a quality review period to previously-consulted stakeholders, and 2 external stakeholders whose literature had been incorporated into the data (World Ocean Council, and Geo Blue Planet). Here, they were given the opportunity to provide a comment on each recommendation. These were then amended/adapted to match this re-visited perspective (appending the code with a “b”, or a new action with a new code was derived to account for it). This resulted in amendments being made to 21 recommendations in the Innovation Clusters Roadmap (Section 3.0), and the addition of 7 new actions. In the recommendations focused on the Atlantic Regional Initiative specifically (Section 4.1), this resulted in the addition of 2 actions and amendments being made to 7 actions contained in the section. No amendments were requested for either the OSPAR or Argentinian deep dives.

2.2. STAKEHOLDER COMMUNITY CHARACTERISATION



Figure 4: Wordcloud generated from stakeholder characterisation notes in the interview data.

The interviewees underpinning the Version 1.0 recommendations represent a wide range of stakeholder perspectives and interests on the Atlantic region, and space-maritime innovation (Figure 4). Overall, 22 stakeholder groups were interviewed, with some key geographical and thematic characterisations shown in figures 5 to 7.. These must be taken into account when considering the recommendations.

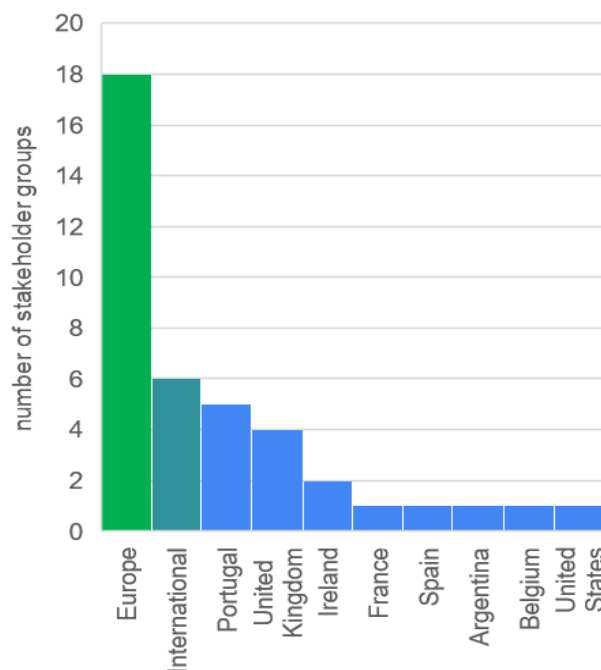


Figure 5: National and regional characteristics of the consultee population. Note that stakeholders may have multiple perspectives (e.g. both Europe and Ireland). International indicates stakeholders which identifiably have a perspective that crosses multiple countries.

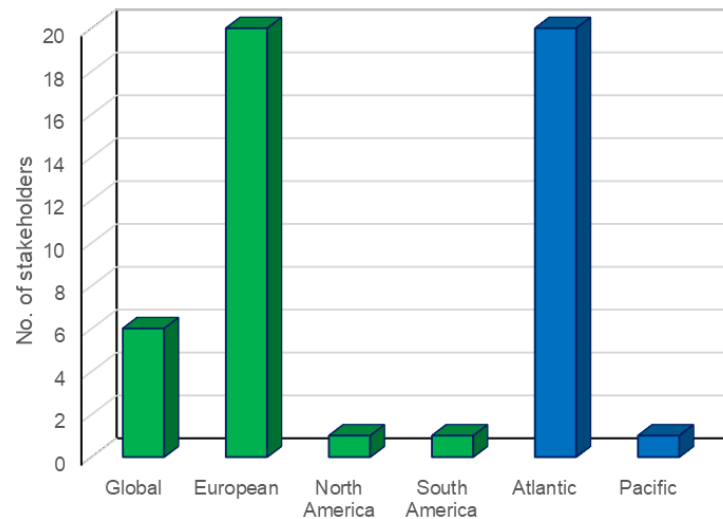


Figure 6: Regional perspectives represented by the consultee population. Note that single stakeholders may have perspectives spanning multiple regions. Note that African perspectives were gathered from the Geo Blue Planet Symposium 2022 report.

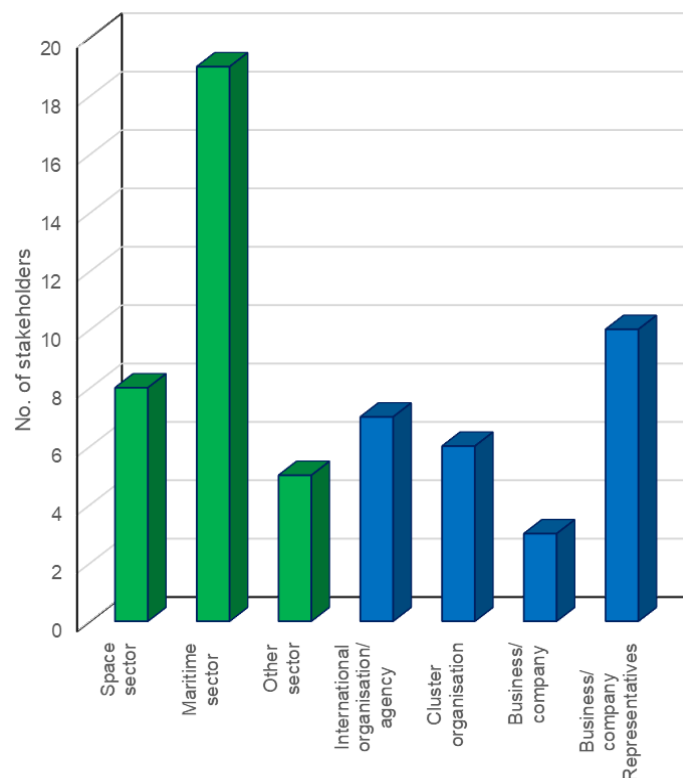


Figure 7: Key sectoral and organisational perspectives represented in the consultee population. Note that single stakeholders may have insights into multiple sectors and/or organisations.

2.3. CONSIDERING KNOWN BIASES

As noted by Ellingsen et al. (2016), respondent-driven sampling carries with it the risk of bias in the data. For the roadmap developed by the ESA-funded CINMarS project (Scarrott et al., 2017), the stakeholder data were used to ensure that the findings from an extensive literature survey were more than anecdotal. Here, the dataset of recommendations that is presented is derived from the stakeholder data primarily. The version 1.0 recommendations were appraised against a limited amount of literature, and moreso against notes from wider group events and event reports. This potential for bias has been highlighted by some of the consulted stakeholders themselves. For example, stakeholders highlighted the risk that the consultation being undertaken under ESA Blue Economy would bias the perspectives towards government organisations, when a balance with independent organisations is needed. The stakeholders went further to emphasize that the Atlantic Regional network should also feature independent institutions that are not dependent on ESA, for the network to function as envisioned.

The stakeholders also offered potential avenues to de-biasing the dataset. They suggested, as part of an expanded consultation, including the following as options to address critical biases that are identified: the Atlantic Action Plan's National Portugal Hub; contacts in Chile to supplement the South American data; the European Association of Remote Sensing Companies (EARSC); the Dutch Marine Energy Centre (DMEC); the Copernicus Relays; CNES; the ICES Working Group on Marine Renewable Energy; the Marine Alliance for Science and Technology (MAST) in Scotland; some more transatlantic stakeholders to ensure the Atlantic Network of Networks is truly Atlantic in nature.

Here a limited bias correction was implemented by addressing known gaps identified in the Version 1.0 data (e.g. no African representation) with targeted literature (e.g. by deriving recommendations from a Geo Blue Planet consultation with African Stakeholders contained in the 2022 Geo Blue Planet Symposium report³. Focused industry perspectives were sought through including data from the World Ocean Council's report on data synergies for Maritime Spatial Planning (World Ocean Council Europe, 2023⁴). Additionally, data gathered from other large group discussions (e.g. an ESA AGORA session at the 2022 Living Planet Symposium, a, EO-focused series of discussion sessions at the TMA-BlueTech-organised Blue Tech Week) were also used to amend and enhance the data gathered from the more individual- and small group-focused discussions responsible for the Version 1.0 data. With this in mind, the recommendations below should be interpreted and used carefully, noting that they have undergone a limited bias-correction.

³ Consultations at the GBP2022 symposium were made possible by (i) the involvement of the lead author on the Programme committee for the event, (ii) their position as a Session Chair, (iii) their role in recording discussions, and (iv) their efforts in reviewing the event report to ensure that information was compatible for subsequent analysis and gathering of African stakeholder perspectives for this Blue Economy analysis.

⁴ See World Ocean Council Europe (2023) Maximising data synergies in MSP for a sustainable Blue Economy: Using data synergies to provide MSP-aligned transboundary and ecosystem-scale information to expanding key elements of the Blue Economy. Technical report delivered under the ESA Blue Economy project, contract 4000131726/20/I-DT,

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Innovation Clusters

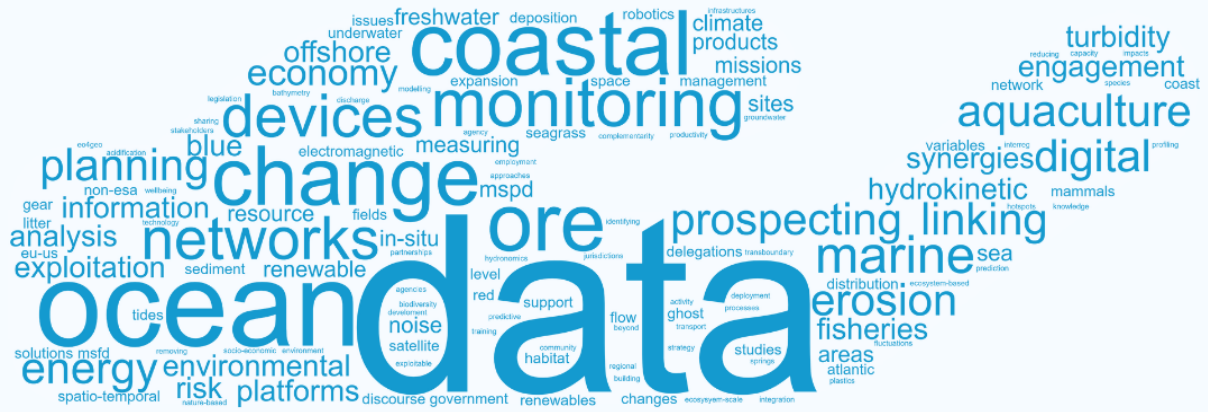
Marine industry and blue economy opportunities are currently underserved by the ESA and other scientific agencies, reflecting a difference in capacity and operational speed between space agencies and maritime stakeholders. This leads to a communication gap, which in turn can restrain innovative dialogue. However, these differences can be easily overcome through targeted facilitated dialogues.

Innovation clusters (IC) can bridge this gap by providing networking and dialogue opportunities, connecting ESA and regional maritime stakeholders. This benefits ESA by having access to a direct line of communication to the heart of regional Blue Economies. Regional maritime stakeholders also benefit from this partnership by having the means to access, understand, and connect to Earth Observation data opportunities.

The goal of ICs is to nurture technological development in support of regional economic development. ICs can have a key role in bringing the best minds together to facilitate mutually beneficial discussions, and can provide opportunities for collaborative problem solving, such as by facilitating the development of roadmaps and advisory papers to determine and refine scientific and economic goals.



Innovation Clusters OPPORTUNITIES



KEY ACTIONS

Recognise regional constraints and current realities
ESA must operate within

2 Establish a clear role for clusters in the ESA element of the Atlantic innovation ecosystem

Establish connections between ESA and innovation clusters within the Atlantic Regional Initiative

Build the
Atlantic
networks of
networks with
Innovation
Clusters as hubs

Use Innovation Clusters to connect to Atlantic stakeholders

Fund activities that secure connected Innovation Clusters

Address all three elements of the communications triangle: outreach, engage, educate

Ensure funded clusters connect and collaborate with key external actors

3.1. INNOVATION CLUSTERS' POTENTIAL

Innovation Clusters that operate across and for the Atlantic region can play a key role in:

- connecting maritime stakeholders to Earth Observation data (and data synergy) opportunities,
- providing space training to the maritime community, and
- providing a refined communications link between agencies such as the ESA and maritime stakeholders.

As such they have clear identifiable roles in education, facilitation, consultation, connection, guidance, and prioritisation that the ESA can support, and synergise with.

It is clear from the consultations here that ICs, and the Innovation Networks they are embedded in are aware that the space sector is there, and there is the possibility for them to identify synergies in different Blue Economy sectors for space/maritime innovations to target. This is the case even in cases where the IC may not be directly involved in space sector solutions (e.g. developing applications, or maritime space uses). Others have already taken dedicated action. As examples, Pol Mer Bretagne Atlantique (E.U., FR.) have created a dedicated space-maritime Booster, to focus effort and activities on the potential of space-maritime applications. Additionally, Forum Oceano (E.U., PT.) has participated in ESA calls, participating in the delivery of the CINMarS roadmap for Space Maritime Innovation using Innovation Networks (Scarrott et al., 2017). TMA BlueTech (U.S.) ran a day of discussions dedicated to opportunities in Earth Observation for the maritime sector at their annual Blue Tech Week in 2021.

These are all examples of Innovation Clusters actively making inroads to foster the use of space technology by the maritime sector. Each has demonstrated the potential for Earth observation data to contribute to regional Blue Economies, while also emphasizing opportunities for space agencies to connect. However, space agencies such as the ESA are now faced with a diverse menu of options concerning how to connect, and who to connect with. This roadmap refines these options.

It provides broad high-level actions, which frame 67 detailed smaller-scale targeted actions that have been requested by stakeholders. These are derived from extensive data gathered from one-to-one and group interviews, and event reports capturing discussions about Earth Observation to maritime innovation.

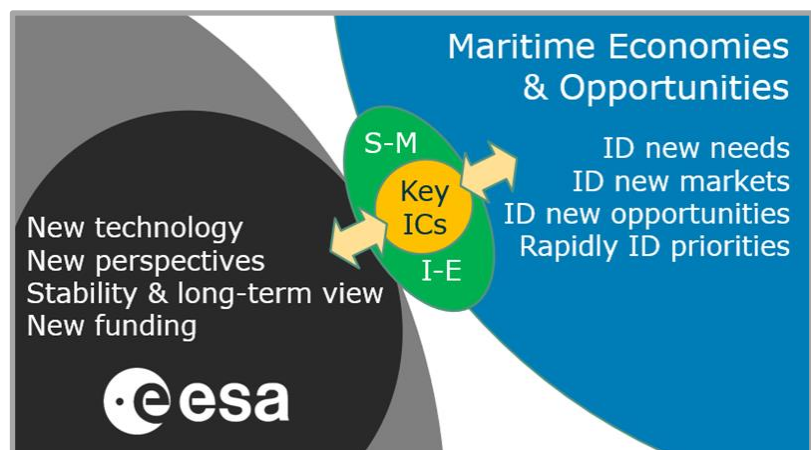


Figure 8: ESA in the Blue Economy, and the role of Innovation Clusters (ICs). Aspects that are brought to the table by both sectors (Space and Maritime) are shown. "S" denotes Space, "M" denotes maritime, "I" means import, and "E" means export.

3.2. WHAT CAN INNOVATION CLUSTERS DO FOR THE ESA?

An IC's goal is to create and nurture innovative technology development, in support of regional economic development. ICs have a strong potential to facilitate technological innovation, contributing to the development of new solutions and technologies. They play a role in devising strategic roadmaps, defining user requirements, and determining scientific goals. Importantly they often initiate dialogues, bringing the right people into the room, and facilitating discussion, information exchange, and collaborative problem solving. Additionally ICs play a crucial role as gateways to experience, expertise, and facilities for member

"You never know what the needs are until you begin the dialogue"

Blue Economy stakeholder, 2021

companies to advance their agendas, and fostering innovation. They can also act as gateways to National Infrastructure, such as "Free Tech Zones," which offer "Test before Invest" services and facilities⁵, or the wealth of knowledge resources held in participating research institutes.

Through their role in fostering collaboration and networking amongst companies and individuals, Innovation Clusters place themselves at the heart of regional Blue Economies. In doing so, they organically position themselves as key eyes and ears on the ground, which is a characteristic that is currently under-utilised by the ESA. For example, stakeholders noted that maritime networking events for companies are not fully leveraged by the ESA, indicating a potential for greater interaction and collaboration. Note that this is not an under-use unique to the ESA. In many cases, interactions between large government agencies and Innovation Clusters can be fragmented in some cases, indicating room for improvement.

This is particularly important given the difference in decision-making and implementation speeds between government and large agencies, and the companies and SMEs working in the maritime sector as part of regional Blue Economies. Space agencies such as ESA and NASA, and the business world, operate at two different paces. Additionally, there is a perception from stakeholders that space agencies may have a perspective gap, as the majority of staff are not there because they were entrepreneurs, or they worked at a company etc, rather they have demonstrated excellence in research and science or engineering. This results in a deficit of interaction with these business/innovation perspectives. It may also lead to some hesitation/reticence on the part of the EO scientists to engage with industry. However, such worries are unfounded, and initial facilitated dialogue can aid in removing these hesitations.

"Bureaucracies do not move at the speed of entrepreneurs"

Blue Economy stakeholder,
2021

Larger organisations are faced with considerable challenges to effectively address user needs through their secretariats/governing bodies. They are effectively too big and administratively ponderous to truly implement the deeper consultations and interactions they need. There is a perception that the public sector and established structures (who are key end-users for the ESA) lack innovation, particularly in areas like Earth Observation data usage. Here, the data indicated there is an opportunity for Innovation Clusters

⁵ A **Free Tech Zone** is a physical area designation in Portuguese legislation, where a company/university/innovator can test technology in the real environment, with a minimum bureaucratic load, and access is managed by a key contact. This considerably reduces time and financial costs spent in technology development. In the case noted here, for example, access is provided to the Portuguese Navy's Free Tech Zone, located in Tróia, Setúbal (30 minutes near Lisbon), with an area of 2590 km², that includes the Setúbal Canyon. Testers have access to testing at several depths, from 20 down to 1200 meters. In this Free Tech Zone, any kind of bluetech or offshore structure can be tested, at any scale. Additionally, all tested technologies in this Free Tech Zone can avail of a Qualification Label issued by the Portuguese Navy.

to act as a bridge between policy-makers, innovation funding mechanisms, large agencies and fast paced Blue Economy sectors, so EO data-driven decision making is improved with on-the-ground perspectives.

Currently, national institutions can serve as intermediaries between Earth Observation (EO) data and public authorities, facilitating the use of EO data for various purposes. With Innovation Clusters, participation of a national institution is an essential part of the triple helix, already equipping them with the capability to be a bridge between the maritime sector, and EO data opportunities. Innovation Clusters are also innovation facilitators. It was generally seen across the stakeholder data how networks that feature clusters can serve as collectors and facilitators for transferring technologies across sectoral divides, and promoting intra- and inter-sectoral technology dissemination.

It is clear from this Innovation Cluster roadmapping that Space is on the minds of some stakeholders, even if they are not currently engaged in space-maritime activities. This highlights the range of potential synergies that are possible. Clusters play a critical role in connecting the ESA and regional Blue Economies, helping the ESA respond effectively to rapidly developing Blue Economies. ESA can integrate with existing clusters and networks to streamline collaboration and information exchange.

*"There exists a huge gulf
between the language and ideas
of the Earth Observation (EO)
and maritime sectors, and even
within maritime sectors."*

Blue Economy Stakeholder,
2021

It is important to recognise that ESA engagement with Innovation Clusters is not a one-way street, with only regional Blue Economies benefitting from Earth Observation data opportunities, access and training. ESA also benefits from this collaborative relationship, which is synergetic, not transactional. Partnership with Innovation Clusters equips the ESA with a voice into the heart of regional Blue Economies. Innovation Clusters can shape and define regional economic policy and strategy, and can integrate space technology perspectives if they are sufficiently informed or enabled to do

so. Effectively they provide the ESA with influence and a place in the room when promoting Blue economy sustainability and regional development. Additionally, establishing these connections simplifies ESA's consultation and engagement activities. The ESA would be equipped with refined, efficient set of connection points into the Atlantic Blue Economies, preferable to the more complicated and diverse community of stakeholder ESA must currently consult and engage with to guide its ocean industry ambitions.

However, there is also a cautionary note. While connecting Innovation Clusters can boost competitiveness and cost-efficiency, there is a risk of over-connecting clusters, which should be carefully considered. Collaborative communities often comprise individuals seeking solutions and innovations, fostering interactions and potentially creating confusion. This has implications for the Atlantic Regional Initiatives Network of Networks. The ESA need to be cautious and strategic in their approach to growing the ARI-NoN. The stakeholders clearly advised that sustainable, reputable Atlantic Maritime Innovation Clusters should be embedded in this network, and act as key hubs of activity. ESA should harness the existing information on Cluster reputation and sustainability, and use it to strategically partner with key Atlantic Maritime Innovation Clusters as a priority activity in growing the ARI-NoN.

Finally, there is an additional cautionary note to the ESA which was expressed by the stakeholders. Currently the ESA are endeavouring to promote space-based solutions in the maritime sector. While stakeholders were generally happy with this, they also advised that the ESA should prepare itself for innovation flows in the other direction, effectively preparing itself and its Space sector communities to

harness innovations that originate in the maritime sector. The detailed mechanisms of how this could be managed were not explored by this consultation.

3.2.1. A NOTE ON SELECTING INNOVATION CLUSTERS TO PARTNER WITH

Maritime ICs play a vital role as intermediaries between the Blue Economy and EO sector, serving as gateways for maritime stakeholders to engage with EO initiatives. Their positioning should be maintained on the Blue Economy side. The goal is not that they become Space innovation hubs, rather that they focus on highlighting existing opportunities, act as network hubs for the maritime sector, foster collaboration and communication between maritime and the EO sector. They can be instrumental in delivering space training to maritime professionals, leveraging programs like Copernicus training, and organizing events focused on Earth Observation (EO) data applications. However, to fully engage in this role, ESA must consider the sustainability of the ICs it chooses to engage with, and provide support for their continued sustainability.

A number of factors influence the long-term sustainability of ICs, which must be taken into account by ESA when scoping potential ICs to partner with. The first is structural. By their nature, ICs interact with each other and promote cooperation among member organisations, despite potential competition. They operate on the assumption that the benefits of collaborative synergies, outweigh the cost of healthy competition to their members. There are some examples where the structure of Clusters has led to direct competition between the Cluster leader organisation and the cluster members. The ESA must be aware of this, and select those ICs where measures or practices are in place to avoid such scenarios. Clearly defined roles for participant entities, clusters, institutions, and activities are a useful metric to evaluate this, as ill-defined roles open the door to confusion and unhealthy practices.

Funding models and sustainability are a particular challenge for ICs. They often face resource challenges in delivering a functioning cluster, requiring sustainable funding models that must enable cluster leaders to operate independently, provide services to members, and maintain healthy competition and collaboration amongst their members. Funding clusters using a 2-3 year approach is inadvisable, a longer-term model is preferable as the companies that benefit from ICs are mainly new, with new companies constantly coming into the development pipeline. Clusters secure funding from various sources, including memberships, services, projects, and cluster-specific funding. However, many of these sources are temporary in nature. The Ecorys report (Ecorys et al., 2012) proposes the involvement of an independent third party to assess clusters' long-term potential, especially for those with regional significance. The recommendations it makes also include a tiered reward system (bronze, silver, gold) based on cluster sustainability and company excellence, verified by independent third parties. Here the information recorded in the Ecorys report would be very useful for defining the selection criteria that ESA can use.

Clusters also prove to be conducive environments for hosting incubators, and aligning the creation of new incubator/accelerator hubs with cluster locations is seen as beneficial. However, the current approach of ESA projects dealing with individual stakeholders separately is noted to slow down the development path from needs to be adapted. A suggestion here is to ensure that ESA Business Incubation Centres focused on maritime applications are co-located and even become members of key, reputable, Atlantic Innovation Clusters. Such a recommendation was also made by Scarrott et al. (2017), and is a recommendation that is yet to be fully addressed⁶.

⁶ There was a geographically distributed ESA BIC developed for Ireland with a maritime element co-located in the Irish Maritime and Energy Resource Cluster (IMERC). However IMERC was subsequently dissolved by the leading academic contributors and the maritime element transferred to lie under the guidance of the national SFI Centre for Marine Energy and Climate (MaREI). Later, MaREI involvement was discontinued and the maritime element was subsumed into a more generic thematic offering by the BIC.

Furthermore, external funding comes with external influence. ICs must actively maintain their independence to act as honest brokers for blue investment and other collaborative activities. The ESA must be aware of this when assessing an ICs potential as a prospective partner, as independent, unbiased advisory is an essential element of any ESA-IC engagement. For ESA, funding to ICs should enable them to work at connecting, providing guidance and delivering training for maritime sectors. Funding activities that quickly turn collaboratively devised guidance into seed collaborations taking Space-Maritime innovative action are also highly desirable and would help bridge the speed difference between the ESA and the Blue Economies they are trying to support.

3.2.2. OVERVIEW OF THE ROADMAP ACTIONS

Recommendations are presented as tables for the Innovation Clusters roadmap. Each recommendation is accompanied by a “Action Code” (e.g. CNC001) which can be used to trace the recommendation’s origin in the anonymised stakeholder data. A suggested key action taker is added as well as a timeframe for action. In general the timeframes suggested conform to the following:

- **Near term:** the action is completed within 3 years
- **Medium-term:** the action is implemented between 3 and 5 years from now
- **Long-term:** the action is implemented more than 5 years from now.
- **Ongoing:** These are actions which can be implemented at any of the three timeframes, but are beneficial whenever they are implemented.

Eight overarching actions are recommended. These suggest that ESA take stock of the current situation and recognise key aspects of the maritime sector which are not often considered. Then the goal is to correctly position ICs within the ESA sphere of influence and establish the key IC-ESA connections, before some guidance is given on how this connection can operate and some recommendations are made to guide IC engagement with the wider community that would bring it more in line with ESA interests. Following the recommendations here would enable the ESA to fully:

- **Action Area 1:** Recognise regional constraints and current realities ESA must operate within ;
- **Action Area 2:** Establish a clear role for Innovation Clusters in the ESA element of the Atlantic innovation ecosystem;
- **Action Area 3:** Establish connections between the ESA and Innovation Clusters within the Atlantic Regional Initiative;
- **Action Area 4:** Build the Atlantic network of networks with Innovation Clusters as hubs;
- **Action Area 5:** Use Innovation Clusters to connect to Atlantic stakeholders;
- **Action Area 6:** Fund activities that secure connected Innovation Clusters;
- **Action Area 7:** Address all three elements of the communications triangle - Outreach, engage, educate;
- **Action Area 8:** Ensure funded clusters connect to and collaborate with key external actors (WOC and GEO Blue Planet).

3.3. ACTION AREA 1: RECOGNISE REGIONAL CONSTRAINTS AND CURRENT REALITIES ESA MUST OPERATE WITHIN

The context for developing an innovation roadmap will differ across sectors. For example the community, infrastructure and technology uptake readiness of the medical sector will differ from those of the marine sector when we consider space-based technologies.

Recognising these realities, the assets in place already, and the capabilities of those assets are key to implementing a viable bespoke roadmap (Table 1).

Table 1: Actions for the ESA to ensure strategic roadmaps and plans to promote EO-maritime synergies using Innovation Clusters are aligned with the sectoral realities of the marine section.

Action code	Recommended action	Potential action taker	Timeframe
CNC025a	Recognise that collaboration activities must be of benefit to all parties in the collaboration, in addition to the driving/funding body.	ESA	Ongoing
CNC022	Recognise the importance of in-person engagement to the success of network development and animation investment.	ESA	Near-term
CNC047	Recognise that there is a paucity of business perspectives within ESA that can restrain ESA from comprehensively considering the strengths in the Blue Economy to engage with.	ESA	Near-term
CNC026	Recognise that many leading companies in the European maritime innovation sector are critically dependent on their being part of a local Innovation Cluster, and are cluster leader companies in themselves.	ESA	Near-term
CNC057	Note the opportunities presented by having proven clusters already in Europe and overseas and the benefits of linking with them as hubs to industry in the ARI roadmap.	ESA	Near-term
CNC018	Recognise the importance of independent institutions to be involved in any network ESA intends to foster around the Atlantic Regional Initiative.	ESA	Near-term
CNC046	Recognise the need for the ARI roadmap to examine/work with what more agile maritime companies can do.	ESA	Near-term
CNC045	Recognise the need for the ARI roadmap to clarify what ESA are going to do with regard to connecting with more agile companies in the maritime sector.	ESA	Near-term
CNC043	Recognise that education plays a key part of building long-term sustained progress in achieving a space-maritime innovation ecosystem.	ESA	Near-term
CNC032	Recognise that clusters can play a key role in finding space-maritime opportunities.	ESA	Near-term

Action code	Recommended action	Potential action taker	Timeframe
CNC033	Recognise that clusters can play a key role in bringing stakeholder together to discover space-maritime opportunities.	ESA	Near-term

3.4. ACTION AREA 2: ESTABLISH A CLEAR ROLE FOR CLUSTERS IN THE ESA ELEMENT OF THE ATLANTIC INNOVATION ECOSYSTEM

Innovation Clusters role in the Atlantic Network of Networks should be tightly focused on connecting stakeholders and facilitating dialogue between the marine business sector, ESA, and the European space sector. Note that these are additional to the role of Innovation Clusters in connecting education efforts as outlined in Section 3.9.3 (within Action Area 7) which is more medium term in nature.

The actions which serve to focus the role of Innovation Clusters in ESA's Atlantic Innovation efforts are outlined in **Table 2**.

Table 2: Near-term actions for ESA to shape and focus the role of Innovation Clusters on essential aspects of building the Atlantic space-maritime innovation ecosystem.

Action code	Recommended action	Potential action taker	Timeframe
CNC040	Clusters should be tasked with presenting products, not selling them, just showing what is possible as part of ESA-linked engagement and consultation activities.	Clusters	Ongoing
CNC038	Partner with maritime clusters for their user consultation meetings, allowing the cluster to bring the relevant community together, and facilitate the clarification of user needs for ESA to then integrate into calls.	ESA	Near-term
CNC039	Integrate the use of clusters into user needs consultations, and in connecting maritime stakeholders to the responding solution developers.	ESA	Medium-term
CNC044	Factor the recognition that space agencies such as ESA and NASA, and the business world, operate at two different paces, into the ARI roadmap, and devise measures to address this.	ESA	Ongoing
CNC037	Focus the role of Clusters within ESA initiatives, on bringing stakeholders together, and/or bringing people to the transversal challenges.	ESA	Ongoing

3.5. ACTION AREA 3: ESTABLISH CONNECTIONS BETWEEN ESA AND INNOVATION CLUSTERS WITHIN THE ATLANTIC REGIONAL INITIATIVE

This section addresses how ESA can establish itself within a network founded by the Atlantic Regional Initiative, and equip itself with the connections to foster Atlantic space-maritime data innovation. Actions are predominantly on ESA and are presented as a range of options for ESA to choose from, and implement should the opportunity arise.

3.5.1. USE FUNDING CALLS TO DRIVE STANDARDS

While generally known, stakeholders were very much aware of the importance of ESA calls in shaping how data are delivered and the standards that shape the character of the datasets (in terms of metadata, parameters developed, and formats). CNC017a recognises this, emphasizing that ESA should be instrumental in driving data producers towards harmonised dataset standards.

Table 3: Action(s) to ensure ESA's potential as a driver of data delivery standards is acknowledged and recognised.

Action code	Recommended action	Potential action taker	Timeframe
CNC017a	Ensure that advisory efforts / user needs consultations of the large data user agencies by ESA, or ESA-linked data providers, consider and align with the large data user agency's ⁷ internal procedures which underpin their efforts to address data gaps.	ESA	Ongoing

3.5.2. CONSIDER THE ROLE OF CLUSTERS IN THE ATLANTIC REGIONAL INITIATIVE

Within this collection of stakeholder data, it is clear that ESA should strongly consider supporting the establishment of, and use of Innovation Clusters as key nodes in any future Atlantic Regional network of networks, and as contributors to the ARI roadmap. In defining this role, the ESA are also provided with an opportunity to better connect industry within the ARI to international initiatives.

There are strong recommendations to retain a tight definition of Innovation Clusters to avoid confusion and ensure that the ARI roadmap is reviewed independently by marine Innovation Clusters as part of the development process.

Table 4: Actions to ensure the ARI roadmap is developed using Innovation Clusters as key developers and reviewers of the road-mapping process.

Action code	Recommended action	Potential action taker	Timeframe
CNC053	Note the importance of having an independent third party of clusters to cooperate with in the ARI roadmap.	ESA	Ongoing
CNC054	Keep the concept of what is an Innovation Cluster in terms of the ARI roadmap tightly focused, to maintain actionability.	ESA	Ongoing

⁷ Here, an example large data user agency could be a group such as OSPAR.

Action code	Recommended action	Potential action taker	Timeframe
CNC062b	Link Forum Oceano, PLOCAN, and the AIR Centre into the development of the ARI Roadmap, keeping the list of involved parties under review.	ESA	Near-term
CNC074	Ensure Innovation Clusters engaged by ESA, and their ESA-focused activities, actively consider international initiatives related to (for example) the Sustainable Development Goals, the U.N. Decade of Ocean Science for Sustainable Development (2021-2030), the U.N. Decade on Ecosystem Restoration, amongst others, and work to contribute to these initiatives.	ESA	Ongoing
CNC008a	Clearly define what is meant by Innovation Network, Innovation Network of Networks, and Innovation Cluster in the Atlantic Regional Initiative roadmap (and future activities).	ESA	Near-term
CNC001a	Provide a clear definition of "Innovation Cluster" at the start of the Atlantic Regional Initiative roadmap.	ESA	Near-term

3.5.3. ENGAGE DIRECTLY WITH KEY EUROPEAN CLUSTERS

There is a strong recommendation from the stakeholder data that Innovation Clusters form a key active part in ESA's envisioned Atlantic Network of Networks. Furthermore, support by ESA for these clusters to implement key enabling activities is strongly recommended.

The actions outlined in Table 5 present a number of options to establish working connections with key European marine Innovation Clusters, and embed Space in key Atlantic hubs of innovation and technology transfer.

Table 5: Actions to embed ESA within key marine innovation networks, through association with and support of marine Innovation Clusters.

Action code	Recommended action	Potential action taker	Timeframe
CNC058a	Examine whether ESA could become a member of key maritime clusters, or establish cooperative support and activity alignment mechanisms as part of the ARI road-mapping exercise.	ESA	Near-term
CNC031b	Engage with Clusters and equip them with knowledge, expertise contacts, and resources, to connect with key maritime stakeholders and convey the information on needs and strategic priorities to the ESA.	ESA	Near-term

Action code	Recommended action	Potential action taker	Timeframe
CNC048b	Appoint someone within ESA to work with European clusters, to shape how ESA can make more meaningful contributions to European Blue Economies (Interaction with the European Blue Forum ⁸ would be useful in this context).	ESA	Medium-term

3.6. ACTION AREA 4: BUILD THE ATLANTIC NETWORK OF NETWORKS WITH INNOVATION CLUSTERS AS HUBS

The consultees emphasized the existence of active, and innovating networks across the Atlantic region, suggesting that ESA should not invest in creating a whole new network for Space-Maritime innovation. In contrast the recommendation is that ESA should enhance these existing networks with information of space-sector opportunities and technologies, and focus on establishing key space-maritime connectors (knowledgeable individuals and entities who have a broad understanding of space-based opportunities, and a proven ability to communicate, translate and connect people).

The surveyed individuals highlight that Innovation Clusters are highly applicable here, given their interaction with diverse companies, institutes and policy agencies, and their core role in connecting business and stakeholders to drive innovation.

Considering these, there are a number of recommendations for ESA to keep in mind when establishing and embedding these space-maritime connectors. The first set refer to the characteristic of the ESA-supported connectors. The second set guides the intention of network connecting – i.e. to ensure that the benefits of being involved are clear for external individuals to see, and understand. The final set of actions here has a more long-term perspective, and highlights perspectives that ESA should take when thinking about how to build the network.

3.6.1. ENSURE THE ATLANTIC REGIONAL INITIATIVE NETWORK OF NETWORKS FEATURES A NUMBER OF ESSENTIAL CHARACTERISTICS

Achieving a sustainably growing and actively innovating Network of Networks requires the participation of stakeholders and establishing their trust. Recommendations here relates to the composition of the network (ensuring key entities and actors are involved) and activities supported by ESA to embed it in the Atlantic region (Table 6). It is important that network developers are clear about what the network represents and who is involved, and why. This allows external stakeholders to make an informed decision on whether or not to participate and invest themselves in the growing community.

Table 6: Considerations concerning the composition of the ESA Network of Networks, and fundamental aspects of its character.

Action code	Recommended action	Potential action taker	Timeframe
CNC019	Implement concrete steps to ensure independent (non-governmental) institutions/entities are included in the Atlantic Regional Initiative's network of networks.	ESA	Medium-term

⁸ For more information on the European Blue Forum, see <https://maritime-spatial-planning.ec.europa.eu/european-blue-forum> [last accessed 6th March, 2024].

Action code	Recommended action	Potential action taker	Timeframe
CNC005	Include measures to build trust in the Network of Networks into the Roadmap.	ESA	Near-term
CNC002a	Ensure ESA BICs play a part in this network of cluster hubs in the ARI Network of Networks.	ESA	Medium-term
CNC003b	Ensure information brokers place in a growing network of networks is recognised, and provide them with the knowledge they need to properly inform others.	ESA	Medium-term

3.6.2. ESTABLISH PRINCIPLES TO GUIDE ATLANTIC REGIONAL INITIATIVE NETWORK OF NETWORKS BUILDING

Confusion and a lack of clarity are to be avoided when aiming to introduce and integrate a new Network to the Atlantic region. It should be clear to prospective participants what the opportunities are, how to get involved, and why they should be able to trust the Network.

Table 7: Guiding principles for ESA to use in their communications concerning the ARI Network.

Action code	Recommended action	Potential action taker	Timeframe
CNC015b	Clarify any development opportunities that may be enabled for participants involved with any envisioned Innovation Network of Networks.	ESA	Ongoing
CNC010ab	Ensure there are activities and principles in place to open paths into the network for currently external stakeholders.	ESA	Ongoing
CNC011ab	Ensure language and messaging is clear within and outside the network - no buzzwords/acronyms should be used.	ESA	Ongoing
CNC067	Focus on the needs of users, noting the needs of the people in one region, are not the needs of people working/living in another.	ESA	Ongoing
CNC068	Ensure that collaborative partnerships between space agencies, private data providers, and maritime industries are a key element of ESA-EO support for the Atlantic.	ESA	Ongoing

3.6.3. CONSIDER KEY ACTIVITIES TO GUIDE EXPANDING THE ATLANTIC REGIONAL INITIATIVE NETWORK OF NETWORKS

A useful way to promote and embed stakeholder connectivity in the ARI network is the use of common challenges. These can be used to bring disparate, currently disconnected stakeholders together, and

promote working and learning about each other and the benefits each brings to the table. New stakeholders can be introduced to the wider network through engagement in the common challenges process.

A clear recommendation is for ESA to think in the longer term about this network, and beyond it's initial establishment. If there is a long-term vision ESA has for the ARI network beyond Blue Economy support, it would be beneficial for ESA to let the network and prospective participants know. For example, ESA may hope to develop a two-way street for technology movement, so the space sector may be benefitting from marine innovations. If so, this needs to be established in information on the network provided to prospective participants.

Table 8: Stakeholder-suggested approaches to expanding the ARI Network for the ESA to consider.

Action code	Recommended action	Potential action taker	Timeframe
CNC006a	Use common challenges to build and strengthen inter-network and within network bonds, to strengthen the network and building the way for new business initiatives.	ESA	Medium-term
CNC007	Start thinking about beyond Blue Economy stakeholders in the Network of Network now, and factor how to engage with them into the roadmap.	ESA	Near-term

3.7. ACTION AREA 5: USE INNOVATION CLUSTERS TO CONNECT TO ATLANTIC STAKEHOLDERS

Innovation Clusters can be key components in the Network of Networks, and critical, effective connection points for the ESA into the Marine sector and its Innovation Ecosystems. Here, the predominating recommendation is for the ESA to identify a number of key European marine Innovation Clusters, and develop partnerships with them to deliver facilitation, sectoral needs analyses, and education activities. Enabling these partnerships with funding calls that can account for the latest sectoral updates, would begin to bridge the perspective gap whereby large agencies such as the ESA have a long-term perspective and administratively complex processes that take time, which are unsuitable for responding quickly to the fast-paced marine innovation sectors. Here, Innovation Clusters can be the vital connectors.

3.7.1. EMBED INITIAL SYNERGIES WITH EXISTING, PROVEN AND REPUTABLE ATLANTIC INNOVATION CLUSTERS

Innovation Clusters are highly regionalised, and geographically contextualised. They also come in a wide diversity of forms, composition and with often disparate priorities. However, due to European investment in creating a vibrant population of Innovation Clusters, the ESA now has a range of options to partner with, with established track records of excellence, and demonstrated capabilities to help the ESA connect more effectively. Selection of the Innovation Clusters to partner with should be done with care, aided by the available assessment reports and characterisations of the various Innovation Clusters that are now available. Note that some European marine Innovation Clusters are already establishing a track record of delivering for the ESA. It is strongly recommended that the ESA use these contacts to initially establish collaborations and partnerships.

Table 9: Recommendations to guide more streamlined engagement of the ESA with the diverse community of Innovation Clusters now present in the European Atlantic region.

Action code	Recommended action	Potential action taker	Timeframe
CNC056	Identify the successful Clusters, and begin working with them.	ESA	Near-term
CNC035b	When examining key clusters to engage with, check that the roles of the participant entities, the clusters and the institutions, and their respective activities, are well-defined as part of their appraisal.	ESA	Near-term
CNC034ab	Note the importance of third-level institution support and how it enhances an Innovation Cluster, ensuring that this is a key aspect to consider when determining whether an Innovation Cluster is suitable for participation in a key ESA ARI activity.	ESA	Near-term
CNC055ab	Focus on Innovation Clusters that prioritise early-stage companies to ensure those innovators and application developers which need the most help are supported. The aim here is to create a virtuous cycle, and not a ruinous cycle.	ESA	Near-term
CNC052b	Ensure any ESA involvement/cooperation with clusters harnesses the implementation of recommendations from the Ecorys report ⁹ .	ESA	Near-term
CNC050b	Use the existing network of proven, and ESA-engaged Innovation Clusters as part of the ARI roadmap range of activities.	ESA	Near-term
CNC027b	Investigate the potential of the Blue Tech Alliance, and the European Network of Maritime Clusters to contribute to enhancing Space-Maritime innovation and commercialisation in the Atlantic Region.	ESA	Near-term
CNC028ab	Ensure ESA are connected to the Atlantic autonomous Robotics Consortium: establishing a testing triangle between Portugal, Madeira and Azores, and Cabo Verde, for the testing of UAVs and robotics innovations, noting the potential to regionally expand the test area to include the Canary Islands (thus ensuring a wider Macronesia-level effort is possible).	ESA	Near-term

⁹ Ecorys, Deltares and Oceanic Development (2012) Blue Growth: Scenarios and drivers for sustainable growth from the oceans, seas and coasts. Technical report to the European Commission (DG Mare) in response to tender no. MARE/2010/01.

3.7.2. FUND A DEDICATED ESA ACTIVITY LED BY AN ATLANTIC MARINE INNOVATION CLUSTER

Experience in working with and for the ESA can help Innovation Clusters immeasurably in advisory services they provide to their member companies and entities. Mature Innovation Clusters are typically coordinated by a single legal entity, and as such can apply for ESA funding. Here, the recommendation is for the ESA to present a demonstration challenge for an Innovation Cluster to lead the space-maritime response. This could take the form of a consultation action, an education action, or a sectoral investigation to define case studies or marine science activities. The ESA could ensure that multiple Innovation Cluster coordinators are involved to ensure the wider inter-regional perspectives are being accounted for, and mitigate against the highly regionalised and geographically constrained nature of marine Innovation Clusters.

Table 10: Guidance to shape the use of a bespoke, Innovation Clusters-focused call to embed a consolidated initial Innovation Cluster connection with the ESA.

Action code	Recommended action	Potential action taker	Timeframe
CNC042	Have a Cluster mediate a discussion where the developments in both the ESA-ARI Offshore Wind Energy project, and the wave use case in ESA-ARI Blue Economy are showcased to prompt an in-depth, user conversation, where developers do not talk, but a cluster helps the users to convey their general needs.	ESA	Near-term
CNC041b	Nominate ESA-funded Innovation Clusters to investigate particular sectors, instructing them to focus primarily on the user perspective, not the developer perspective.	ESA	Near-term
CNC013b	Examine the potential for Small Island Developing States (SIDS) to act as focal challenges for Innovation Network collaborations to address.	ESA	Medium-term
CNC014	Examine the practicalities, and their consequences, of upscaling advances developed for small island regions/states to continental scales.	ESA	Medium-term
CNC012	Ensure activities promoted within the Innovation Network that focus on monitoring, are approved by/in line with state regulatory authority requirements.	ESA	Near-term

3.8. ACTION AREA 6: FUND ACTIVITIES THAT SECURE CONNECTED INNOVATION CLUSTERS

Sustainability and funding models are a recognisable challenge for Innovation Clusters. Through their actions of supporting their member companies to succeed, they do not typically accrue large profits, nor can they compete with their member companies for resources. Innovation Cluster coordinator entities have a tightly defined remit, which can limit their ability to sustain themselves in the long-term.

The funding, how it is dispersed and recognises the different realities across different regions is a critical aspect for any All-Atlantic roadmap to consider and highlight. Indeed, funding should be an important mechanism through which the ESA can build the Network of Networks, using Innovation Clusters as key connection points. The design of such ESA funding mechanisms needs to consider the wider funding landscape and the potential for other non-ESA mechanisms/initiatives to build the needed capacity to suit

ESA needs. For example, non-ESA funding mechanisms can play a part in regional capacity building to enable ESA-funding accessibility.

In contrast to the U.S. for example, the E.U. and member states have a more state-investment approach to maintaining and growing the SME base. This has enabled the development and establishment of the Marine Innovation Clusters the ESA can now use to connect. However, the ESA must consider partnering with a number of key strategically established clusters, with funding being a component of these connections.

Table 11: Recommendations for the ESA to inform discourse concerning the funding of deeper more medium-term partnerships between the ESA and marine Innovation Clusters.

Action code	Recommended action	Potential action taker	Timeframe
CNC051b	Develop a set of metrics that are indicative of Innovation Cluster success - this could include funding but not be solely limited to financial viability hence are more 'true'.	ESA Regional authorities European Commission	Medium-term Long-term
CNC036b	Investigate providing a range of viable funding sources to ensure cluster sustainability, continuity in the Innovation Ecosystem, and contribution to space-maritime innovation and commercialisation.	ESA Regional authorities European Commission	Medium-term Long-term
CNC024	Ensure that collaboration activities benefit the collaborators as well as the funding body.	ESA Regional authorities European Commission	Ongoing
CNC016	Consider and synergise with the wider non-ESA funding landscape when designing ESA funding mechanisms.	ESA European Commission	Medium-term
CNC063	Fund the creation of Boosters ¹⁰ within key marine Innovation Clusters (focused on space-maritime tech transfer).	ESA	Medium-term
CNC064	Fund clusters to organise the relevant meetings with key stakeholders, and identify the gaps.	ESA	Near-term

¹⁰ A "Booster" is a small cluster (almost a consortium) operating within, and led by, a Technology Innovation Cluster. They are created to focus on a particular problem/opportunity area. An example would be the the MORESPACE Booster operated by Pol Mer Bretagne-Atlantique. This Booster was created to focus on marine and space knowledge transfer. It supports the development of ideas in areas of risk management, safety at sea, Energy, resource management, and environmental monitoring. It important to note that Boosters do not provide infrastructure support, rather they provide the framework to help ideas develop (through representation, event activities, communication activities, identifying and focus Cluster efforts on opportunities, working on key projects, etc.).

Action code	Recommended action	Potential action taker	Timeframe
CNC065b	Develop a funding call that can respond to more urgent/priority maritime needs. Flexibility is needed to account for maritime needs, funding several initiatives with clusters engaged to propose annual maritime needs - like the ESA Science4Society call, but working with marine Innovation Clusters tasked with providing the list of priority areas. Funding rules for the Clusters themselves should contain specific obligations/quality review commitments and mechanisms to address bias associated with Innovation Clusters advocating in their own interests.	ESA	Medium-term

3.9. ACTION AREA 7: ADDRESS ALL THREE ELEMENTS OF THE COMMUNICATIONS TRIANGLE: OUTREACH, ENGAGE, EDUCATE

Space to maritime innovation is currently underperforming, and this is in part due to a deficit of clear, concise messaging to marine stakeholders on (i) what is possible using space-based technologies, and (ii) how can they engage with the sector. A productive, innovating and self-sustaining Atlantic Network of Networks, requires strategic investments to be made in communications activities. These activities foster the initial connections, and integrate ESA's ambitions into existing Atlantic Innovation Ecosystems. Innovation Clusters are a key factor in enabling this integration, as they can facilitate action in three essential communications areas – outreach, engagement, and education/capacity building.

3.9.1. OUTREACH

Improving awareness of Earth Observation (EO) potential in marine sectors is key to building demand for EO-solutions. There is an issue with the EO narrative and perception of EO. The storyline from the space industry has been predominantly about outer space, and not inner-space. However, as one stakeholder noted – “*there is only one Earth, so the Space storyline should be inclusive of Earth Observation in a much more profound way*”. Stakeholders noted that ESAs current efforts to communicate the data available to (non-satellite-literate) marine stakeholders could be improved.

“When you think space, you don’t think Earth Observation”

Blue Economy stakeholder, 2021

This information flow outward from ESA to marine stakeholders must be considered as part of any ARI activity. Stakeholders highlighted that care needed to be taken with regard to the use of language, highlighting the need to consider its impact on communications in the ESA Atlantic Regional Initiative network. In particular stakeholders cautioned against the use of buzzword language (e.g. “Internet of things”) which though appealing are relatively meaningless to marine stakeholders. They also cautioned against the use of broad terms such as “natural resources” given this can lead to confusion when discussing inter-sectoral opportunities.

With outreach, there are three key recommendations from the stakeholders which could be addressed. These would (i) establish an online presence for space which specifically targets marine stakeholders, and (ii) ensure that targeted outreach is conducted in forums of importance to marine stakeholders themselves, and (iii) support outreach and engagement with audience-appropriate content and materials. Interestingly both these recommendations are also made in Scarrott et al., 2017, emphasizing their continued importance in the minds of marine stakeholders.

Table 12: Actions for the ESA to establish key outreach activities to support and promote awareness of space data opportunities in the marine section.

Action code	Recommended action	Potential action taker	Timeframe
CNC020a	Design and establish a communications platform that can overcome the communications barriers across the different communities ESA are hoping to animate through the Atlantic Regional Initiative.	ESA	Near-term
CNC060	Attend Maritime events put on by Blue technology Clusters, and Blue Economy events, to expose the maritime sector to the EO side of Space.	ESA	Near-term

Action code	Recommended action	Potential action taker	Timeframe
CNC071	Develop simple communications materials (a pamphlet, a slide deck, a one page brief) backed by a single online entry point to information (in maritime language) on opportunities for them in the Space Sector. The target audience is key marine organisations and stakeholder groups that could potentially utilise EO data, but currently do not and have no familiarity with Space Sector terminology.	ESA	Near-term

3.9.2. ENGAGE

Engagement involves a two-way flow of information, and is often iterative in nature. Engaging with stakeholders is crucial for the European Space Agency (ESA), and their current approach involves continuous interaction, with marine sectors over extended periods. This includes direct engagement, user consultation meetings to shape programs and tenders, and ensuring contractors engage iteratively during product or service development. However, to maximise the benefits of engagement, subtle changes in their approach may be useful.

In certain circumstances, the traditional engagement model may need tailoring for efficiency. For example, larger organisations often do not express user needs through their secretariats, as these focus on policy and strategic direction rather than operational details. Despite this, secretariats play a vital role in linking to the wider working activities community, where user needs can be identified. Engaging with operational actors within larger organisations poses challenges, requiring deeper iterative consultations to explore the organization thoroughly. Recognising this iterative approach is needed before the initial contact with the Secretariat may be useful in preparing for the follow-ons. Additionally, Innovation Clusters are key nodes in the innovation ecosystem, acting as vital connection points between space agencies and the marine innovation community. Regular interactions between a space agency, like NASA, and a cluster, such as TMA BlueTech, have led to a greater understanding of each other's potential for example. Maritime ICs have initiated space-to-maritime discussions, dedicating events to Earth Observation (EO) data applications with inputs from agencies. Going forward, ESA's participation in such discussions, when invited, would be highly beneficial, especially for the Atlantic region.

While ESA holds stakeholder consultations, the development of a consultation report may not fully capture user needs. Innovation Clusters can really assist here, and maximise efficiency in the engagement process for the ESA, by bringing the right community to consultation meetings and facilitating stakeholders to articulate their user requirements. This can help address biases in space-maritime consultation forums, and ensure a balanced representation of space developers and marine users.

Several projects were identified as of interest to the engagement challenge, including the ReFLEX project¹¹, the Atlantic Wind project¹², and the ConnectEO project¹³. Stakeholder recommendations include engagement with Portuguese organisations focused on marine renewables, the Atlantic autonomous Robotics Consortium, the Blue Hubs network in Portugal, the Portuguese navy, and affiliated institutes.

ESA has an opportunity to invest in discussions facilitated by ICs. By defining priority areas through focused industry discussions, ICs can provide ESA with updated information, or release publicly available reports

¹¹ For more information on the ReFLEX project, see <https://www.reflexorkney.co.uk/about-reflex> [last accessed 8th March 2024].

¹² For more information on the Atlantic Wind project, see <https://eo4society.esa.int/projects/atlantic-regional-initiative-applications-offshore-wind-energy/> [last accessed 8th March, 2024].

¹³ For more information on the ConnectEO project, see <https://www.connect-eo.eu/> [last accessed 8th March 2024].

for the Space Sector to respond to. A tailored funding call could then refer applicants to these reports, establishing a long-term funding mechanism adaptable to near-term priorities of the marine industry.

Stakeholder fatigue is a potential risk in engagement activities. While engagement with ESA is generally rewarding, repeated requests for inputs can lead to fatigue. Measures to address and mitigate this issue are included, emphasizing the importance of clear principles in ESA's engagement to prevent stakeholder fatigue from becoming a problem.

Table 13: Actions for the ESA to establish key engagement activities to support and promote awareness of space data opportunities in the marine section, while activating information transfer to ESA.

Action code	Recommended action	Potential action taker	Timeframe
CNC009a	Maximise the opportunities for innovators and stakeholders to meet, and align schedules in an increasingly busy network	ESA Cluster	Ongoing
CNC004a	Bring together researchers from different backgrounds (industry, academic paths, general population), get them in a (class)room, and use small targeted events to strengthen bonds, develop commercial skills, and collaborative knowledge transfer, ensuring there is in-person engagement to balance online.	ESA Clusters	Near-term
CNC009a	Maximise the opportunities for innovators and stakeholders to meet, and align schedules in an increasingly busy network.	ESA, Clusters	Ongoing
CNC069b	Establish a engagement mechanism, whereby Atlantic-based Innovation Clusters engage with the Atlantic maritime sector (bringing the right people together) in response to ESA requests for guidance, to define the near-time priority areas for ESA to fund near-term Space-maritime innovation activities.	ESA, Clusters	Medium-term
CNC066	Engage with organisers of maritime industry-specific collaboration platforms - to encourage companies to share insights, experiences, and potential applications of EO data.	ESA, Clusters	Near-term

3.9.3. EDUCATE AND BUILD CAPACITY

Across the stakeholder data, education was a key part of innovation network activities and ambitions. There was evidence of confusion as to what 'ESA's education effort is. Between storytelling and education, it is unclear what ESA are doing for non-space marine stakeholders and potential users. The consulted community highlighted opportunities presented by the Portuguese Blue School initiative, which is in need of curriculum content. Furthermore, Portuguese stakeholders highlighted their efforts to include education and a Blue School aspect into the Portuguese Blue Hubs network.

The community emphasized that the provision of training is particularly helpful in overcoming barriers, and a key part of building the space-maritime innovation ecosystem. Engagement with the next generation of innovators was seen to be of particular importance (e.g. the Blue School initiative, and the U.S.-focused Aqua Optimism (Ocean and Water) module looking at space for 5th graders). Aside from the typical learning

and education approaches, participation by the marine community as Beta testers of space-developed systems was noted as an alternative approach to building capacity.

In terms of recommendations, ESA, perhaps through the Atlantic Regional Initiative (ARI) or through linking education efforts to the ARI, could use clusters to magnify the impact of their capacity building efforts (**Table 14**). This would nurture a technology-ready community of users for marine Earth-observation derived data, aligned with key marine Innovation Clusters across the Atlantic, and co-located with these hubs of marine innovation.

Table 14: Actions for the ESA to establish key capacity building and education hubs for space-maritime innovation within the Atlantic Network of Networks.

Action code	Recommended action	Potential action taker	Timeframe
CNC030	Engage with Clusters to deliver co-designed and co-developed EO training courses for the maritime sector.	ESA	Medium-term
CNC059	Partner industry, with Clusters, ESA and a Blue School-like initiative to embed long-term foundations in the ARI-linked Space-maritime Innovation Ecosystem.	ESA	Medium-term
CNC049	Link with a Cluster and use an education/industry challenge to foster deepened collaboration between ESA and NASA.	ESA	Medium-term
CNC061	Ensure that the initial education-focused activities are done in partnership with a certified cluster.	ESA	Medium-term
CNC072	Build on existing [regional] ocean literacy strategies and efforts to ensure these take account of space-maritime aspects.	ESA and Clusters	Ongoing
CNC073	Ensure dedicated resources are available in the ESA to support ocean literacy strategies and efforts with space-maritime content.	ESA	Ongoing
CNC029	Ensure education and capacity building are a key part of any maritime innovation network/cluster roadmap for the Atlantic area.	ESA	Near-term

3.10. ACTION AREA 8: ENSURE FUNDED CLUSTERS CONNECT TO AND COLLABORATE WITH KEY EXTERNAL ACTORS (WOC AND GEO BLUE PLANET)

Two key global initiatives were identified over the course of this research, that could have a considerable advisory and active role in partnership/collaboration with Atlantic Innovation Clusters.

The first is an international business association known as the World Ocean Council (WOC). Through its membership, community and engagement activities, the has amassed a considerable network amongst the global and Atlantic industry community of relevance to the developing ESA Atlantic Regional Initiative (Section 4.1). However, there could also be benefits to connecting the WOC directly to the Innovation Cluster hubs this roadmap envisions, as part of the growing a network of networks. A natural starting point is the WOC's "Smart Ocean-Smart Industries" (SO-SI) program (Table 15). This program focuses on promoting sustainable development and innovation by integrating smart technologies and practices within ocean-related industries. As part of its activities it could function as a provider of data, a place for the maritime industry to engage with EO-derived ocean data and its role in MSP and the Blue Economy. The Innovation Cluster-WOC interactions could also provide the ESA with insights that help shape a more comprehensive ESA-WOC strategy that builds further upon the existing ESA-WOC Memorandum of Understanding (ESA, 2021).

Table 15: Actions to deepen ESA-ARI-relevant interactions and collaboration between Atlantic Innovation Clusters and the World Ocean Council.

Action code	Recommended action	Potential action taker	Timeframe
ARI012	Engage with the WOC's SO-SI Programme, as this functions as a ground truthing provider of data to EO remote sensing data and is a key avenue for the maritime industry to become (more) engaged with ocean data and its role in MSP and the Blue Economy.	ESA	Near-term
ARI013	Build upon the existing ESA-WOC MoU ¹⁴ and adopt a comprehensive ESA-WOC strategy and/or initiate a dedicated ESA-WOC project for involving the business and investment sectors in ESA's initiatives related to the Blue Economy.	ESA	Medium-term
ARI022	Host a targeted side event at the next WOC conference to determine future activities in this area.	ESA with WOC	Near-term
ARI023	Utilise the WOC 'Resources' tab on the WOC website ¹⁵ as a way to make outreach / engagement materials available to more marine stakeholders and sectors.	ESA with WOC	Near-term

The second initiative is GEO Blue Planet, is a global initiative that operates within the Group on Earth Observations (GEO). GEO Blue Planet activities are focused on stakeholder engagement, capacity development and cooperation and co-design (Figure 9 in Section 4.1.4). GEO Blue Planet engages with United Nations (UN) entities such as UNEP (including the Regional Seas Conventions, the Global

¹⁴ See

https://www.esa.int/Enabling_Support/Preparing_for_the_Future/Space_for_Earth/ESA_signs_Memorandum_of_Collaboration_with_World_Ocean_Council [last accessed 15th December, 2023]

¹⁵ See <https://www.oceancouncil.org/resources/> [last accessed 6th March, 2024].

Environment Monitoring Services - GEMS), FAO and UNESCO (GOOS and regional commissions of the Intergovernmental Oceanographic Commission - IOC), international stakeholders initiative such as Cordio East Africa or the South Pacific Community (SPC) and national governments. GEO Blue Planet also coordinates a number of active working groups of experts on matters such as *Sargassum*, coastal geomorphology, flooding and inundation, eutrophication, fisheries, oil Spills, and marine policy. Through these groups and it's engagement activities, the initiative is actively bridging the gap between ocean and coastal observational data, and societal needs to deliver actionable information. Ove the years it has developed a highly useful, and engaged community of regional stakeholders and global ocean research community experienced in satellite-derived data.

Through its Symposia, GEO Blue Planet identifies regional and global coastal and ocean stakeholder needs (e.g. the 5th GEO Blue Planet Symposium in Accra, Ghana¹⁶), facilitates targeted discussions to identify regional challenges and needs, and summarises these in their publicly available Symposia reports(e.g. GEO Blue Planet, 2022). The working groups then actively work on solutions for some of these needs (Solutions such as the Sargassum Information Hub¹⁷). The key recommendation here is for Atlantic Innovation Clusters, supported by the ESA, to actively engage and collaborate with GEO Blue Planet to (i) address existing stakeholder needs they have already identified, and (ii) further refine the needs of communities in identified challenge areas, for their stakeholders along the African and European seabords, Atlantic Small Island Developing States and European overseas territories.

Table 16: Actions for Innovation Clusters to be involved with, connecting the ESA to GEO Blue Planet activities in the Atlantic region.

Action code	Recommended action	Potential action taker	Timeframe
ARI014	Work with GEO Blue Planet to ensure peer-review publications of relevance to the region are made available to African educators who lack access to non-open access publications.	ESA	Medium-term
ARI015	Liaise with GEO Blue Planet to help refine the needs of African stakeholder with regard to fisheries and aquaculture.	ESA	Medium-term
ARI016	Liaise with GEO Blue Planet to coordinate/synergise with education, training and capacity building in Atlantic Facing countries (e.g. the European and African regions).	ESA	Near-term
ARI017	Liaise with GEO Blue Planet to inform the development of monitoring capabilities for ocean and coastal ecosystem health around Small Island Developing States.	ESA	Medium-term
ARI018	Note that GEO Blue Planet can be a source of user needs and requirements for stakeholders across the Atlantic Region, including SIDS, Europe and Africa.	ESA	Near-term
ARI019	Liaise with GEO Blue Planet to inform the development of marine and coastal education curricula in Atlantic Facing countries (e.g. the European and African regions).	ESA	Medium-term

¹⁶ For a short summary of this event, see <https://geoblueplanet.org/5thsymposium-summary/> [last accessed 1st December 2023]

¹⁷ See the Sargassum Information Hub at <https://sargassumhub.org/> [last accessed 1st December 2023]

Action code	Recommended action	Potential action taker	Timeframe
ARI020	Work with GEO Blue Planet to help develop an information hub for the fishing community & other stakeholders to expand the reach and efficiency of the GMES and Africa marine weather early warning service.	ESA	Medium-term
ARI021	Work with connections already established by GEO Blue Planet to engage with local marine stakeholders and policy makers to build inclusive and integrated regional solutions to coastal hazards.	ESA	Near-term

4. KEY FOCUS AREAS

Over the course of developing the Innovation Clusters roadmap presented in Section 3.0, three thematically focused sets of recommendations were identified. These are presented here, noting they are supplementary, and often complementary, to the Innovation Clusters roadmap. Action taken in these three areas would synergise with advancements made by implementing the Innovation Clusters roadmap in due course.

These three additional focus areas are:

- 1) Recommendations to shape the ESA's Atlantic Regional Initiative;
- 2) Deepening ESA-OSPAR collaborations and synergies on Earth Observation data use;
- 3) Deepening collaboration and synergies between the ESA range of Earth Observation activities, and Argentinian stakeholders;

Note that under the ESA Blue Economy project, a fourth deep dive has been investigated, through a focused activity by the UK's National Oceanographic Centre, to provide guidance on how ESA can more effectively support Offshore Renewable Energy development in the Atlantic Region (described in Sams and Bell, 2024¹⁸). Data from Sams and Bell's study was not included here, nor did it factor into the analysis reported on in this document.

¹⁸ See Sams, C., Bell P (2024) Roadmap for Successful Uptake of EO Data and Applications in Ocean Energy Projects. Version 1. National Oceanography Centre, UK. Technical report delivered under the ESA Blue Economy project, ESA ESRIN Contract number contract 4000131726/20/I-DT.

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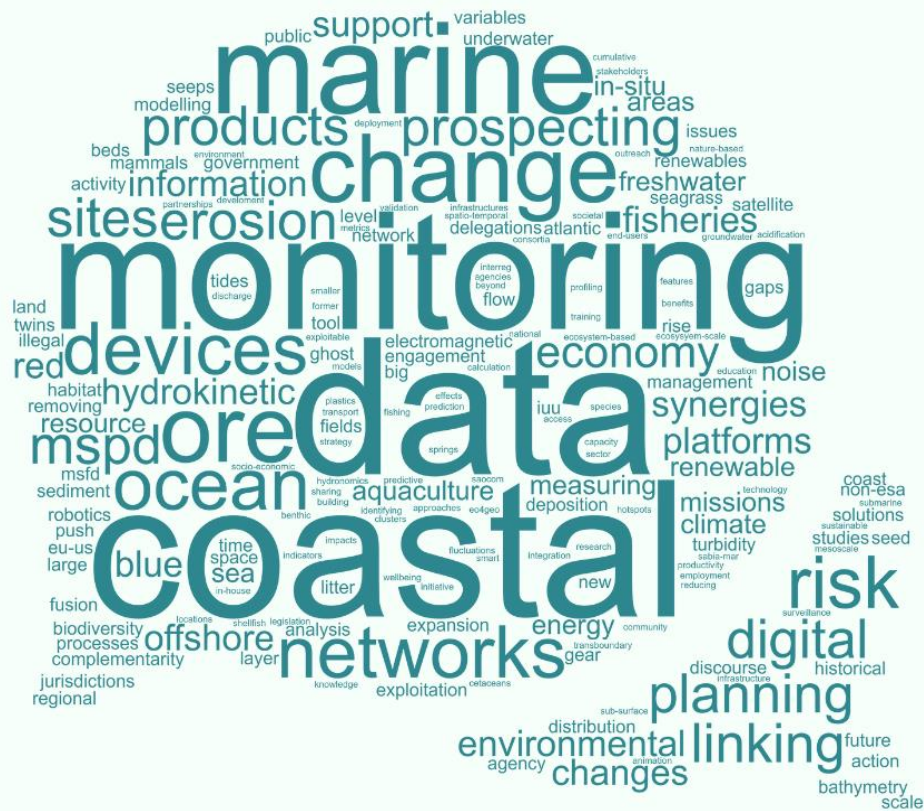
Atlantic Regional Initiative

The Atlantic Regional Initiative is actively connecting maritime stakeholders to Earth Observation data. It is just the beginning of an ambitious regional journey. Communications and networking between organisations is crucial. Membership of such networks must be mutually beneficial and members must be sensitive to funding and capacity differences between large and small organisations.

ESA's Atlantic Regional Initiative aims to create an Atlantic Network of Networks (A-NoN). The A-NoN would be tasked with ensuring that opportunities for utilising Earth Observation data, such as satellite data, thermal imaging, and infrared data, are not overlooked but are instead put to use for societal benefits by regional maritime stakeholders, such as businesses, fisheries, and local governments.

Fostering societal benefits is a key goal of the ARI. Knowledge sharing and collaboration between ESA and maritime stakeholders is mutually beneficial, providing ESA with knowledge on what data is needed by stakeholders, and providing stakeholders access to datasets and knowledge on how best to harness data for sustainable development.





Ensure the roadmap addresses key stakeholder concerns

Ensure a role for ESA-BICs is clear in the ARI Network of Networks

Ensure a role for the World Ocean Council is clear in the ARI Network of Networks

Ensure the role for GEO Blue Planet is clear in the ARI Network of Networks

Build the
Atlantic
Network of
Networks with
Innovation
Clusters as hubs

One of the aims of the ESA Atlantic Regional Initiative is to create a collaborative Atlantic Network of Networks (A-NoN) to harness EO potential. This is focused on maximising the societal benefits EO, and needs effective engagement strategies. This ARI-NoN must recognise and build upon existing initiatives and organisations with similar objectives in the Blue Economy and EO domain. Additionally, it has a stated aim of integrating existing networks into the A-NoN, considering regional Blue Economies and Smart Specialization strategies.

Already, through its initial vanguard of projects and consultations, the ESA Atlantic Regional Initiative (ARI) is actively connecting stakeholders to EO communities, and fostering a vibrant Atlantic Innovation Ecosystem that harnesses Earth Observation (EO) data synergies. However, this is the start of an ambitious journey. The initiative must seek to enhance EO integration into European programs beyond ESA, define the role of ESA Business Incubation Centers (BICs), explore more effective ways of delivering data, and maintain momentum through specific targeted actions.

This consultation identified and recognises the similarities between existing network organisations and those sought by the ARI. These provide an opportunity for strategic network animation efforts. There are also opportunities for alignment with existing multi-agency network organisations, leveraging similarities in ambitions.

Concerning engagement, the participation of component networks in the wider network must be recognisably beneficial to their members. This is true for Innovation Clusters for example, where they are reticent to expose their membership to the demands of a new network, unless they can identify tangible benefits for their membership in doing so.

Fostering societal benefits is highlighted as a crucial overarching goal for any network enhanced under the ARI. Mechanisms must be in place to ensure this. Collaboration activities should benefit all parties involved, not just the entity promoting collaboration. The challenges of large organisations engaging with smaller companies must be acknowledged, for which the Flood and Coast innovation program funded by UK-DEFRA provides an exemplar model to follow.

Here, these stakeholders identified four key action areas for the ESA to help focus its attention and efforts. A fifth is included which has been drawn from the Innovation Clusters roadmap. This is because the two are intricately inter-linked and complimentary.

- **Action area 1:** Ensure the roadmap addresses key stakeholder concerns;
- **Action area 2:** Ensure a role for ESA-BICs is clear in the ARI network of networks;
- **Action area 3:** Ensure a role for the World Ocean Council is clear in the ARI network of networks;
- **Action area 4:** Ensure a role for GEO Blue Planet is clear in the ARI network of networks;
- **Action area 5:** Build the Atlantic network of networks with Innovation Clusters as hubs.

4.1.1. ACTION AREA 1: ENSURE THE ROADMAP ADDRESSES KEY STAKEHOLDER CONCERNS

The European Space Agency's Atlantic Regional Initiative aims to harness space-based technologies for societal benefits in the Atlantic region. Focusing on Earth observation, satellite communications, and navigation, it aims to improve the connection between space technologies and data, and maritime sectors such as, maritime safety, fisheries management, ocean renewable energy, while improving our capability to protect the environment and develop Blue Economies sustainably. The initiative collaborates actively with local stakeholders, governments, and industries, promoting innovation, knowledge transfer, and economic growth. Meanwhile, it facilitates access to ESA's space infrastructure, creates opportunities to develop applications tailored to the Atlantic region's specific needs, and critically, opportunities for scientific research and business development.

To keep its activities focused on critical regional development needs, and ensure the resources are best used, the ESA Atlantic Regional Initiative is developing a roadmap - i.e. a strategic plan with key milestones and actions. It aims to ensure ESA and its partners continue to: identify regional needs, develop usable solutions, foster meaningful collaborations and partnerships, support innovation and promote sustainability, and enable Blue Growth in regional economies. All the while progress should be monitored with evaluated impact guiding and re-directing efforts.

The below actions have been derived from across the pool of stakeholder data. They should be considered and addressed as the ARI roadmap is in development, to ensure the maritime-focused roadmap is following the advice offered by this already engaged and passionate community of maritime stakeholders.

Table 17: Actions to ensure the ARI roadmap aligns even closer with Atlantic maritime stakeholders needs.

Action code	Recommended action	Potential action taker	Timeframe
ARI009b	Recognise in the ARI roadmap that what ESA does, is relevant not only to member states, but also to developing countries, (including SIDS - Small Island Developing States).	ESA	Near-term
ARI008	Recognise the need to initiate dialogue between the EO scientists and industry stakeholders	ESA	Near-term
ARI010	Ensure the ARI roadmap acknowledges and delivers a path to implementing a multi-pronged approach to fostering a vibrant Atlantic Innovation Ecosystem harnessing EO data synergies.	ESA	Near-term
ARI004	Roadmap should highlight the opportunity to explore new, better, and more effective ways of delivering data	ESA	Near-term
ARI001b	Ensure the ESA Blue Economy Innovation Clusters roadmap (this document), and the wider ESA Atlantic Regional Initiative roadmap, aim to enhance EO infiltration into European programmes beyond ESA.	ESA	Near-term
ARI003	Roadmap should address 2 types of knowledge transfer - knowledge transfer amongst peers, and knowledge transfer amongst more heterogeneous perspectives	ESA	Near-term

Action code	Recommended action	Potential action taker	Timeframe
ARI005b	Ensure the ESA Blue Economy Innovation Clusters roadmap (this document), and the wider ESA Atlantic Regional Initiative roadmap accounts for exploring opportunities beyond those investigated by the ESA Blue Economy project, with specific actions to maintain the momentum.	ESA	Near-term
ARI007	Ensure regionally-focused activities funded under ESA ARI consider the regional Blue Economy, and Smart Specialisation strategies of relevance to the activity which are in place, or are in any way relevant	ESA	Medium-term
ARI006	Include in the roadmap a path on how extensive pre-existing transatlantic networks can become important components of the Atlantic network of Networks	ESA	Near-term
AR006	Look at roadmapping from two perspectives - the ocean science needs, and administrative/authority reality	ESA	Medium-term

4.1.2. ACTION AREA 2: ENSURE THE ROLE FOR ESA BICS IS CLEAR IN THE ARI NETWORK OF NETWORKS

The European Space Agency's (ESAs) network of Business Incubation Centre's (BICs) are a key existing asset which is currently under-utilised by the ARI. Comprised of business incubators across Europe, they are managed by the ESA in partnership with national or regional organisations. They support entrepreneurs and start-ups using space technology or satellite applications for non-space sectors, providing selected start-ups with financial support, technical expertise, business development guidance, access to ESA's technology and patents, office space, and networking opportunities. As such, they can play a pivotal role in nurturing and accelerating the growth of start-ups by bridging many of the gaps between space technology and maritime applications. ESA-BICS alone are not sufficient as they have a tight, and focused remit. However, they do have considerable capability to synergise with Innovation Clusters, and ARI activities to foster a vibrant start-up Space-Maritime innovation community rapidly capitalising on Space-Maritime opportunities. They are also key Space Information brokers, suitable for complementing the Maritime Information brokering provided by Atlantic Innovation Clusters.

Table 18: Actions to ensure the ARI Network of Networks harnesses the potential of ESA BICs.

Action code	Recommended action	Potential action taker	Timeframe
CNC002a	Ensure ESA BICs play a part in this network of cluster hubs in the ARI Network of Networks.	ESA	Medium-term
CNC003b	Ensure information brokers place in a growing network of networks is recognised, and provide them with the knowledge they need to properly inform others.	ESA	Near-term

Action code	Recommended action	Potential action taker	Timeframe
ARI002	Encourage ESA BICs to feed into an electronic industry directory, cataloguing current and alumni companies, where they are based, and what they provide.	ESA	Medium-term

4.1.3. ACTION AREA 3: ENSURE A ROLE FOR THE WORLD OCEAN COUNCIL IS CLEAR IN THE ARI NETWORK OF NETWORKS

The World Ocean Council (WOC) is a registered non-profit organization that operates as an international business association. Through cross-sectoral dialogue and policy engagement, the WOC fosters collaboration, advocates for responsible practices, and drives innovation for a healthy and productive ocean economy. Through its membership and community activities, the WOC unites a diverse global ocean industry community to address sustainability challenges.

There is a very clear role for the WOC as a key stakeholder to be consulted as part of the ARI roadmap development process. They can provide invaluable insights into global industry, regional actors, and the industry-policy context for the Atlantic region. This is a perspective which can be useful when combined with those of the scientific research and academic communities, and those environmental advocacy perspectives, to find ways for the ARI to foster mutually beneficial advances towards truly sustainable Blue Growth.

Actions presented here build on the existing Memorandum of Understanding¹⁹ between the ESA and the WOC (ESA, 2021). For example, they envision a wider MoU being developed with other key agencies and initiatives, or identify key activities within the WOC for which the ESA-WOC MoU provides a basis for enhanced cooperation.

Table 19: Actions to ensure the ARI Network of Networks harnesses the potential of World Ocean Council.

Action code	Recommended action	Potential action taker	Timeframe
ARI011	Co-develop and commit to a multi-party MoU with EMODnet, Copernicus, the World Ocean Council and potentially additional relevant organisations, to foster collaboration and data synergy, enable the pooling of resources, expertise, and diverse data sources, create a more comprehensive understanding of marine environments, and support more informed decision-making in various sectors.	ESA	Near-term
ARI012	Engage with the WOC's SO-SI Programme, as this functions as a ground truthing provider of data to EO remote sensing data and is a key avenue for the maritime industry to become (more) engaged with ocean data and its role in MSP and the Blue Economy	ESA	Near-term

¹⁹

https://www.esa.int/Enabling_Support/Preparing_for_the_Future/Space_for_Earth/ESA_signs_Memorandum_of_Collaboration_with_World_Ocean_Council [last accessed 15th December, 2023]

Action code	Recommended action	Potential action taker	Timeframe
ARI013	Build upon the existing ESA-WOC MoU ¹¹ and adopt a comprehensive ESA-WOC strategy and/or initiate a dedicated ESA-WOC project for involving the business and investment sectors in ESA's initiatives related to the Blue Economy.	ESA	Medium-term
ARI022	Host a targeted side event at the next WOC conference to determine future activities in this area.	ESA with WOC	Near-term
ARI023	Utilise the WOC 'Resources' tab on the WOC website ²⁰ as a way to make outreach / engagement materials available to more marine stakeholders and sectors.	ESA with WOC	Near-term

4.1.4. ACTION AREA 4: ENSURE A ROLE FOR GEO BLUE PLANET IS CLEAR IN THE ARI NETWORK OF NETWORKS



Figure 9: The three core activities of GEO Blue Planet.

GEO Blue Planet is a global initiative that operates within the Group on Earth Observations (GEO), an international partnership working to enhance the availability, accessibility, and usability of Earth observations for societal benefit. GEO Blue Planet activities are focused on stakeholder engagement, capacity development and cooperation and co-design (Figure 9). This connects regional communities to global expertise, and enables global and regional communities to advance their ocean observation capabilities, energises regional and global data sharing, and fosters collaboration among scientists, policymakers, and stakeholders. The initiative coordinates a number of working groups on matters such as *Sargassum*, coastal geomorphology, flooding and inundation, eutrophication, fisheries, oil Spills, and marine policy. Through these groups and its engagement activities, the initiative is actively bridging the gap between ocean and coastal observational data, and societal needs to deliver actionable information.

²⁰ See <https://www.oceancouncil.org/resources/> [last accessed 6th March, 2024].

Table 20: Actions to ensure the ESA fully harness the potential of GEO Blue Planet in their Atlantic Regional Initiative.

Action code	Recommended action	Potential action taker	Timeframe
ARI014	Work with GEO Blue Planet to ensure peer-review publications of relevance to the region are made available to African educators who lack access to non-open access publications.	ESA	Medium-term
ARI015	Liaise with GEO Blue Planet to help refine the needs of African stakeholder with regard to fisheries and aquaculture.	ESA	Medium-term
ARI016	Liaise with GEO Blue Planet to coordinate/synergise with education, training and capacity building in Atlantic Facing countries (e.g. the European and African regions).	ESA	Near-term
ARI017	Liaise with GEO Blue Planet to inform the development of monitoring capabilities for ocean and coastal ecosystem health around Small Island Developing States.	ESA	Medium-term
ARI018	Note that GEO Blue Planet can be a source of user needs and requirements for stakeholders across the Atlantic Region, including SIDS, Europe and Africa.	ESA	Near-term
ARI019	Liaise with GEO Blue Planet to inform the development of marine and coastal education curricula in Atlantic Facing countries (e.g. the European and African regions).	ESA	Medium-term
ARI020	Work with GEO Blue Planet to help develop an information hub for the fishing community & other stakeholders to expand the reach and efficiency of the GMES and Africa marine weather early warning service.	ESA	Medium-term
ARI021	Work with connections already established by GEO Blue Planet to engage with local marine stakeholders and policy makers to build inclusive and integrated regional solutions to coastal hazards.	ESA	Near-term

4.1.5. ACTION AREA 5: BUILD THE ATLANTIC NETWORK OF NETWORKS WITH INNOVATION CLUSTERS AS HUBS

There is considerable crossover between the Innovation Clusters Roadmap presented in Section 3, and the guidance for the ARI. The crossover has been consolidated in both sections to help readers. Regarding this topic, ESA should not invest in creating a whole new network for Space-Maritime innovation. In contrast the recommendation is that ESA should enhance these existing networks with information of space-sector opportunities and technologies, and focus on establishing key space-maritime connectors (knowledgeable individuals and entities who have a broad understanding of space-based opportunities, and a proven ability to communicate, translate and connect people). It is strongly recommended that these space-maritime connectors are the Innovation Clusters that are located along the Atlantic seaboard.

4.1.5.1. Ensure the Atlantic Regional Initiative network of networks features a number of essential characteristics

Achieving a sustainably growing and actively innovating Network of Networks requires the participation of stakeholders and establishing their trust. It is important that network developers are clear about what the network represents and who is involved, and why. This allows external stakeholders to make an informed decision on whether or not to participate and invest themselves in the growing community.

Table 21: Considerations concerning the composition of the ESA Network of Networks, and fundamental aspects of its character.

Action code	Recommended action	Potential action taker	Timeframe
CNC019	Implement concrete steps to ensure independent (non-governmental) institutions/entities are included in the Atlantic Regional Initiative's network of networks.	ESA	Medium-term
CNC005	Include measures to build trust in the Network of Networks into the Roadmap.	ESA	Near-term
CNC002a	Ensure ESA BICs play a part in this cluster of clusters.	ESA	Medium-term
CNC003b	Ensure information brokers place in a growing network of networks is recognised, and provide them with the knowledge they need to properly inform others.	ESA	Medium-term

4.1.5.2. Establish Principles to guide Atlantic Regional Initiative network of networks building

Confusion and a lack of clarity are to be avoided when aiming to introduce and integrate a new Network into the Atlantic region. It should be clear to prospective participants what the opportunities are, how to get involved, and why they should be able to trust the Network.

Table 22: Guiding principles for ESA to use in their communications concerning the ARI Network.

Action code	Recommended action	Potential action taker	Timeframe
CNC015b	Clarify any development opportunities that may be enabled for participants involved with any envisioned Innovation Network of Networks.	ESA	Ongoing
CNC010ab	Ensure there are activities and principles in place to open paths into the network for currently external stakeholders.	ESA	Ongoing
CNC011ab	Ensure language and messaging is clear within and outside the network - no buzzwords/acronyms should be used.	ESA	Ongoing
CNC067	Focus on the needs of users, noting the needs of the people in one region, are not the needs of people working/living in another.	ESA	Ongoing

Action code	Recommended action	Potential action taker	Timeframe
CNC068	Ensure that collaborative partnerships between space agencies, private data providers, and maritime industries are a key element of ESA-EO support for the Atlantic.	ESA	Ongoing

4.1.5.3. Consider key activities to guide Expanding the Atlantic Regional Initiative network of networks

A clear recommendation is for ESA to think in the longer term about this network, and beyond it's initial establishment. If there is a long-term vision ESA has for the ARI network beyond Blue Economy support, it would be beneficial for ESA to let the network and prospective participants know. For example, ESA may hope to develop a two-way street for technology movement, so the space sector may be benefitting from marine innovations. If so, this needs to be established in information on the network provided to prospective participants.

Table 23: Stakeholder-suggested approaches to expanding the ARI Network for the ESA to consider.

Action code	Recommended action	Potential action taker	Timeframe
CNC006a	Use common challenges to build and strengthen inter-network and within network bonds, to strengthen the network and building the way for new business initiatives.	ESA	Medium-term
CNC007	Start thinking about beyond Blue Economy stakeholders in the Network of Network now, and factor how to engage with them into the roadmap.	ESA	Near-term

OSPAR

OSPAR is a cooperative and intergovernmental organisation established to protect the North-East Atlantic marine environment. Created by the OSPAR Convention, it allows 15 governments and the EU to work collaboratively towards policies and goals which aim to benefit and protect the North-East Atlantic marine life against pollution, aquatic biodiversity loss, and harmful human activities.

Earth Observation data refers to datasets which are collected by observing the planet from space. When applied to the marine, this can contain information such as on pollution detections, oil spill detections, and monitoring sea ice. Satellite data provides us with the opportunity to observe hard to reach parts of the globe, such as remote seascapes with challenging conditions.

OSPAR can benefit in numerous ways from Earth Observation data. Considering the cross-border impacts of climate change, satellite data can enhance and contextualise existing data from OSPAR member states, simplifying comparison and analysis. OSPAR monitoring efforts would also benefit from access to satellite data, giving OSPAR access to areas of interest beyond national borders.



PEOPLE



NATURE



POLICY



Establish productive ESA-OSPAR engagement

Provide an Earth Observation data advisory service

Help OSPAR
build capacity
to exploit
Earth
Observation
data

Implement a set of initial OSPAR-specific EO data demonstrations

The OSPAR organization is a cooperative and intergovernmental body established to protect and conserve the marine environment of the North-East Atlantic. It operates through several key components. The *OSPAR Convention* is a mechanism through which 15 Governments²¹ and the European Union cooperate to protect the marine environment of the North-East Atlantic. It is an international agreement, a legally binding treaty formerly known as the “Convention for the Protection of the Marine Environment of the North-East Atlantic”. The goals of the convention are implemented and enforced by the *OSPAR Commission*, which oversees the development and execution of policies, strategies, and programs to achieve the objectives set out in the convention. Supporting the work of the OSPAR Commission and serving as their administrative arm, is the *OSPAR Secretariat*. They provide the logistical, administrative and technical assistance to facilitate the activities of the Commission, and were the point of contact for the roadmap discussions held under the Blue Economy project¹².

“Are there datasets they should be adding, to supplement what OSPAR do currently?”

OSPAR consultation, 2021

Satellite imagery (Earth Observation, or EO, data) can cover vast, remote, or challenging terrains, providing valuable data that the OSPAR²² Commission and its member states can use for monitoring, reporting and decision-making. Satellite-derived datasets, offering expansive spatial and temporal awareness, can complement and contextualise existing in-situ and modelled data. Large organisations such as the OSPAR also face challenges to harmonise multi-source data for comprehensive analyses, with some dataset proving to be particularly useful as demonstrating best practice standards, and driving alignment.



Figure 10: Opportunities for the ESA to connect with OSPAR and develop OSPAR capacity for Earth Observation data uptake.

Within the organization, three key entities that contribute uniquely to OSPAR’s activities were highlighted. These were *Workstreams*, *Working Groups*, *EXPO Groups* (Expert and Experiential Input Groups) and *Correspondence Groups*. *Workstreams* are groups focused on particular, long-term, thematic topics critical for implementing the goals of the OSPAR convention. They conduct research, set objectives, and execute actions related to their respective thematic area. Meanwhile, *Working Groups* handle more specific operational tasks, or issues within a defined timeframe. *EXPO Groups* provide expert advisory input, and specialised knowledge to support the decision-making processes ongoing within OSPAR. Finally, *Correspondence Groups* are sometimes formed to gather inputs, work on particular topics/tasks, or formulate recommendations,

without the need for physical meetings or formal sessions. A Correspondence Group’s work is tightly focused, and the group is temporary in nature. It is ordinarily dissolved once their objectives are met, tasks are completed, or their recommendations have been submitted to the relevant OSPAR body. Supporting

²¹ The fifteen Governments are Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

²² Here, where “OSPAR” is used in isolation, it refers to the overall organization and it’s community, through the established ESA connection with the Secretariat.

and facilitating them is the OSPAR Secretariat, providing administrative support, technical assistance, and support for reporting, engagement and liaison for example.

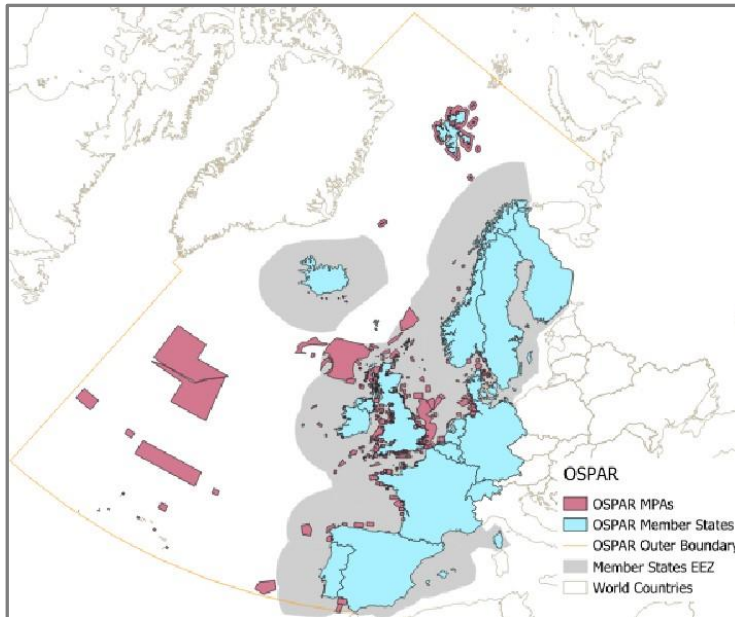


Figure 11: The OSPAR Convention's region, member states and network of Marine Protected Areas (MPAs) including those beyond national jurisdictions.

Initial discussions with OSPAR highlighted a number of benefits that satellite-derived data could bring to OSPAR, and aid the work of the OSPAR community. These include providing observation possibilities to less accessible areas and the 10 Marine Protected Areas beyond national jurisdictions which OSPAR has a particular interest in, providing enhanced comparative and contextual data, supporting high-level analyses, and acting as a unifying driver of data collection activities. Not only could the use of satellite data assist in OSPAR's monitoring efforts, it could also address a number of their specific data needs (e.g. information on seagrass), while also supplying their data portals with information that contextualises and complements their member state's data submissions.

Despite the preliminary nature of this discussion, initial cooperative activities are already possible. 16 recommendations have been identified, that can broadly be summarised into the following areas:

- Establish productive ESA- OSPAR engagement
- Help OSPAR build capacity to exploit Earth Observation (EO) data
- Provide an EO data advisory service
- Implement a set of initial OSPAR-specific EO data demonstrations.

For large and multi-faceted international agencies, starting with their policy and strategy is a useful way forward to begin determining their data use needs. However, these discussions highlighted the complex and multi-entity nature of OSPAR. It is clear that the ESA community needs to conduct iterative discussions on satellite-data opportunities, as there is a considerable knowledge gap to be bridged.

From the data, it is clear that this initial discussion could be the start of very fruitful and deep discussions for the ESA with end-users of satellite-derived data at the science-policy nexus. Such discussions would benefit both the engaged users (OSPAR staff and collaborators), and the ESA, not only building data and user linkages, but also establishing those institutional and community connections that are the bedrock of the coordinated and collaborative activities needed for the OSPAR region.

4.2.1. ESTABLISHING PRODUCTIVE ESA-OSPAR ENGAGEMENT

Both the ESA and OSPAR are two large and complex organisations with very diverse stakeholder communities. Structured engagement is crucial to ensure that future interactions between them are organised, purposeful, and productive. This will help navigate their complexities, manage expectations, and foster the meaningful and impactful collaborations needed for the region.

Table 24: Actions to guide the next stage of engagement with OSPAR after the ESA Blue Economy project.

Action code	Recommended action	Potential action taker	Timeframe
OS014	Act quickly to further the conversations established in the ESA Blue Economy project.	ESA	Near-term
OS002	Ensure there are actionable follow-ons in support of deeper, more extensive OSPAR-ESA collaboration activities.	ESA	Near-term
OS001	Take time beyond the timeframe of the Blue Economy project to explore the full range of opportunities with OSPAR.	ESA	Near-term
OS003	Examine OSPAR's strategy and priorities to identify the route to clarify their data needs from satellite-data.	ESA	Near-term
OS006	Ensure that advisory efforts / user needs consultations of the OSPAR community by ESA, or ESA-linked data providers, align with the internal procedures of OSPAR which underpin OSPARs efforts to address data gaps.	ESA	Near-term
OS016	Liaise with OSPAR to engage the new workstreams with satellite data opportunities in a structured advisory, and iterative manner, possibly beginning with: - the biodiversity Committee (as a priority); - the renewables correspondence group; - the marine litter correspondence group; and - the noise correspondence group (which could be the most useful starting point).	ESA	Near-term

4.2.2. HELP OSPAR BUILD CAPACITY TO EXPLOIT EARTH OBSERVATION DATA

Building the capability for OSPAR to harness Earth Observation data opportunities is a considerable challenge. There are a number of fundamental training and awareness challenges to be met, while the changeable composition of their Working Groups, and temporary nature of Correspondence Groups is a not very conducive to establishing a core cadre of trained OSPAR actors. There may be opportunities in the Secretariat itself, to equip team members with the skills to identify when EO data may be useful, and who to contact to explore this opportunity further. However, having a contact person in place to assist these actors is essential, and broached in Section 4.2.3.

Table 25: Actions to help build critical capacity within OSPAR to recognise when and where EO advice should be sought.

Action code	Recommended action	Potential action taker	Timeframe
OS007	Recognise that the exploration of OSPAR to identify satellite-derived data opportunities is likely to encounter a wide range of questions, such as: - How could satellite-derived data tell you about biomass, seafloor condition etc.? - How deep can satellite-sensors “see” below the sea surface? - Can satellite-sensors deliver information on wrecks/munitions etc.? - How could satellite-sensors and data contribute to monitoring the 10 OSPAR MPA’s (those Area beyond National Jurisdiction MPAs which OSPAR has a particular interest in)?	ESA	Ongoing
OS004	When considering OSPAR, account for the need to conduct iterative discussions on satellite-data opportunities, as there is a knowledge gap that needs to be bridged.	ESA	Ongoing

4.2.3. PROVIDE AN EO DATA ADVISORY SERVICE

Ultimately, satellite data is simply another form of data. However, it comes with its own jargon, specifications and origins which restrains uptake. This is often addressed through direct training. However, given the characteristics of OSPAR, and the temporary aspects to Working Group contributors, and *Correspondence* Groups, it would be more appropriate to establish a Satellite Data Advisor to handle, advise and make recommendations for data, products, and training opportunities that meet the various group’s needs. This expert advisory service would comprise a specialised support offered by individuals or entities possessing in-depth knowledge, experience, and expertise in the area of Earth observation for marine and coastal regions. They would effectively liaise with their counterparts in the OSPAR secretariat to be brought into the relevant EXPO, Correspondence, or Working Groups, provide targeted insights into what is possible, and advise on what cautions may need to be considered.

Table 26: Actions to shape the set-up of an EO-advisory service/mechanism, to support Working, EXPO and Correspondence Groups within OSPAR.

Action code	Recommended action	Potential action taker	Timeframe
OS010	Devise and implement an advisory “marine satellite-data” service in support of the OSPAR range of EXPO groups.	ESA	Medium-term
OS011	Devise and implement an advisory “marine satellite-data” service in support of non satellite-data literate marine stakeholders in the OSPAR region.	ESA	Medium-term
OS009	Recognise there could be advantages to making satellite data expertise available for OSPAR's EXPO groups to avail of	ESA	Near-term
OS013	Determine how ESA and satellite-data provides could provide helpful inputs to OSPAR in support of strategy and data call development.	ESA	Near-term

4.2.4. IMPLEMENT A SET OF INITIAL OSPAR-SPECIFIC EO DATA DEMONSTRATIONS

Demonstrator activities showcase practical applications of space technology in maritime contexts, illustrating their viability and benefits. These activities validate concepts, encourage investment, collaboration, and wider adoption of innovative trans-sectoral solutions. To stakeholders, they represent tangible examples of what is possible, and can be used by the ESA and their OSPAR counterparts to foster understanding and interest amongst their communities and member states, to support enhanced cooperation and collaboration.

Table 27: Actions to develop OSPAR-specific data demonstrations of EO potential.

Action code	Recommended action	Potential action taker	Timeframe
OS005	Propose a range of single, keystone datasets for environmental monitoring, for OSPAR data users to apply and explore	ESA	Near-term
OS015	Involve satellite providers/data experts in OSPAR discussions on Ocean Renewable Energy / Marine Renewable Energy.	ESA	Near-term
OS012	Support a study on seagrass with OSPAR as a key stakeholder, looking at habitat distribution change, and historical change, and ensuring that the information is delivered as comparable datasets over a large (international) area.	ESA	Near-term

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Argentinian Stakeholders

Argentina currently does not have a consolidated Blue Growth strategy - however, it has been actively involved in various efforts aimed at harnessing its oceanic potential and promoting sustainable development. Despite not being labelled as a "Blue Growth" strategy, it is clear that Argentina's actions signal a willingness to implement measures promoting sustainable blue growth and economic development.

Argentina's current activities include the Pampa-Azul, SABIA-Mar, and SAOCOM initiatives. These efforts have fostered collaboration between scientific disciplines and have promoted awareness of the importance of the ocean and maritime environment, improved data management, and enhanced Argentina's ability to collect regional Earth Observation data on its oceans.

High-level links need to be established between Argentina and the ESA for the Argentinian oceanic science community to deepen collaboration with ESA, resulting in the development of tailored solutions for Southern Atlantic stakeholders and mutually beneficial outcomes. This will help ESA better understand the needs of Argentinian stakeholders and help Argentina continue its journey towards sustainable blue growth.



Argentinian Stakeholders

OPPORTUNITIES



KEY ACTIONS

1 Consider the regional southern hemisphere context

2 Recognise all the communities North and South that have a stake in the Atlantic Regional Initiative's roadmap

3 Expand regional engagement

4 Support regional capacity building activities

5 Connect existing European and Argentinian data programmes and initiatives

6 Conduct key regional demonstrator activities

Argentina harnesses technologies for maritime sectors through initiatives such as the Pampa-Azul, and satellite programs such as SABIA-Mar (*Satélites Argentino-Brasileño para Información Ambiental del Mar*) and SAOCOM (*Satélite Argentino de Observación Con Microondas*). Pampa-Azul, led by the Ministry of Science, fosters interdisciplinary collaboration. It emphasizes and promotes awareness of the importance of the ocean, and activities to improve data harmonization. Meanwhile, satellite programmes such as SABIA-Mar (a dual-satellite program) and SAOCOM (polarimetric L-band SAR constellation) enhance the countries capability to acquire regional oceanic information. This regional context was an important facet of the conversation, which highlighted the need for tailored solutions for Southern Atlantic stakeholders. This requires us to acknowledge the importance of considering regional nuances, and recognise Southern Hemisphere-specific issues, as distinct from those in the Northern Hemisphere.

This initial consultation provides the basis for future conversations between the ESA, and Argentinian stakeholders. There was a clear wish to widen consultations to encompass the networks of the Comisión Nacional de Actividades Espaciales (CONAE: the National Commission for Space Activities in Argentina), Instituto Nacional de Investigación y Desarrollo Pesquero (INIDEP: the National Institute for Fisheries Research and Development) and the Consejo Federal Pesquero (CFP: Federal Fisheries Council). There is an opportunity to begin discussions with Argentinian agencies towards collaborations that co-promote both ESA, and Argentinean mission data, and focus on the different regional thematic and technological challenges and opportunities. Links should be established at the higher levels, addressing the need for capacity building (assessment and analysis).



Table 28: Opportunities for the ESA to connect with Argentinian stakeholder needs for Space-Maritime solutions.

developing MOUs that drive collaborative development (addressing the need for capacity building activities, and regionally tailored thematic platforms for data access and analysis).

Overall, the consultation resulted in 34 recommendations, broadly summarised by the following action areas:

- Consider the regional context;
- Recognise the communities that have a stake in the Atlantic Regional Initiative's roadmap;
- Expand regional engagement;
- Support regional capacity building activities;
- Connect existing European and Argentinian data programmes and initiatives;
- Conduct key demonstrator activities.

4.3.1. CONSIDER THE REGIONAL CONTEXT

Considering the regional context is critical for supporting Blue Economies with space sector technologies, as it acknowledges diverse socio-cultural, economic, and environmental factors specific to a region. Understanding these nuances ensures that innovations are relevant, address unique challenges, and leverage local strengths.

Table 29: Actions to shape wider engagement between the ESA and Argentinian space-maritime stakeholders.

Action code	Recommended action	Potential action taker	Timeframe
AR008	Recognise the administrative and authority constraints in sub-regions, and forge the right contacts to involve them in the process	ESA	Near term
AR014	Recognise that private sector companies can be sources of data and service requirements, and can be the developers of data and service solutions	ESA	Near term
AR013	Recognise the difference between institutional stakeholders, and private sector stakeholders, accounting for it in the seed collaborations and MOUs	ESA	Near term
AR007	Recognise the requirements and necessities for ocean science activity	ESA	Medium-term

4.3.2. RECOGNISE THE COMMUNITIES THAT HAVE A STAKE IN THE ATLANTIC REGIONAL INITIATIVE'S ROADMAP

Recognizing the communities affected within roadmaps and strategies is essential for inclusive and effective uptake. Doing so acknowledges their diverse needs, perspectives, and the potential impacts the ambitions may have on them. It ensures that their voices are heard, fostering ownership and trust in the planning process, and the actions that will be taken. Here, the recommendation pertains to two Argentinian communities, encouraging ESA to ensure that the roadmap addresses not only the needs of the science community, but also the needs of administrations and regional authorities.

Table 30: Action(s) to guide engagement and the range of perspectives gathered for Argentinian inclusion in the ARI road-mapping process.

Action code	Recommended action	Potential Action taker	Timeframe
AR006a	Look at road-mapping from two perspectives - the ocean science needs, and the administrative/authority reality	ESA	Medium-term

4.3.3. EXPAND REGIONAL ENGAGEMENT

The consultation resulting in these recommendations should be considered the first of a wider engagement with CONAE and linked authorities and stakeholder groups. The below actions emphasize this, and suggest means to shape the initial steps of this wider engagement.

Table 31: Actions to shape expanding engagement by the ESA with CONAE and linked authorities and stakeholder groups.

Action code	Recommended action	Potential Action taker	Timeframe
AR016	Recognise this initial Blue Economy consultation should be the basis for future conversations between ESA, and Argentinian stakeholders	ESA, CONAE	Near-term
AR012	Recognise that ESA-CONAE is the best connection to exploit here as the seed collaboration.	ESA, CONAE	Near-term
AR027	Establish links at the higher levels so there is possibility for cooperation to permeate in the lower strata of sectors.	ESA, CONAE	Near-term
AR005	Conduct a wider stakeholder consultation with Argentinian stakeholders, prioritising relevant authorities that are recommended by CONAE, INIDEP and the CFP.	ESA, CONAE	Near-term
AR026	Ensure the CONAE council is involved in discussions on initial seed collaborations between Argentina-ESA or CONAE-ESA	ESA	Near-term
AR009	Focus on seeding collaborations with an aim of clarifying user needs and the regional way forward	ESA, CONAE	Medium-term

4.3.4. SUPPORT REGIONAL CAPACITY BUILDING ACTIVITIES

Capacity building facilitates technology adoption by providing the necessary skills, knowledge, and resources. It empowers individuals and sectors to understand, implement, and optimise technologies effectively. However, regionalised approaches to capacity building are needed as Blue Economies capability to uptake technologies varies between regions.

Table 32: Actions to ensure regionalised capacity building approaches are adopted to support the uptake of Space-Maritime innovations developed for the Argentinian Atlantic.

Action code	Recommended action	Potential Action taker	Timeframe
AR020	Work with existing regional satellite-derived data users (CONAE and INIDEP), to run capacity building activities for enhancing EO-data synergies and uptake	ESA	Near-term
AR019	Invest in equipping key end-user groups with the skills to appraise information based on satellite-derived data, or use satellite-derived data itself	ESA, CONAE	Medium-term

4.3.5. CONNECT EXISTING EUROPEAN AND ARGENTINIAN DATA PROGRAMMES AND INITIATIVES

Connecting and harmonising data access and analysis programmes/initiatives across borders is challenging, however the rewards can be impressive. Doing so facilitates collaborative activities and insights from different data sources, and reduces duplication of efforts. Furthermore, harmonised data programs streamline access, allowing diverse stakeholders to benefit from shared knowledge, and coordinate their efforts more effectively. Connecting EU and Argentinian data programmes would enable a more holistic understanding of Atlantic challenges, connecting both the Northern and Southern regions.

Table 33: Actions to facilitate and guide connecting European and Argentinian data programmes and initiatives.

Action code	Recommended action	Potential Action taker	Timeframe
AR029	Begin a multi-agency discussion between ESA and Argentinian agencies seeking develop collaborations that (i) co-promote both ESA, and Argentinean mission data, and (ii) focus on the different regional thematic and technological challenges and opportunities.	ESA, CONAE	Medium-term
AR010	Develop MOUs with key Argentinian stakeholders to drive collaboration development	ESA, CONAE	Medium-term
AR004	Near-term activities aiming to align with Argentinian ambitions should synergise with the SAOCOM satellite programme	ESA	Near-term
AR031	Build on existing cooperation between ESA and Argentina on I-band activities, and assess potential synergies using SAOCOM and SABIA-Mar as starting points.	ESA, CONAE	Near-term
AR011	Start with collaborations that focus on the use and distribution of SAOCOM and SABIOMAR data,	ESA, CONAE	Near-term
AR030	Consider whether SABIA-Mar or SAOCOM can act as a contributory mission to COPERNICUS	ESA, CONAE	Near-term

Action code	Recommended action	Potential Action taker	Timeframe
AR002	Near-term activities aiming to align with Argentinian ambitions should synergise with the ROMA network	ESA, CONAE	Near-term
AR015	For ROMA network alignment, initially focus on establishing contacts with the various government agencies involved in the ROMA	ESA, CONAE	Near-term
AR001	Near-term activities aiming to align with Argentinian ambitions should synergise with the Pampa-Azul initiative.	ESA, CONAE	Near-term

4.3.6. CONDUCT KEY DEMONSTRATOR ACTIVITIES

Demonstrator activities showcase practical applications of space technology in maritime contexts, illustrating their viability and benefits. These activities validate concepts, encourage investment, collaboration, and wider adoption of innovative trans-sectoral solutions. To stakeholders, they represent tangible examples of what is possible, and can be used by the ESA and their Argentinian counterparts to foster understanding and interest among stakeholders.

Table 34: Actions to guide the implementation of ESA-Argentinian demonstrators of Space-Maritime EO data possibilities.

Action code	Recommended action	Potential action taker(s)	Timeframe
AR023	Focus on developing thematically-focused platforms for data access and analysis, focused on groups of related issues (e.g. red-tides)	ESA, CONAE	Medium-term
AR025	If developing platforms for southern hemisphere users, ensure the differences in their needs in comparison to northern hemisphere stakeholders, are taken into account in design and development.	ESA, CONAE	Medium-term
AR021	Work with existing regional satellite-derived data users (CONAE and INIDEP), to co-design and develop data access and analysis platforms relevant to the Argentinian region.	ESA, CONAE	Medium-term
AR003	Near-term activities aiming to align with Argentinian ambitions should synergise with the SABIA-Mar programme	ESA, CONAE	Near-term
AR018	Scope using optical/radar imagery to monitor squid fisheries at night, addressing IUU fishing	ESA, CONAE	Near-term

Action code	Recommended action	Potential action taker(s)	Timeframe
AR022	Ensure co-design and co-development activities for any possible marine-focused regional platform engages with stakeholders representing the Pampa-Azul initiative and the ROMA network.	ESA, CONAE	Medium-term
AR017	Ensure that initial studies encompass the whole continental shelf of Argentina	ESA, CONAE	Near-term

4.3.7. RE-ASSURE INNOVATORS ABOUT FINANCING

Financial surety encourages investment in trans-sectoral innovation opportunities, and confidence to stakeholders and future markets. It reduces risk, and can be leveraged to attract further funding for research, technology development, and innovation applications. Assurance fosters long-term commitment, spurring further innovation and driving sustainable economic growth in regional Blue Economies.

Table 35: Action(s) to promote and encourage investment in Argentina's Blue Economy and activities that harness Space-Maritime innovation opportunities.

Action code	Recommended action	Potential Action taker	Timeframe
AR028	Ensure there are financial resources available to embed cooperation priorities.	ESA, CONAE	Near-term

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ANNEX A: POLICY BRIEFS

Below are four policy briefs, designed for printing and dissemination to higher-level policy and decision makers. The policy briefs exactly align with the various roadmap sections contained in this document, linked by colour.

Detailed actions that underpin each of the higher-level Action Areas noted in the policy brief, can then be appraised in this report.

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Innovation Clusters

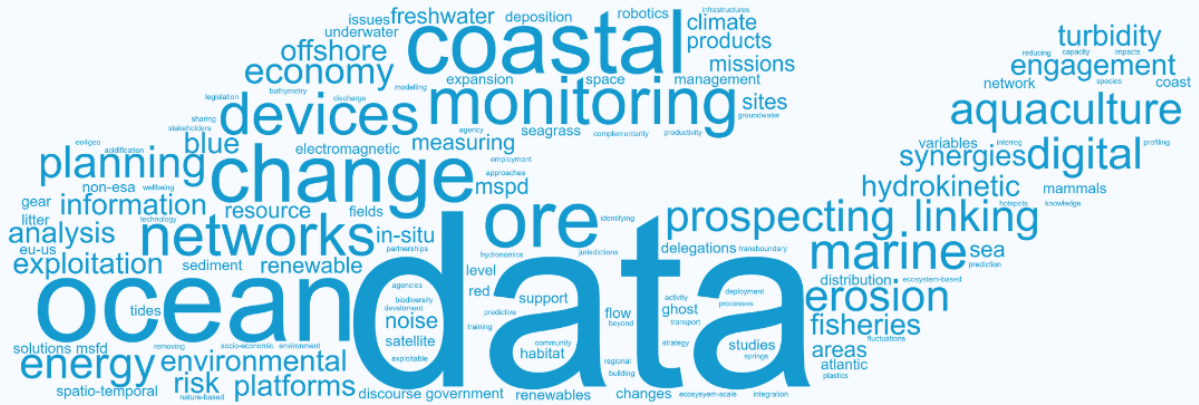
Marine industry and blue economy opportunities are currently underserved by the ESA and other scientific agencies, reflecting a difference in capacity and operational speed between space agencies and maritime stakeholders. This leads to a communication gap, which in turn can restrain innovative dialogue. However, these differences can be easily overcome through targeted facilitated dialogues.

Innovation clusters (IC) can bridge this gap by providing networking and dialogue opportunities, connecting ESA and regional maritime stakeholders. This benefits ESA by having access to a direct line of communication to the heart of regional Blue Economies. Regional maritime stakeholders also benefit from this partnership by having the means to access, understand, and connect to Earth Observation data opportunities.

The goal of ICs is to nurture technological development in support of regional economic development. ICs can have a key role in bringing the best minds together to facilitate mutually beneficial discussions, and can provide opportunities for collaborative problem solving, such as by facilitating the development of roadmaps and advisory papers to determine and refine scientific and economic goals.



Innovation Clusters OPPORTUNITIES



KEY ACTIONS

Recognise regional constraints and current realities
ESA must operate within

Establish a clear role for clusters in the ESA element of the Atlantic innovation ecosystem

Establish connections between ESA and innovation clusters within the Atlantic Regional Initiative

Build the
Atlantic
networks of
networks with
Innovation
Clusters as hubs

Use Innovation Clusters to connect to Atlantic stakeholders

Fund activities that secure connected Innovation Clusters

Address all three elements of the communications triangle:
outreach,
engage, educate

Ensure funded clusters connect and collaborate with key external actors

Atlantic Regional Initiative

The Atlantic Regional Initiative is actively connecting maritime stakeholders to Earth Observation data. It is just the beginning of an ambitious regional journey. Communications and networking between organisations is crucial. Membership of such networks must be mutually beneficial and members must be sensitive to funding and capacity differences between large and small organisations.

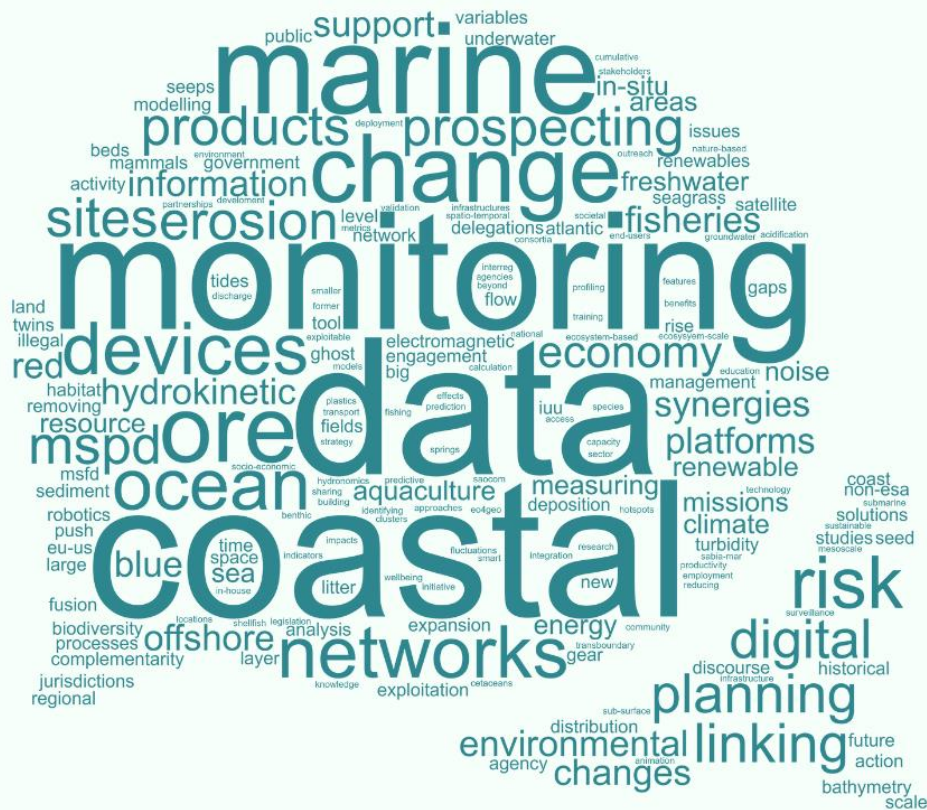
ESA's Atlantic Regional Initiative aims to create an Atlantic Network of Networks (A-NoN). The A-NoN would be tasked with ensuring that opportunities for utilising Earth Observation data, such as satellite data, thermal imaging, and infrared data, are not overlooked but are instead put to use for societal benefits by regional maritime stakeholders, such as businesses, fisheries, and local governments.

Fostering societal benefits is a key goal of the ARI. Knowledge sharing and collaboration between ESA and maritime stakeholders is mutually beneficial, providing ESA with knowledge on what data is needed by stakeholders, and providing stakeholders access to datasets and knowledge on how best to harness data for sustainable development.



Atlantic Regional Initiative

OPPORTUNITIES



KEY ACTIONS

1 Ensure the roadmap addresses key stakeholder concerns

2 Ensure a role for ESA-BICs is clear in the ARI Network of Networks

3 Ensure a role for the World Ocean Council is clear in the ARI Network of Networks

4 Ensure the role for GEO Blue Planet is clear in the ARI Network of Networks

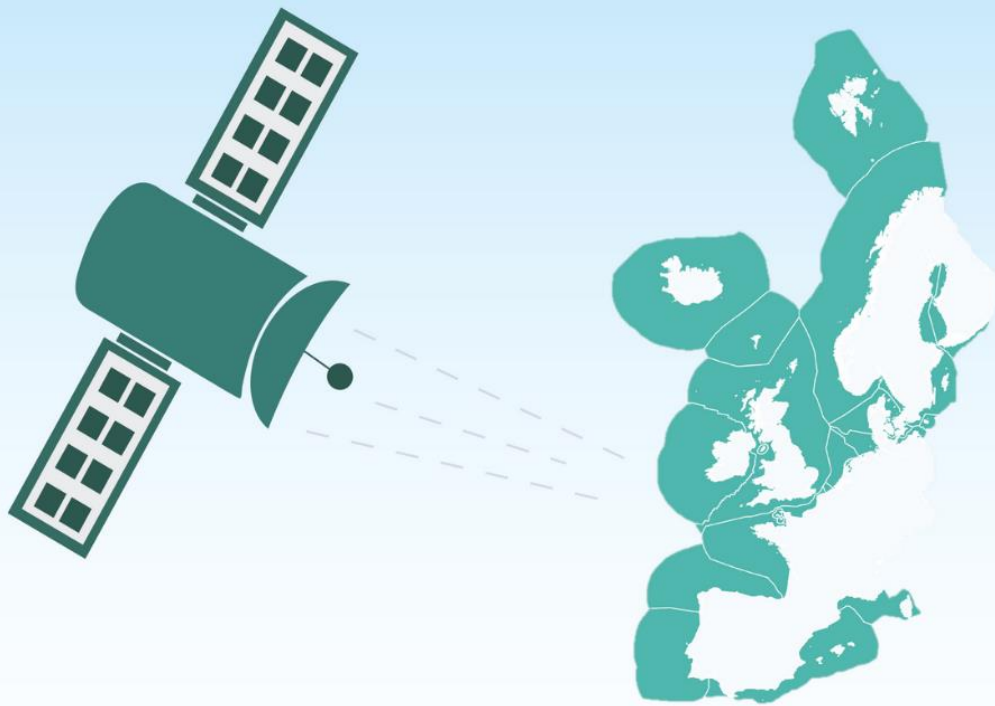
5 Build the Atlantic Network of Networks with Innovation Clusters as hubs

OSPAR

OSPAR is a cooperative and intergovernmental organisation established to protect the North-East Atlantic marine environment. Created by the OSPAR Convention, it allows 15 governments and the EU to work collaboratively towards policies and goals which aim to benefit and protect the North-East Atlantic marine life against pollution, aquatic biodiversity loss, and harmful human activities.

Earth Observation data refers to datasets which are collected by observing the planet from space. When applied to the marine, this can contain information such as on pollution detections, oil spill detections, and monitoring sea ice. Satellite data provides us with the opportunity to observe hard to reach parts of the globe, such as remote seascapes with challenging conditions.

OSPAR can benefit in numerous ways from Earth Observation data. Considering the cross-border impacts of climate change, satellite data can enhance and contextualise existing data from OSPAR member states, simplifying comparison and analysis. OSPAR monitoring efforts would also benefit from access to satellite data, giving OSPAR access to areas of interest beyond national borders.



PEOPLE



NATURE



POLICY

OSPAR

OPPORTUNITIES



KEY ACTIONS

1 Establish
productive
ESA-OSPAR
engagement

2 Help OSPAR
build capacity
to exploit
Earth
Observation
data

3 Provide an
Earth
Observation
data
advisory
service

4 Implement a set
of initial
OSPAR-specific
EO data
demonstrations

Argentinian Stakeholders

Argentina currently does not have a consolidated Blue Growth strategy - however, it has been actively involved in various efforts aimed at harnessing its oceanic potential and promoting sustainable development. Despite not being labelled as a "Blue Growth" strategy, it is clear that Argentina's actions signal a willingness to implement measures promoting sustainable blue growth and economic development.

Argentina's current activities include the Pampa-Azul, SABIA-Mar, and SAOCOM initiatives. These efforts have fostered collaboration between scientific disciplines and have promoted awareness of the importance of the ocean and maritime environment, improved data management, and enhanced Argentina's ability to collect regional Earth Observation data on its oceans.

High-level links need to be established between Argentina and the ESA for the Argentinian oceanic science community to deepen collaboration with ESA, resulting in the development of tailored solutions for Southern Atlantic stakeholders and mutually beneficial outcomes. This will help ESA better understand the needs of Argentinian stakeholders and help Argentina continue its journey towards sustainable blue growth.



Argentinian Stakeholders

OPPORTUNITIES



KEY ACTIONS

Consider the regional southern hemisphere context

Recognise all the communities North and South that have a stake in the Atlantic Regional Initiative's roadmap

Expand regional engagement

Support regional capacity building activities

Connect existing European and Argentinian data programmes and initiatives

Conduct key regional demonstrator activities

Document End



