



Sustainable Blue
Economy Partnership

Sustainable Blue Economy Partnership

Strategic Research and Innovation Agenda 2024



Co-funded by
the European Union

Authors: Kürten B ⁱ, Cappelletto M, Zorgno M ⁱⁱ, Carpino G ⁱⁱ, Magnussøn A ⁱⁱⁱ, Flæten J ⁱⁱⁱ, Areng M ⁱⁱⁱ

Contributors: Angell-Hansen K ⁱⁱⁱ, Baltov M ^{iv}, Björnsson S ^v, Bolton-Warberg M ^{vi}, Boncompagni A ⁱⁱ, Campana E ^{vii}, Danovaro R ^{viii}, De Pascale D ^{ix}, Dumitrache R ^x, Enserink L ^{xi}, Fjeldavli F ^x, Heral M ^{xii}, Kiefer T ^x, Kolu P ^{xiii}, Lehtimäki J ^{xiii}, Leotardi C ^{vii}, Lima A ^{xiv}, Melchiorre C ^{ix}, Olivier J ⁱ, Resende C ^{xv}, Sprovieri M ^{vii}, Stanica A ^{xvi}, Suarez E ^{xvii}, ten Hoopen F ^{xviii}, Tikansak O ^{xix}, Trujillo-Quintela A ^{xx}, van der Boog C ^{xxi}, Vasiliu D ^{xvi}, Weyler E ^{xxix}, and colleagues from the European Commission.

Preferred citation: Benjamin Kürten, Margherita Cappelletto, Margherita Zorgno, Giorgio Carpino, Anne Magnussøn, Jon Flæten, Marianne Areng (2024) Sustainable Blue Economy Partnership – Strategic Research and Innovation Agenda 2024.

DOI: <https://doi.org/10.5281/zenodo.14243414>

Contact info: sbep@mur.gov.it, info@bluepartnership.eu

© Horizon Europe Sustainable Blue Economy Partnership, 2024

Affiliations:

ⁱ FZJ | Forschungszentrum Jülich GmbH, Project Management Juelich (PtJ) DE; ⁱⁱ MUR | Ministero dell'Università e della Ricerca, IT; ⁱⁱⁱ RCN | Norges Forskningsrad, NO; ^{iv} BFU | Burgaski Svobodan Universitet, BG; ^v RANNIS | Rannsóknamiðstöð Islands, IS; ^{vi} MI | Marine Institute, IE; ^{vii} CNR | Consiglio Nazionale delle Ricerche, IT; ^{viii} UNIVPM | Università Politecnica delle Marche, IT; ^{ix} SZN | Stazione Zoologica Anton Dohrn, IT; ^x JPI Oceans | Joint Programming Initiative Healthy and Productive Seas and Oceans; ^{xi} Min I&W | Ministerie Van Infrastructuur En Waterstaat, NL; ^{xii} ANR | Agence Nationale de la Recherche, FR; ^{xiii} AKA | Suomen Akatemia, FI; ^{xiv} AIR CENTRE | Air Centre, PT; ^{xv} DGPM | Direção-Geral de Política do Mar, PT; ^{xvi} GEOECOMAR | National Institute for Research and Development on Marine Geology and Geocology, RO; ^{xvii} UVIGO | University of Vigo, ES; ^{xviii} IFD | Innovationsfonden, DK; ^{xix} FORMAS | Forskningsrådet För Miljö, Areella Näringar Och, Samhällsbyggande, SE; ^{xx} FECYT | Fundación Española para la Ciencia y



Salicornia europaea



TABLE OF CONTENTS

PREFACE		
	Orientation and reader guidance	6
1	OVERVIEW OF THE OBJECTIVES	
	Pillar 1 – A blue economy in harmony with nature	8
	Pillar 2 – Blue economy solutions towards climate neutrality	9
	Pillar 3 – A thriving blue economy for the people	10
2	CORE FEATURES OF THE PARTNERSHIP	
	2.1 High-level Vision	14
	2.2. Why a Sustainable Blue Economy Partnership?	15
	EU Blue Economy trends [2]	16
	General objectives	17
	The Blue Arm of the Green Deal	17
	Context and placement	17
	2.3 Connectivity and synergies	18
	Across the research and innovation landscape	19
	From the global to the local scale	20
	Funding streams	22
3	PILLARS	
	3.1 Pillar 1 – A blue economy in harmony with nature	26
	3.2 Pillar 2 – Blue economy solutions towards climate neutrality	28
	3.3 Pillar 3 – A thriving blue economy for the people	30
3	CROSS-CUTTING ENABLERS	
	Digitalisation	32
	FAIR data	32
	Human capacity building	32
	Ocean literacy	32
	Infrastructures	33
	Social innovation	33
	Sustainable finance	33
	Multi-stakeholder and multidisciplinary approach	33
	Science for evidence-based decision making	34
	Internationalisation and science diplomacy	34
4	IMPLEMENTING THE STRATEGY	
	4.1 Impact pathway	37
	4.2 Implementation plan	38
	4.3 Intervention Areas	39
	Digital Twins of the Ocean	39
	Transitioning Blue Economy Sectors	39
	Management of Sea Uses	39
	Blue Bioresources	39
	Resilient Coastal Communities and Businesses	39
5	APPENDIX	
	Structure of the Partnership	41
6	REFERENCES	43

PREFACE

Orientation and reader guidance

The **Sustainable Blue Economy Partnership** is a key implementation instrument of **Horizon Europe** as 9th Framework Programme for Research and Innovation of the European Union, and is embedded within Cluster 6 - Food, Bioeconomy, Natural Resources, Agriculture and Environment. Horizon Europe partnerships contribute significantly to achieving the EU's political priorities, i.e. drive green and digital transitions that are **impact-driven** and offer **market- and/or policy-oriented solutions** by deploying a broad range of research and innovation (R&I) activities. The partnerships contribute significantly to building a stronger European Research Area (ERA), avoiding duplication of efforts, catalysing investments, and enhancing synergies between R&I programmes at EU and national level.

The **Strategic Research and Innovation Agenda** (SRIA) portrays the vision of the Partnership. It is the framework of reference co-owned by countries, the sea basins and the European Commission to align their sustainable blue economy R&I agendas and to develop impactful green and digital solutions towards joint objectives.

The present **Agenda for the period 2024-2026** of the European Sustainable Blue Economy Partnership represents a development from the first SRIA [1] of the Partnership published in April 2021. It has a stronger emphasis on the impact of the partnership activities^a, and reflects relevant changes of the past years, a situation where the EU countries operate in a transformed global environment and in where key sectors are still recovering from the disruptions caused by the Covid-19 pandemic. This situation gives more urgency to the need for impactful R&I that can support transitions and innovative solutions for the blue economy sectors.

The **first part** of the SRIA introduces the core **R&I objectives**.

The **second part** of the SRIA outlines its **program logic** and **positions it in the policy context**.

The **third part** of the SRIA describes the **Pillars and Enablers** as the foundation of the objectives.

The **fourth part** of the SRIA outlines the strategy for implementation and the approach to achieving impact, offering a brief overview of the thematic intervention areas.

^a Cross-sectoral and cross-disciplinary co-design fortify the SRIA. The present SRIA takes account of viewpoints and recommendations developed during themed strategic workshops held in autumn 2023 on (i) Innovative Governance, (ii) Ocean Observation and (iii) Social Sciences and legal perspectives, in addition to contributions from Member States, Associated Countries and the European Commission. Furthermore, consultations of stakeholders from the network of European sea basins and the Atlantic Ocean facilitated valuable contributions. The SRIA 2024 has been prepared by a drafting group appointed by their member state or associated country, comprehensive, reliable, and consistent data on the condition of the world's ocean, encompassing the physical (Blue), sea ice (White), and biogeochemical (Green) aspects, both on a global and regional level. Access to this valuable information is freely available to the public on a regular and structured basis.

1. OVERVIEW OF THE OBJECTIVES

The **EU Sustainable Blue Economy Partnership** supports accelerating the **green, digital, and social transition** in the blue sectors. Europe promotes the blue economy to drive sustainable economic growth, enhance innovation, create jobs, and ensure the long-term health and resilience of marine ecosystems, which are essential for food security, climate regulation, and overall well-being [2]. The causal transition to a green, digital, and socially-inclusive society also relates to the blue economy, which supports making marine and maritime activities more sustainable, technologically advanced, and equitable. This involves reducing environmental impact, adopting innovative technologies, and ensuring that economic growth in blue sectors benefits all communities while preserving ocean health for future generations.

The Partnership SRIA set the present objectives:

Pillar 1 – A blue economy in harmony with nature

- Enhancing the scientific basis for the sustainable use of living and non-living marine resources.
- Fostering collaboration with the private sector and industry to understand their capacity, needs, and trade-offs for increased pressures from use and multiuse of the ocean and seas in the face of a changing climate and associated extreme events, e.g. in relation to port developments, dredging, and maritime security.
- Introducing innovative technological and circular developments, which follow the 'Rethink, Refuse, Reduce, Reuse, Recycle, Repair' principle (e.g. in R&I of materials).
- Nature-based Solutions (NbS) for sustainable use and protection of marine ecosystems against eutrophication, harmful algal blooms (HAB), non-indigenous species, hazardous substances, litter, introduction of anthropogenic energy (underwater noise, light), overfishing, and physical damage to benthic and pelagic habitats, thereby restoring biodiversity.
- Improving the monitoring of the health of our ocean and seas in concordance with the Marine Strategy Framework Directive (MSFD; Good Environmental Status criteria, GES) requirements of the assessment and predictable frameworks for the industry. Better understanding of (cumulative) impacts of (blue) economic activities from shallow areas to the deep sea in all European seas to improve effectiveness of measures.
- Contributing to understanding and quantifying the ecosystem responses to climate change and direct and indirect anthropogenic pressures on the European sea basins at relevant spatial and temporal scales and in line with the specific requirements of the MSFD assessment framework, e.g. further development of existing and new indicators and related reference and threshold values forming baselines for activities at sea.

- Delivering FAIR data (including socioeconomic and socioecological) and science-based recommendations for coherent ecosystem-based management, including Marine Protected Areas (MPAs), Maritime Spatial Planning (MSP) and multi-use of marine spaces.
- Contributing to the development of tools to support maritime spatial planning (MSP), such as sensitivity mapping or modelling of cumulative impacts.
- Promoting standardisation in innovation and procurement processes to scale up the application of new solutions at higher Technology Readiness Levels (TRL).
- Enhancing and optimising the cost-benefit ratio of ocean and seas' modelling and observation capacities, including fostering the development of sensors, sensor networks and marine robotics, as well as by means of artificial intelligence (AI) and machine learning tools. This will include advancing digital twin technologies and supporting the European Digital Twin of the Ocean (EDITO) initiative.
- Contributing concretely to alignment of national efforts to strengthen activities along the ocean observation value chain and data management and avoid duplication and fragmentation, including innovative governance concepts, e.g. demonstrating the value of ocean observation to society and removal of outdated regulations blocking transformation.

Pillar 2 – Blue economy solutions towards climate neutrality

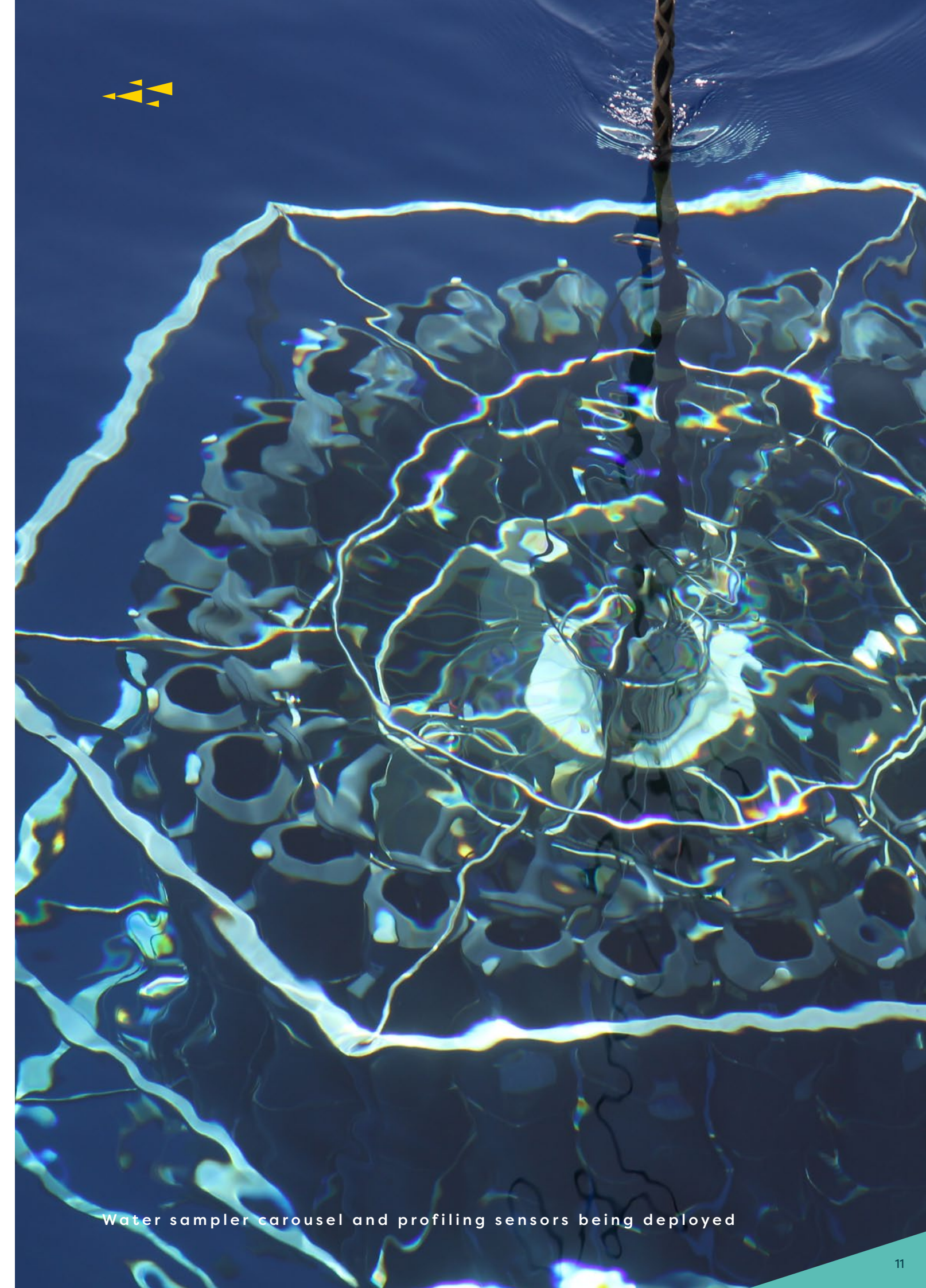
- Developing marine Nature-based Solutions (NbS) to improve resilience to natural disasters, increase natural capital, and restore ecosystems.
- Fostering the carbon sequestration capacity and resilience of coastal and marine environments ('blue carbon'), including related management actions and preventing carbon seepage to the atmosphere caused by humans.
- Support knowledge production and evidence-based recommendations for ocean and coastal resilience by quantifying at regional-scale and across basins the impacts of climate change and related stressors.
- Supporting inventions for upscaling innovation in the renewable ocean energy sector (e.g. wind, wave and tidal energy) and focusing on solutions that reduce the use of energy, materials, and other resources and the impact on marine life.
- Enabling novel materials and technologies for sustainable manufacturing and product life-cycle management.
- Developing sustainable and cost-efficient solutions for construction, maintenance, reuse of multi-use offshore platforms.
- Designing green and smart ports, blue marinas and transport.
- Contributing to innovative and sustainable concepts for small- and medium-sized vessels and recreational boating.



Offshore wind farm

Pillar 3 – A thriving blue economy for the people

- Promote efficient and sustainable use of bioresources through biotechnology, AI, machine learning, digital twins and Information and Communications Technology (ICT). This includes value chain co-development and optimisation within the blue bioeconomy and biotechnology to reduce waste and ensure safe, healthy, affordable, and traceable products within a circular economy.
- Enhance safety and efficiency in maritime operations by advancing autonomous technologies for offshore operations, including underwater deployment and maintenance while reducing risks for humans and the environment.
- Encourage product and process innovation and exploration of low trophic level bioresources, innovate sustainable seafood production systems, including offshore, closed, low- and multi-trophic aquaculture, and low impact sustainable fisheries.
- Strengthen resilience of coastal communities and sectors through preparedness for climatic, geological, and anthropogenic hazards, while analysing community needs, building diverse employment opportunities, and formulating sustainable tourism models valuing coastal and maritime heritage.
- Promote human health and safety by generating knowledge that help mitigating risks from marine-borne pathogens, toxins, harmful algae, toxicants, and pollutants.
- Ensure equitable benefit-sharing in marine activities, including biodiscovery.
- Explore and harness the potential of blue spaces and economies to improve the health and well-being of diverse communities, ensuring equitable access and benefits.
- Foster equity from innovation, circularity, and job creation in coastal communities.
- Foster a community of practice (CoPr) for knowledge sharing and co-creation of skills on advancing the sustainable blue economy.
- Promote financial instruments for inclusion (especially for disadvantaged/marginalised groups) and transparency, while ensuring accountability of key actors.



Water sampler carousel and profiling sensors being deployed

2. CORE FEATURES OF THE PARTNERSHIP

The **Sustainable Blue Economy Partnership** (SBEP, hereafter ‘the Partnership’) is a co-funded partnership under Horizon Europe^b that aims to leverage research and innovation (R&I) to boost the **green and digital transitions of economic activities related to the ocean, seas and coasts**. Together with the European Commission, **30 countries** are strategically joining forces by aligning priorities and pooling about €450 million in-cash and in-kind contributions over seven years that are jointly invested into **transnational joint calls for R&I projects and additional activities**.

The geographical scope of the Partnership adheres to the EU sea basin approach and includes the Atlantic and Arctic Ocean, Baltic Sea, Black Sea, Mediterranean Sea, and North Sea, covering more than 11 million km² (**Fig. 1**) [3]. By creating a community of R&I stakeholders across this expanse, the Partnership supports far-reaching **innovative, impactful, market-oriented** economic and science-policy interface developments.

Arctic Ocean

Atlantic Ocean

North Sea

Baltic Sea

Black Sea

Mediterranean Sea

^b Horizon Europe is the key EU's research and innovation framework program with a budget of €95.5 bn (2021-27). [Horizon Europe – European Commission \(europa.eu\)](https://european-commission.europa.eu)

Fig. 1: Map of partner countries in 2024 and geographical reach of the Partnership (highlighted in darker blue). Considered are European and adjacent waters in the basins bordering the EU including the Atlantic and Arctic Ocean, Baltic Sea, Black Sea, Mediterranean Sea, and North Sea.

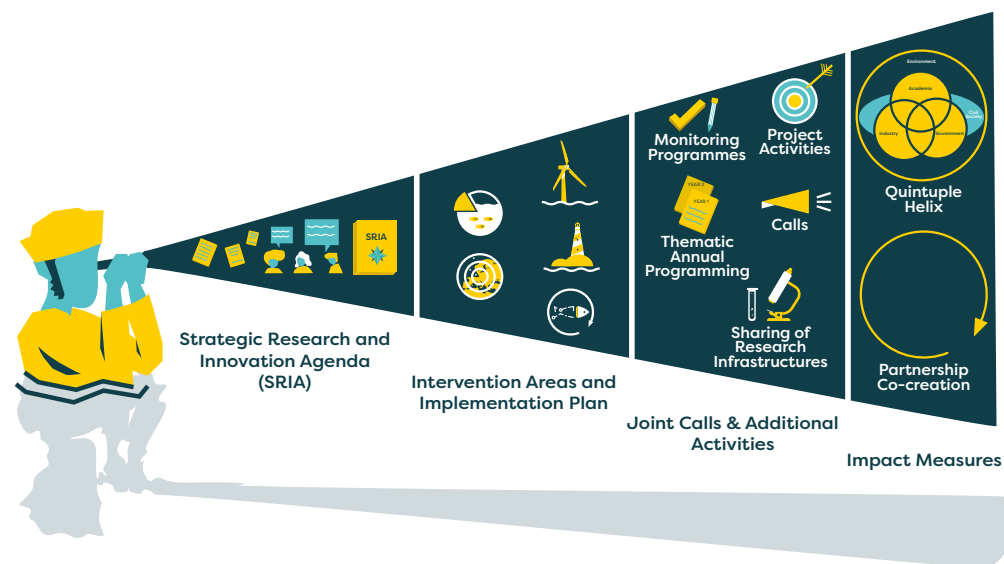


Fig. 2: The EU Sustainable Blue Economy Partnership architecture features its Strategic Research and Innovation Agenda, the Intervention Areas and the operational Implementation Plan, the joint R&I calls and additional activities, and impact measures. The Partnership approach entails actions to manage, monitor and ensure the impact of its co-funded R&I projects and additional activities. The Partnership features co-creation, community building and capacity enhancement principles reflecting the quintuple-helix innovation model (c.f. Fig. 3).

Anchored to the **Pillars and Objectives of the SRIA**, the architecture of the Partnership (Fig. 2) sketches a set of impact-oriented Intervention Areas offering routes towards sustainable and digital solutions and approaches to the complex challenges the blue economy is facing.

The **Intervention Areas** point to specific needs for R&I activities and investments through **joint impact-oriented R&I calls** and a range of **additional activities**, e.g. alignment of monitoring programmes, portfolios of projects, and sharing of research infrastructures. The Intervention Areas and their implementation through partnership activities are described in the **Implementation Plan** for the period 2025-27^c.

2.1 High-level Vision

The vision articulates what the Sustainable Blue Economy Partnership aims to achieve:

- ▶ **Design, steer and support a just and inclusive transition to a regenerative, resilient and sustainable blue economy.**
- ▶ **Boost the transformation towards a climate neutral, sustainable, productive and competitive blue economy by 2030.**
- ▶ **Create, enhance and sustain ocean health and the social, environmental and economic well-being of the people by 2050.**

2.2 Why a Sustainable Blue Economy Partnership?

The just transition towards a sustainable blue economy involves and affects numerous sectors of our society.

The global ocean and its marginal seas constitute the largest ecosystem on Earth and offer a large variety of essential services. The ocean and seas are not only sources of sustenance, energy, food, and other marine resources, but also play a vital role in global trade and recreation. The blue economy sectors, which are industries related to the ocean, seas and coasts, contribute substantially to the economy in Europe. They generate around €623 billion in total turnover and employ around 3.6 million people, particularly in regions where there are limited employment alternatives [2].

The blue economy sectors have **substantial economic potential** and prospects to contribute to both sustainable development and prosperity and reducing the human impact on the environment. Ports and harbours constitute foundational infrastructure hubs and provide essential services for many **blue economy sectors** [2], including those in the domains of *marine living and non-living resources, marine renewable energy, coastal tourism, maritime transport and blue biotechnology^d*. Coastal tourism employs 1.9 million people and is the largest sector in the blue economy [2], followed by maritime transport, which facilitates global and connected markets. Globally, Organisation for Economic Co-operation and Development (OECD) estimates suggest a doubling of value added generated by ocean-based industries from 1.5 trillion USD to 3 trillion USD between 2010 and 2030 [4].

At the same time, the ocean and seas are subject to cumulative pressures

from human activity and accelerating climate change, resulting in declining resilience of our seas, and endangering ecosystems and the services they provide. Global warming is likely to exceed 2 °C by 2050 [5], potentially leading to significant ecological disruptions and the crossing of irreversible tipping points, accompanied by substantial costs and negative impacts on the EU's natural capital and well-being of citizens. Climate change is expected to lead to significant losses in marine biodiversity, shifts in biogeography, and severe impacts on fisheries, aquaculture, coastal infrastructure, and communities. This will also affect tourism, recreation, shipping, and transportation. In fact, the anticipated losses will be exacerbated by climate-induced disasters like sea level rise and more frequent extreme weather events, contributing to overall economic losses that could reach trillions of USD by 2100 [6].

Altogether, these scenarios underscore the urgency to address these challenges with substantial efforts to mitigate climate change, adapt to its impacts, and avoid the significant economic, social, and environmental costs associated with inaction. Against this background, the **Sustainable Blue Economy Partnership** sets goals to grapple with these grand pressures and support the development of **impact-oriented innovation for the blue economy** through concerted R&I efforts and collaboration across countries and sectors. Since many opportunities for the transformation of the blue economy are situated at the interface of the marine and maritime space with other sectors and disciplines, the blue economy is, therefore, a quintessential framework for ensuring that the ocean and its resources can continue to support human well-being, economic prosperity, and environmental health in the long-term.

^c The Implementation Plan is publicly available upon completion and approval by the General Assembly. The Intervention Areas for 2025 are briefly sketched in Section 4.

^d Blue biotechnology - This sector includes the non-traditionally commercially exploited groups of marine organisms and their biomass application. Macro- and microalgae, bacteria, fungi and invertebrates are important marine resources used inter-alia as feedstock in the Blue Bioeconomy.

EU Blue Economy trends



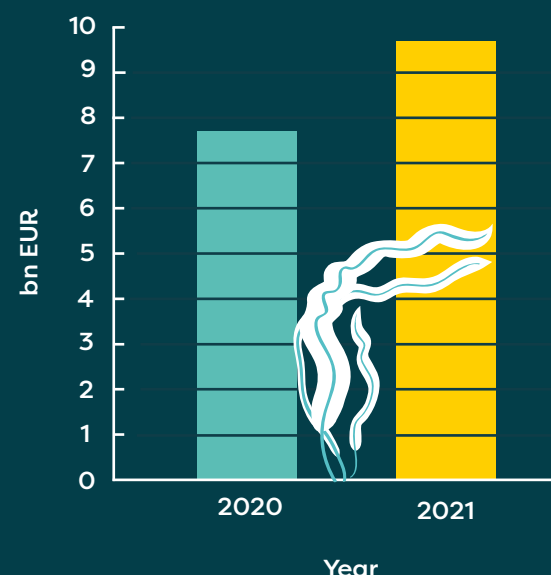
€623.6 billion
 turnover

€171.1 billion
 gross value added

€76.4 billion
 gross profit

3.59 million
 employed

Marine living resources: gross profits



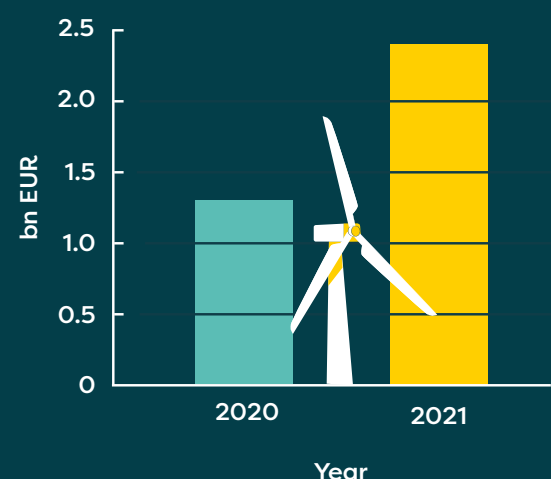
Coastal tourism remains the largest part of the EU Blue Economy sectors, accounting for 54% of employment and 29% of the Gross Value Added, followed by **Maritime transport** (11% and 26%, respectively) and **Port activities** (11% and 17%).

In terms of growth, the EU Blue Economy Report 2024 particularly highlights two sectors:

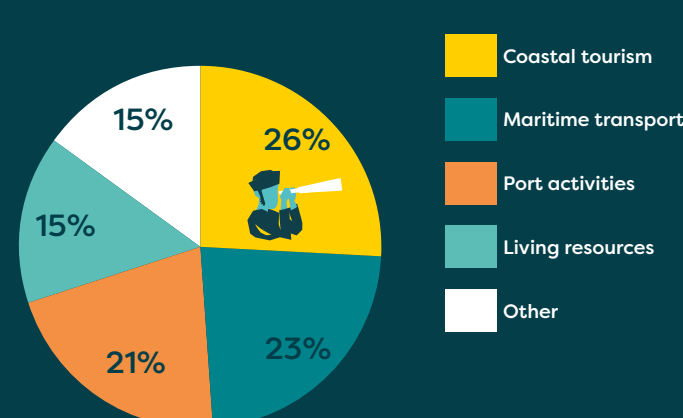
Marine living resources experienced an increase in gross profits by approximately a quarter from 2020 to reach €9,7 billion in 2021.

Marine renewable energy – mainly offshore wind – saw an even more substantial growth, almost doubling the gross profits in a year reaching an estimated € 2.4 billion in 2022.

Marine renewable energy: gross profits



Gross value added per blue economy sectors in 2021



Note: Indicators from EU Blue Economy Report 2024, data from 2021.

General objectives

The general objectives embed the Partnership in the global policy framework of the United Nations (UN) 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs) [7], the EU policies and strategic autonomy strategies, chiefly the European Green Deal [8], Digital Europe [9], Next Generation EU [10], the Eighth Environment Action Programme (8th EAP) [11], and marine regulatory legislations. The activities of the Partnership pursue:

- **Supporting** the Green Deal and Digital transformation to a modern, resource-efficient and – through excellence in sustainability – competitive economy with no net emissions of greenhouse gases by 2050.
- **Enabling** R&I cooperation in the blue economy in Europe and beyond through a portfolio of projects and actions reducing fragmentation across disciplines, sectors, geographical areas and communities to respond to policy strategy.
- **Advancing** sustainability and resilience of blue economy sectors by promoting joint projects that enable new blue jobs and skills, engage citizens, and fully contribute to the well-being of coastal and maritime communities.
- **Developing** innovative governance frameworks, contributing to the removal of outdated regulations that hinder progress, and advancing fit-for-purpose legal frameworks to support transformation.

The Blue Arm of the Green Deal

Playing a central role in the transition of the ocean economy envisioned in the European Green Deal, the Partnership follows the EU COM agenda *Transforming the EU's Blue Economy for a Sustainable Future for the blue economy* [12], and supports the EU Mission: Restore our Ocean and Waters [13]. The Partnership contributes to Europe's efforts to overcome the major challenges posed by climate change and biodiversity loss and responds to global societal disruptions such as

post-COVID-19 pandemic recovery, the energy crisis, and the need for strategic competitiveness. Therefore, the Partnership is perceived as the *Blue Arm of the Green Deal*.

Context and placement

To address global challenges and promote sustainable development, the UN adopted Sustainable Development Goals (SDGs) [7] and prompted cooperation and harmonisation of institutional and legal frameworks. Through its program logic, the Partnership primarily contributes to SDG 14 (Life Below Water), while also supporting several other SDGs^e through its activities.

Following the adoption of the UN SDGs, investment strategies worldwide increasingly support enabling **green and digital twin transition** initiatives. The twin transition, embodied in the Partnership, refers to two interdependent global transformations aimed at fostering sustainability and strengthening economic competitiveness. It provides solutions such as energy and resource efficiency as well as cost savings for the blue economy. The components of the transition are mutually reinforcing, with digital R&I and technology solutions playing a crucial role in advancing the green economy. Digitalisation can enable smarter energy systems, reduced energy consumption, improve environmental monitoring and management, optimise resource utilisation, facilitate circular economy practices, and empower individuals and communities to participate in sustainable development efforts.

The Partnership brings momentum, speed and directionality towards shared high-level goals for a **Just Transition**^f, in which societal and environmental changes are guided by principles of **fairness, equity, and justice**, with a focus on ensuring that no one is left behind in the pursuit of a more sustainable and prosperous future. As conceived by the UN, the blue economy promotes “sustainable economic competitiveness, social inclusion, and the preservation or improvement of livelihoods while at the same time ensuring environmental sustainability of the ocean and coastal areas”. This accentuates the need for

^e Other SDGs relevant for the Partnership 'Zero Hunger' (2), 'Good health and well-being' (3), 'Affordable and clean energy' (7), 'Decent work and economic growth' (8), 'Industry, Innovation and Infrastructure' (9), 'Sustainable cities and communities' (11), 'Responsible consumption and production' (12), 'Climate action' (13), and 'Life on land' (15).

^f Broadly defined as ensuring that no one is left behind or pushed behind in the transition to low-carbon and environmentally sustainable economies and societies ("Just Transition", Committee for Development Policy, United Nations, 2023) CDP-excerpt-2023-1.pdf (un.org)

global cooperation across borders and sectors, where governments, organisations and decision makers cooperate to ensure their policies alignw and support each other in reaching common objectives [14]. Accelerating the just transition within the EU is essential for ensuring its global prosperity – it meets the needs of the present without compromising the ability of future generations to meet their own needs, and balances social, economic and environmental concerns (IPCC, 2022).

The Partnership takes a proactive approach in promoting sustainable development and finance, which could help to address environmental and social challenges while also **creating new opportunities** for economic activities and development in balance with the long-term capacity of ocean and seas ecosystems to support these activities and remain resilient and healthy. The Partnership will also contribute to address the skills gaps that are identified to achieve the just green and digital transition, including the need to exchange and transfer knowledge to vulnerable communities and enhance their **skills development**, as further highlighted in the human capacity building enabler (see 3.4).

2.3 Connectivity and synergies

A holistic approach that balances economic development with social equity and environmental protection is a prerequisite for the transition to a sustainable blue economy. To ensure that environmental and societal needs, as well as socio-ecological synergies, are adequately considered, the Partnership supports the **5'-helix concept**, which encompasses the natural environments of society and the economy as drivers of knowledge production and innovation, thereby defining opportunities for the **knowledge-based economy (Fig. 3)**. The concept underscores the importance of and potential for a knowledge society and knowledge economy, both of which are pivotal in fostering innovation for sustainable, climate-neutral development. Furthermore, the Partnership provides science-policy support through its co-design structure, which is designed to navigate the complexities inherent in policy and technology. By doing so, it creates an enabling environment that fully acknowledges these complexities. To effectively address this complexity and optimize the impact of engagement, the Partnership *builds a community* around ocean and seas R&I stakeholder by establishing **co-design** mechanisms that operate at the interface of science-policy-business-society.

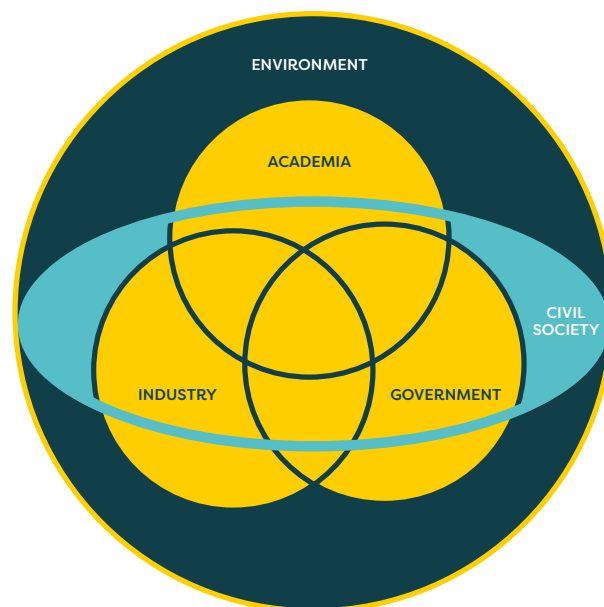


Fig. 3: The quintuple helix innovation model (5'-helix) underpins the formation of a **win-win situation between ecology, knowledge and innovation**, creating synergies between economy, society and democracy by co-creation (Figure adapted from [15]).

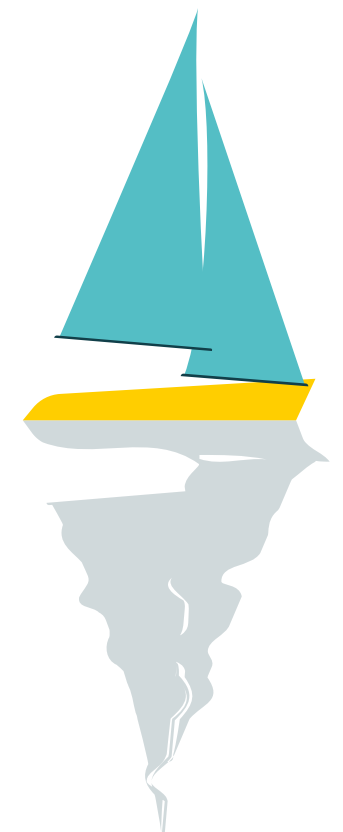
Across the research and innovation landscape

Through its cross-sectoral and transdisciplinary approach, the Partnership aims at coherence and complementarity of activities with other EU initiatives. Many of the research priorities and activities of the EU and of single nations are similar and thus offer an opportunity for pan-European alignment over all European sea basins. Transnational cooperation is likely to increase its impact and bring important benefits, such as addressing jointly common challenges, developing common solutions, overcoming barriers for market uptake and reducing operating costs. Additional advantages include pooling data and expertise, achieving higher scientific, technological and innovation impacts, eliminating cross-European programme duplication, increasing programme depth, and reducing management costs.

Accordingly, this Partnership SRIA takes into account commonalities among existing SRIAs from the EU sea basins. In brief, the Partnership builds on the legacy of European Research Area Networks (ERA-Activities) such as the Cofund ERA-NET on Blue Bioeconomy (BlueBio) and Maritime and Marine Technologies for a New ERA (MarTERA), the Article 185 initiatives Baltic Sea Research and Development Programme (BONUS) and the Partnership for Research and Innovation in the Mediterranean Area (PRIMA), as well as at regional scale the Blue Growth Initiative for Research and Innovation in the Black Sea, BLUEMED, and the All-Atlantic Ocean Research and Innovation Alliance (AANChOR). The respective roadmaps were supported by Horizon 2020-funded Coordination and Support Actions (AORA-CSA, AANChOR-CSA, BlueMed CSA, Black Sea CONNECT, BANOS CSA) and offer demonstrated achievability of policy targets at sea basin scales, allow common issues to be jointly addressed and facilitate the development of national marine and maritime strategies for a climate neutral, sustainable and productive blue economy in a consistent way.

In addition, the Partnership will foster symbiotic synergies with other EU Partnerships (**Fig. 4**) and key initiatives such as the Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI Oceans). The Partnership will also complement the EU Mission Restore our Ocean and Waters, for instance, through thematic and regional portfolios of projects in conjunction with the area-based Mission Lighthouses, and communities of actors.

The Partnership's activities also target all relevant scientific disciplines including social sciences and humanities and promote inter- and multi-disciplinary approaches. Co-production processes, where diverse disciplines converge and interact with non-scientific knowledge (practical, place-based, contextual), are crucial for a just and inclusive transition of the blue economy, especially for emerging sectors facing economic, social, and environmental ethical challenges, as well as those requiring systemic behavioral and socio-economic change [16].



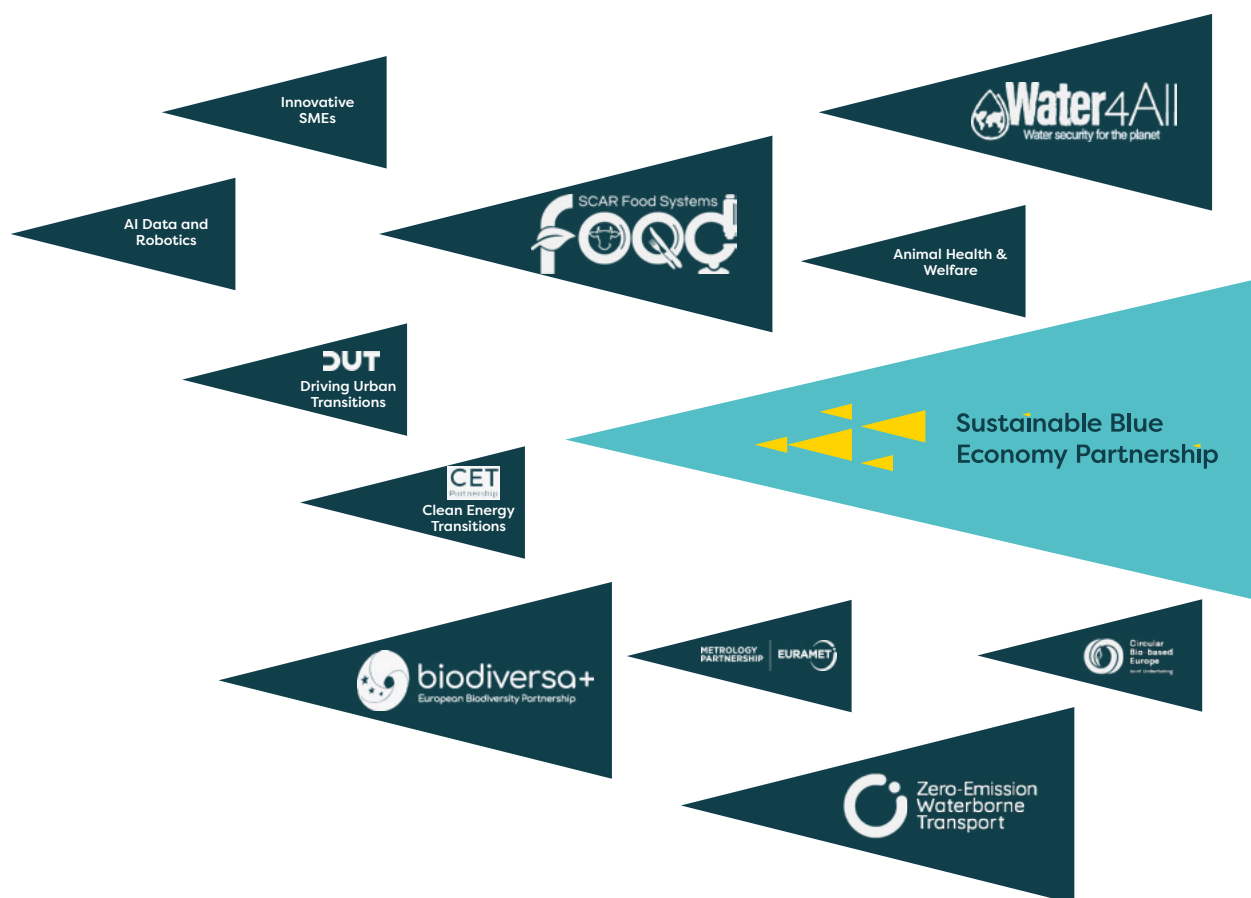


Fig. 4: Interactions and collaborations of the Partnership include the EU Partnerships ‘Rescuing biodiversity to safeguard life on Earth’ (Biodiversa+), ‘Water Security for the Planet’ (Water4All), ‘Zero-Emission Waterborne Transport’ (ZEWT), ‘Driving Urban Transitions’ (DUT), ‘Clean Energy Transition’ (CETP), ‘Circular Biobased Europe Joint Undertaking’ (CBE-JU), ‘Sustainable Food Systems Partnership for People, Planet and Climate’ (SFS), ‘European Partnership on Innovative SMEs’ (Innowide), ‘European Partnership on Animal Health & Welfare’ (PAHW), ‘Artificial Intelligence, Data and Robotics’ (ADR). Interactions are foreseen with the European Partnerships on ‘Resilient Cultural Heritage’ and on ‘Social Transformations and Resilience’.

From global to the local scale

The connectedness of the global ocean urges on international perspective and cross-border cooperation.

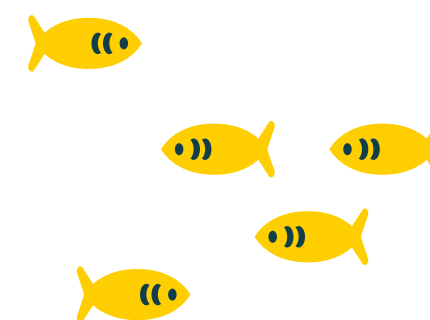
By embedding the globalisation principle of *think global – act local*, the Partnership promotes interconnected international and regional connectivity. For that reason, its alignment with EU Programmes and global agendas is deeply integrated into its **international liaison and widening strategy**. The international dimension of the Partnership adheres to the principle of **leaving no one behind** and considers the need of encouraging the participation and the urgency of engaging with

countries sharing the same sea basin, including from the EU neighbouring countries, and creating a level playing field towards fair return, global sustainability, and mutual relevance⁹.

In the **global dimension**, the Partnership strengthens international cooperation and connects with relevant actors and organisations from the policy field, aligning with the EU’s strong commitment to the UN Decade of Ocean Science for Sustainable Development and its Vision 2030 process [17]. Moreover, the activities of the Partnership support and align with activities of the Group of Seven and its ‘Future of the Seas and Oceans Initiative’ (G7 FSOI) [18], as well as the

‘Chennai High Level Principles for a Sustainable and Resilient Blue / Ocean-based Economy’ of the Group of 20 (G20) [19]. Since areas beyond national jurisdiction comprise around two-thirds of the ocean’s surface, some activities of the Partnership concern supporting the EU commitment to respective legal frameworks. This includes, for example, the UN ‘Biodiversity Beyond National Jurisdiction’ Agreement (BBNJ [20]^h), concurrent with the EU ‘International Ocean Governance’ agenda [21].

As an instrument of Horizon Europe, the geographical reach of the Partnership spans EU and adjacent waters in the **regional sea basins** bordering the EU, including the Atlantic and Arctic Ocean, Baltic Sea, Black Sea, Mediterranean Sea, and North Sea (**Fig. 1**). Strong bonds and exchange of practice with the regional communities ensure aligned action at EU level (see also Draft SRIA¹).



Altogether, the Partnership works collaboratively with governments, international organisations, and stakeholders to promote the implementation of policy frameworks such as the Common Fishery Policy (CFP) Data Collection Framework (DCF) [22], the Water Framework Directive (WFD [23]) and the Marine Strategy Framework Directive (MSFD) [24]. The latter requires EU member states to establish **national strategies** to achieve or maintain **Good Environmental Status (GES)**. On this account, the Partnership liaises in particular with the **Regional Sea Conventions (RSCs)**, which support their contracting parties in the implementation of the MSFD through their regional and national marine monitoring and assessment programmes. The relevant conventions include the:

- (i) Convention for the Protection of the Marine Environment in the North-East Atlantic (OSPAR),
- (ii) Convention on the Protection of the Marine Environment in the Baltic Sea Area (HELCOM),
- (iii) Convention for the Protection of Marine Environment and the Coastal Region of the Mediterranean (UN Environment Programme – Mediterranean Action Plan (UNEP-MAP),
- (iv) Convention for the Protection of the Black Sea (Black Sea Commission), and
- (v) EU Atlantic Strategy and associated Revised Atlantic Action Plan 2.0.

Compliance with EU Directives is required for EU member states to develop and implement marine strategies for the protection and sustainable use of marine waters.

- The EU Marine Strategy Framework Directive (MSFD) aims at reaching Good Environmental Status (GES) in all European seas, delineating the ecological boundaries of sustainable use in a coherent manner, and thereby supporting a level playing field for economic sectors.
- The Partnerships’ Member States, collaborating in the four Regional Sea Conventions, have defined the research needed to comply with the MSFD legislation and work towards coordinated and integrated ecosystems-based management (EBM). These regional science agendas account for regional characteristics and provide concrete research topics that the Partnership will address.
- The Partnership supports integrated and sustainable approaches, i.e. ecosystem-based management, for which observation and modelling of the marine realm facilitate more comprehensive understanding of ocean dynamics, and which sets baselines against which to assess the greening and needs at policy / governance level for decision-making and planning (as per maritime spatial planning directive, MSP). Observation and modelling also supports the development of effective management strategies, and ultimately MSFD compliance.

⁹ In 2024, the Partnership included Brazil, Georgia, Ukraine, and Tunisia as partners.

^h The BBNJ aims to govern activities such as fishing, shipping, marine protected areas and other conservation measures in areas beyond national jurisdiction, bioprospecting, marine genetic resources and benefit sharing, technology transfer and knowledge-sharing and scientific research in the high seas and to balance the conservation and sustainable use of marine biodiversity.

Regional connectivity (including indigenous communities) creates synergies and produces a strong pan-European voice for the sustainable blue economy. In return, the Partnership features close contact with a dedicated network of regional contact nodes, i.e. sea basin contact persons from the Partnership members established in each basin. Their role is to provide specific coordination support by informing about developments and needs of each region of relevance for the co-design of activities of the Partnership. This connectivity contributes to the agility of the Partnership and bridges the sea basins / Atlantic and Arctic Ocean and EU dimensions. Building on interregional cooperation instruments such as Smart Specialization Strategies (S3¹) and innovative governance models into the development of regional and thematic portfolios of projects facilitates the market uptake of the innovative solutions supported by the Partnership.

Funding streams

By following its internationalisation roadmap, the Partnership promotes synergies of funding streams by engaging with managing authorities of European Structural and Investment Funds (ESIF [25]), including the European Regional Development Fund (ERDF [26]) and the European Maritime, Fisheries and Aquaculture Fund (EMFAF) [27], as well as other funding sources such as the LIFE programme, the post-Covid19

Recovery and Resilience Plan Next Generation EU [28], [27], the Instrument for Pre-Accession Assistance (IPA III [29]), and the Neighbourhood, Development and International Cooperation Instrument (NDICI) [30]. Additional contributions from major EU funding programs are supporting the implementation of the Partnership. Furthermore, the Partnership fosters synergies between different funding sources through activities such as the formation of clusters for Thematic Annual Programming (TAP) and the alignment of national monitoring programmes.

To enhance the impact of R&I investments in transforming the blue economy, the Partnership will support initiatives that bridge the gap between invention and innovation, bringing products, services, technologies, and processes to both public and private markets. Partnering with initiatives such as the EU BlueInvest [31], is therefore important to connect entrepreneurs, start-ups, small and medium-sized enterprises (SMEs) and projects in the blue economy sectors with investors, financial institutions and venture capital funds, which will be important to secure high TRL level funding and quality control on their business models and market potential. Providing access to expertise and leveraging broader innovation support networks facilitate the realisation of concepts, products, or services even after the conclusion of Partnership funding.

EU Taxonomy compliance

- The Implementing and Delegated Regulation act for the EU Taxonomy establishes a general framework for financial private market investments and blended funding.
- The EU Taxonomy creates a common language used to direct investments to projects and economic activities that have a substantial positive impact on climate and the environment.
- R&I is an integral part of the EU Taxonomy Regulation as an “enabling activity” with its capacity to improve the performance of economic activities through technologies, products or services it provides.
- Partnership activities contribute substantially to the sustainable use and protection of water and marine resources in line with the environmental objectives of the EU Taxonomy criteria for economic activities and the “Do no harm or do no significant harm” principle.

¹ The Smart Specialisation Strategy (S3) is a place-based innovation policy concept to support regional prioritisation in innovative sectors, fields or technologies through the ‘entrepreneurial discovery process (EDP)’, a bottom-up approach to reveal what a region does best in terms of its scientific and technological endowments (https://www.interreg.europa.eu/sites/default/files/inline-files/Smart_Specialisation_Strategy_S3_-_Policy_Brief.pdf)



Mytilus galloprovincialis

3. PILLARS AND CROSS-CUTTING ENABLERS

The SRIA sets the foundation for the partnership by identifying the **directionality**. The R&I activities of the Partnership segment into **three thematic pillars** and ten **cross-cutting enablers** (Fig. 5). Each pillar is supported by specific objectives, which are informed by scientific evidence and stakeholder input. They pivot around **sustainability, climate neutrality and productivity** and contextualise the objectives and strategic directionality of the Partnership. Attributable to the complexity and high interconnectivity featured in the Partnership framework, the pillars cut across among each other, vary in size and scope, and depict various target opportunities for impact-creation support hinging on innovative governance. The wide reach of the pillars and enablers echo the high ambitions in advancing knowledge and collaboration for resilient and improved ocean governance.

Pillar 1 outlines science support for policy and decision making as well as sustainable use activities and monitoring. **Pillar 2** focuses on topics beyond the major policy drivers such as MSFD and outlines routes towards sustainable uses and strengthened climate change mitigation. **Pillar 3** promotes a sustainable, resilient, and equitable and circular bioeconomy. The **enablers** depict essential catalysts to achieve the **objectives** formulated for each pillar (for objectives see **Section 1**). The enablers are critical for ensuring that the activities are not only effective but also scalable and adaptable to different regional contexts.

“...when you cannot measure it, knowledge is of a meagre and unsatisfactory kind, [but] it may be the beginning...”

(William Thomson, 1889 [33])

A knowledge base for the blue economy

The current knowledge of the ocean, in terms of its physics and dynamics, might be close to sufficient for alerting the society and governments about many of the existing or emerging threats of climate change. However, there is a strong exigence for more specific knowledge based on accurate measurements and its systematic delivery and application to enable effective and efficient actions toward sustainability at the global and regional levels [32]. Supporting **knowledge production, creation and generation about the ocean and seas** forms a **central tenet** of the Partnership activities, because the diverse information about our ocean and seas serves as the foundation for strategic planning, performance evaluation, and resource and space allocation.

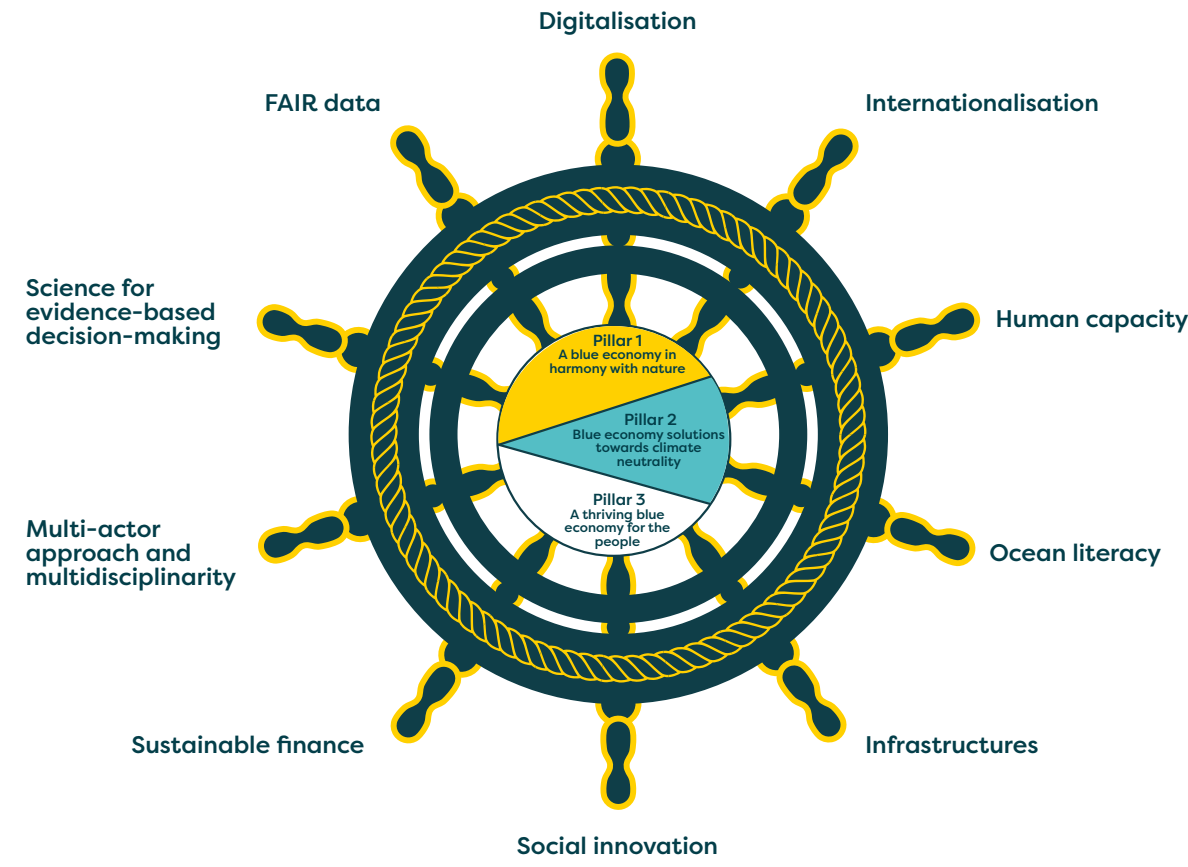
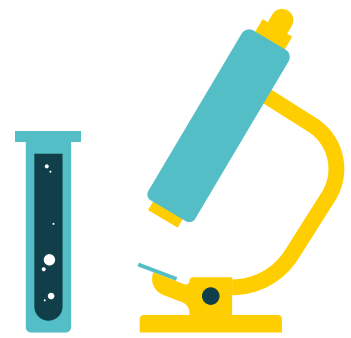


Fig. 5: Overview of the pillars and enablers of the EU Sustainable Blue Economy Partnership.

Observing, monitoring and forecasting are key for the development of a productive and truly sustainable blue economy, as impact-driven solutions must gauge and account for the needs and limitations of organisms, food webs and ecosystem metrics, which underpin health and well-being. All-encompassing, ocean observation^j facilitates understanding of climate patterns, variability and change, monitoring environmental health, supporting marine navigation and safety, management of marine resources, monitoring and predicting natural hazards, and supports a wide range of other scientific research endeavours.

Accordingly, connectivity and synergistic activities of the Partnership with initiatives and organisations in the

fields of ocean observations, data management, and marine research at the international and EU level include (not exhaustive): EU Copernicus Marine Services (CMS; implemented by Mercator Ocean International, MOI), the EU Global Satellite Navigation System (GNSS; Galileo), the European Ocean Observation System (EOOS), Global Ocean Observing System (GOOS; coordinated by the Intergovernmental Oceanographic Commission, IOC of UNESCO), the European GOOS (EUROGOOS), Food and Agriculture Organization of the United Nations (FAO), International Council for the Exploration of the Sea (ICES), the European Marine Observation and Data Network (EMODnet), the European Marine Board (EMB), and the Scientific, Technical and Economic Committee for Fisheries (STECF).

^j Here, ocean observation refers to the systematic collection, monitoring, and analysis of data related to various physical, chemical, biological, ecological, socio-economic, and geological characteristics. It involves the use of remote sensing, observation platforms, sensors, instruments, and technologies to gather information about ocean and seas' conditions, processes, and phenomena.

3.1 Pillar 1 - A blue economy in harmony with nature

► *How can the blue economy contribute to the sustainable use of marine resources and to the restoration and regeneration of marine ecosystems?*

Knowledge for evidence-based decision making and sustainability

Promoting and accelerating a truly sustainable blue economy will contribute to set biodiversity in Europe on a path to recovery by 2030. Adopting an **ecosystem-based approach to manage marine resources sustainably** will help alleviate unsustainable pressures from human activities and climate change, while enhancing marine ecosystem services. To provide the knowledge to determine the status, resilience and capacities of EU and adjacent waters in the sea basins bordering the EU are the aims of the **Pillar 1**.

This knowledge will support sustainable blue economy solutions, which will help regenerating marine ecosystems, restoring marine biodiversity, and assessing trade-offs between alternative strategies in terms of supporting ecosystem dynamics and socioeconomic needs. This is attainable by (i) adequate environmental monitoring, including ocean observation and forecasting techniques and networks, and (ii) generating a thorough understanding of the positive and negative impacts of the blue economy on ecosystem health. Moreover, multi-use developments such as for energy and aquaculture (e.g. energy islands^k) are a part of this integrated approach, as they have the potential to optimise multiple ocean uses while maintaining ecosystem services.

Ocean observation value chains

The overall approach should involve a sustained alignment of national efforts and activities to strengthen the ocean observation value chains (including data management) and avoid duplication and fragmentation. This will enable a more constant and continuous observation and monitoring of maritime activities and of the biological, chemical, physical, geological, and hydrological

parameters of ocean and seas' ecosystems in combination with socio-economic data.

Maritime Spatial Planning (MSP) has emerged as a crucial tool in this context, playing a pivotal role in supporting the ecosystem-based approach to achieve Good Environmental Status (GES).

Ocean Accounting is also fundamental – i.e. the thorough understanding of ecosystem functioning (incl. ocean observation) and delivery of ecosystem goods and services to society, understanding of who benefits from marine ecosystem services, and how the collective and often cumulative pressures of human activities impact on those functions.

Efforts aimed at supporting and developing ocean observing and forecasting systems must be guided by an ecosystem-based approach to management of human activities (hereafter Ecosystem-based Management, EBM), alongside considerations for sustainable development, particularly in socioeconomics.

Enhanced capabilities through the development of innovative sensors and sensor networks should be attained. This can be complemented by innovations on underwater connectivity, including real-time communication to land-based data centres and platforms, as well as deep integration of *in situ* and remote sensing observation.

Solutions in harmony with nature

New information and knowledge will provide both a benchmark of the effects of economic activities on marine ecosystems and the feasibility of continued or new economic activities, as well as adequate considerations of historical and cumulative impacts in relation to ecosystem services and other societal needs. At various scales from the national to the EU scale, this can contribute to the assessment framework of the MSFD.

Preventing and reducing marine and coastal pollution, including the introduction of energy sources such as underwater noise and light pollution, is crucial for a blue economy that is in harmony with nature.

Innovative and nature-based reduction and remediation solutions (**Nature-based Solutions**, NbS) will be identified to prevent, minimize, and remediate pollution and other pressures on the marine environment.

Adopting a circular approach, energy efficiency, and optimising and reducing the input of resources by use of tools such as Artificial Intelligence (AI), machine learning and digital twins will succeed the linear 'take-make-use-dispose' production-consumption practice. Accordingly, the use of innovative bio-based and biodegradable new material (see also Pillar 3) will be a focus for the reduction of pollution. Other forms of pressures, such as seafloor disturbance, habitat loss, hydrological and biogeographic changes (incl. non-indigenous species) need to be considered.

Management for sustainability

Effective implementation of EU policies such as the Common Fisheries Policy (CFP) and the MSFD faces challenges due to insufficient understanding of the cumulative human impacts on marine ecosystems. This makes it difficult to establish consistent criteria for assessing Good Environmental Status (GES), leading to inconsistencies in how member states apply these directives. R&I efforts are needed to improve indicators, criteria and effective measures for implementing relevant directives across borders (see also Pillar 3).

Involving stakeholders from the outset (5' helix) is important for science-policy interface developments such as implementing MSP, EBM and Integrated Coastal (Zone) Management (ICZM), because of needs for trade-offs and opportunities such as of multi-use. On this account, the 5' helix approach is fundamental for social acceptance. Efforts will also focus on finding solutions to enhance transboundary governance integration, particularly at the sea basin scale. Key priorities include understanding interactions between ecological and socio-economic systems, legal frameworks, and institutional deployment, with emphasis on EBM across member states. Solutions and demonstrations, that enable coastal member states to successfully implement EBM for their marine space and resources, should be developed

through operational assessment frameworks and drawing on coherent and accessible tools and evidence, including best practices developed through international collaborations. Intelligent digital support systems and tools will be used to support decision-making for the public and private sectors.

Digital twins for sustainable economies

Digital twinning approaches differ between the domains of oceanography and social sciences from applications in industry. In ocean observation and social sciences, digital twins are conceptual frameworks used to model and simulate complex systems, such as ocean ecosystems or social phenomena, in virtual environments.

In the **ocean observation domain**, Digital Twins of the Ocean (DTOs) aim to enhance understanding, prediction, and decision-making by replicating real-world dynamics and interactions by integrating data from various sources, such as satellite observations and ocean sensors to model ocean currents, temperature patterns and marine ecosystems. These models support the ecosystem-based approach in MSP and ICZM, thus contributing to sustainable management of marine resources and coastal areas. Similarly, in **social sciences and humanities**, digital twins can also be used to simulate human behaviour and societal trends (e.g. tourism), or coastal developments based on demographic data, historical trends, and social dynamics. In both domains, digital twins aim to enhance understanding, prediction, and decision-making by replicating real-world dynamics and interactions.

In **industry settings**, digital twins are virtual replicas of physical **assets, products, or processes**, such as machinery or manufacturing workflows, focused on improving efficiency, reliability, and productivity through proactive maintenance, troubleshooting, and performance optimization. These digital twins leverage real-time sensor data, IoT (Internet of Things) connectivity, and advanced analytics to monitor, analyse, and optimise performance, maintenance, and operations, including autonomous transport systems.

^k The concept of multi-use (incl. energy islands) aims to harness the abundant renewable energy resources available offshore to support the transition towards a low-carbon energy system and meet the growing demand for clean electricity. R&I may also include infrastructure for power transmission, energy storage (also in form generated hydrogen and associated Power-to-X platforms, where hydrogen can be used to produce synthetic electrofuels, and grid connection to distribute the generated electricity to nearby coastal regions or mainland areas.

Co-design activities are anticipated to encourage enterprises to leverage the digital ocean twins when delivering new products and services. Maritime sectors will benefit from the developed data products and tools to reduce their costs and risks and opportunities. Developing new business models, including on observations, delivering their benefits to society and policy, and sharing data with existing data infrastructures to enrich Europe's **Findable, Accessible, Interoperable, and Reusable (FAIR)** data offering is stimulated.

Connecting **Digital Twins of the Ocean** (DTOs) with digital twins used in industry and technology Research and Development (R&D) can enhance the efficiency and sustainability of offshore operations by providing comprehensive insights into both environmental factors and operational performance. Harmonisation of data collection, sound data management, and abundant delivery of diverse FAIR data and optimal use of existing global and national marine observation and data systems are crucial elements that support sustainable ocean management and innovative governance. AI and advanced Information Communication and Technology (ICT) will create a smart digital environment – the Digital Ocean¹ – and which comprises large FAIR databases (including, when possible, socio-economic data), models, and simulation tools superimposed on the physical space.

3.2 Pillar 2 - Blue economy solutions towards climate neutrality

► *How can the blue economy contribute to climate resilience and climate neutrality by 2050?*

Achieving the goals of the Paris Agreement and the European Green Deal will require the rapid deployment of **climate neutral solutions across the blue economy**. Greenhouse gas (GHG) emissions must be reduced to net zero by the middle of the century through decarbonisation of all economic activities as well as the removal and storage of carbon dioxide (CO₂) from the atmosphere, also known as negative emissions. The present substantial growth of the marine renewable energy

sector (see **EU Blue Economy trends, page 16**) and anticipated multi-use will further intensify **competition for marine space** and exacerbate **cumulative impacts** on the integrity of marine ecosystems.

The activities outlined in **Pillar 2** aim at solutions to the potentially conflicting demands for space and resources from various sectors such as environmental protection, aquaculture, fisheries, tourism and associated marine curio trade^m, and at interventions that mitigate the impact of such uses on the environment, marine biodiversity, sea users and coastal communities.

Coastal and marine infrastructures, operations, facilities, and amenities

Intricate and interconnected relationships characterise the terrestrial (land-based) and marine (sea-based) environments – the **land-sea nexus**. Most sea-related activities and offshore operations are directly connected to and have a significant impact on coastal and land-based infrastructures, including their operations, facilities, and amenities. Coastal and marine infrastructures – for instance for energy and the associated electricity transmission and distribution lines to and within ports, akin desalination and wastewater treatment plants providing for land-based water uses – altogether feature critical components for sustainable development and economic prosperity.

The development of multi-use platforms and focused efforts on the multi-use of marine space must consider circular-inspired design and the end-of-life phase. New methodologies and co-development of research priorities and objectives are important to identify suitable installation sites, considering climate change effects on marine ecosystems and shifting human uses. Yet, the various stakeholders, each engaged in a wide array of tasks and responsibilities, have differing priorities when it comes to development. Hence, understanding and managing the land-sea nexus is essential for achieving sustainable development goals, preserving biodiversity, and mitigating the impacts of human activities on marine ecosystems and coastal communities.

Transformative changes and simplification in **ocean governance** based on multidisciplinary and interdisciplinary scientific knowledge and an ecosystem approach to management will ensure the provision of ecosystem services, effective management of the ocean and seas in balance with infrastructure and operational requirements and resources. In fact, EU seaports are of great economic and strategic importance as hubs of maritime and continental supply and value chains. Ports, harbours and marinas are the EU's gateways to the world, playing a crucial role in the economy by facilitating external trade, **connecting land and sea**, supporting industrial production, and driving prosperity in the blue economy and energy transition. They also form an indispensable basis for our prosperity by featuring important infrastructures and centres of attraction for tourism from all over the world. Through smart design and development, ports and marinas can be transformed into 'green' hubs for sustainable trade and transport in commercial sectors and tourism, which aligns the Partnership activities with the development of a **European port strategy [34]**. Hence, the economic success of ports depends largely on the optimisation of their surroundings (e.g. spatial prioritisation), making a sustainable and socially responsible approach to transport and supply chains, including the ports as hubs themselves, essential.

To enhance the maritime domain's intelligence, circularity, and multi-use efficiency, cross-sector technological cooperation aimed at fostering innovation must be actively promoted. This includes also transport networks and (renewable) energy supply infrastructures (e.g. alternative fuels, electrification) in ports, which are governed thus far through separate sectoral policies. Furthermore, the development of novel materials and technologies that enable flexible manufacturing and full lifecycle management of products and constructions is also crucial. More cost-efficient and climate neutral platforms as well as ships must be developed, based on innovative methods for construction, maintenance, and multiple use, but also for reuse for secondary purposes after decommissioning.

Carbon and ecosystems

Human activities can alter the ability of marine ecosystems to sequester carbon and often even cause the release of carbon dioxide, which the International Tribunal for the Law of the Sea recently ruled is a form of pollution in the sea [35].

Research in this area will extent from the focus on filling knowledge gaps about carbon uptake and storage processes **by developing solution-oriented approaches** and informing management strategies about **Nature-based Solutions (NbS)** in line with the EU Biodiversity Strategy 2030 [36] and the EU Action Plan Towards Zero Pollution for Air, Water and Soil [37]. It will also investigate the release of (sub-)marine carbon (e.g. methane and carbon dioxide) into the atmosphere, how climate change will affect this, and what measures can prevent unintended carbon seepage (for example, reducing bottom trawling as effective ocean-based option to limit carbon dioxide emissions [38]). Mapping, quantifying, understanding, preserving, and restoring coastal and marine ecosystems are crucial for sequestering and storing carbon from the atmosphere, including important blue carbonⁿ initiatives. It also requires a sound understanding of trade-offs such as reducing bottom trawling to reduce climate impacts.

Moreover, it is particularly important to monitor and strengthen resilience to expected climate-induced changes and related stressors, such as ocean warming, ocean acidification, sea level rise, extreme weather events, changing weather patterns and oxygen depletion. Hence, the envisaged ecosystem conservation, management and restoration interventions will contribute to both climate change adaptation and mitigation, develop opportunities for regional and local solutions, and thereby restore coastal resilience and ecosystem services that support local and indigenous communities.

It is important to tailor the Partnership's R&I efforts to complement the EU Mission Restore our Ocean and Waters by fostering a participatory approach that empowers local stakeholders and encourages their long-term commitment to protecting and restoring our ocean, seas, and waters. Hence, effective

¹ The digital ocean concept broadly describes the digitisation of ocean-related data, technologies, and solutions. It entails efforts to leverage digital technologies such as satellite-based remote sensing, in situ sensor networks, data analytics, and artificial intelligence (AI) to better understand, monitor, and manage the oceans. Digital ocean initiatives may include projects related to ocean observation, marine research, environmental monitoring, maritime safety, and sustainable ocean management. The goal is to harness digital innovations for various challenges facing the world's oceans, including climate change, pollution, overfishing, and habitat degradation.

^mCollection of live and dead corals, seashells, and turtle shells for the trade in for example ornaments, curios and jewellery (<https://www.oceansatlas.org/subtopic/en/c/116/>)

ⁿ Blue carbon refers to the carbon captured and stored in coastal and marine ecosystems, primarily in mangroves, salt marshes, and seagrasses, which play a critical role in mitigating climate change by sequestering atmospheric carbon dioxide.

contribution of social science disciplines and inclusion that enhance the societal impact of the related innovation activities is supported.

3.3 Pillar 3 – A thriving blue economy for the people

► *How can the blue economy contribute to people's health, well-being and prosperity in a sustainable, resilient and equitable way?*

The vision of a **thriving blue economy for the people** builds on the promotion of a sustainable, resilient, and equitable contribution to human health, well-being, and prosperity. Recognizing the significance of robust economic development opportunities and the quality of marine and coastal ecosystems, the Partnership addresses sustainable food sources, bioactive compounds, recreational possibilities (including in rural areas), and fosters the development of employment opportunities for all-inclusive transitional developments that endorse the 'Rethink, Refuse, Reduce, Reuse, Recycle, Repair' principle of sustainability.

Pillar 3 entails the progression towards a greener blue bioeconomy, alleviating pressures on marine resources and contributing to global food security through the promotion of sustainable products. The pillar also aims to yield benefits for coastal communities, businesses, and the environment, with a specific focus on providing fair and secure employment opportunities for those connected to the seas and ports. Simultaneously, it emphasizes ecosystem protection and restoration for the diverse benefits, which people derive from productive and healthy coastal and marine ecosystems.

A just and equitable transition

Understanding the interconnected importance of the ocean and seas for environmental health, economic prosperity and human well-being, including justice and equity, is crucial. Through a 5' helix approach, a *Just Transition* can be reached in alignment with the indications of the European Economic and Social Committee (EESC) [39]. Establishing a truly sustainable and just blue economy in the long term requires equity – particularly given the

challenges posed by non-standardised data collection and reporting systems used in assessing the implications of green policies on social policies.

Under this pillar, the Partnership addresses a just and inclusive transition to more sustainable sectoral supports and assessment of effectiveness and impact of subsidies to encourage equality rather than advantage of a few actors. The aim is to contribute to cultivating social contributions and fair distribution of the costs associated with the EU Green Deal, stimulating new economic activities (e.g. aquaculture, renewable energy sites, low-impact fishing), tourism, and circular bio-based production, but also encouraging and supporting people in the transition via skills development, quality of education and training at all career levels. Social mobility can also ease how communities, based on non-green industry, can embed new economic activities.

Establishing science-based safe and sustainable thresholds for economic operations through co-creation, such as those established under the MSFD, is crucial within the EU Taxonomy frame of reference. A fair and just transition of Europe's blue economy will depend on finding solutions across all sectors that achieve sustainability and climate neutrality whilst safeguarding competitiveness and equitable access to jobs in the sustainable blue economy.

In the R&I objectives, one of the focuses is on achieving sustainability, accessibility, security, and safety in food, feed, and bio-based products. The sustainable growth of the blue bioeconomy also depends on enhancing circular use of bioresources through e.g. blue biotechnology and ICT. This involves optimizing and developing value chains, reducing waste, implementing circular practices, exploring low trophic level bioresources (see Pillar I), innovating seafood production systems, and addressing **Illegal, Unreported, and Unregulated (IUU)** fishing, the latter comprising also research on social behaviour and preventive incentive systems.

Understanding 'Blue Benefits'

Regardless how far away we live from the ocean and seas, its healthiness is imperative for many reasons, from sourcing of critical medication and nutritious diets to providing new

medicines and space for recreational activities [40]. Hence, when developing ocean-based opportunities – **blue benefits – for health and well-being**, it is crucial to consider the potential users and their diverse and various priorities and values. In fact, new knowledge production can improve our understanding of the potential of blue spaces, including health impacts, products for health and well-being as well as recreation, harnessing digitalisation and Nature-based Solutions (NbS) to mitigate health risks, and advocating for equity in activities related to marine biodiscovery of e.g. pharmaceuticals, nutraceuticals, and cosmetics. Strategies for achieving equitable sharing of benefits arising from their uses could include e.g. obtaining prior informed consent and negotiating benefit-sharing agreements with local communities, promoting inclusiveness in decision-making processes, and protecting traditional knowledge.

Safety and Security at Sea

With the dual goals of **enhancing maritime safety** and supporting a sustainable blue economy, Pillar 3 targets secure offshore operations, including underwater cables and pipelines relevant for e.g. energy

transmission and communication. This involves the advancement of autonomous technologies, the minimisation of risks associated with novel maritime technologies and materials, and the contribution to efficient maritime surveillance. Furthermore, these new technologies and robotics, alongside complementary innovations such as AI, data analytics, marine sensors, and the use of digital twins to optimize resource utilization, will help reduce environmental impacts and improve decision-making processes.

Resilient Coastal Activities and Communities

In the marine and **coastal tourism sector**, innovative solutions need to be developed and economic opportunities identified while prioritising disaster risk reduction through improved resilience and preparedness. The goal is to build **community resilience**, create diverse employment opportunities, and formulate sustainable tourism models, in balance with needs for coastal and marine protection, heritage protection, and restoration. This is accomplished through participatory approaches and multi-stakeholder engagement, involving the co-design of objectives and priorities.



3.4 Cross-cutting enablers supporting the transition

The success of the European Green Deal twin transition within the sustainable blue economy relies on various enabling factors that facilitate the achievements of a particular goal, objective or outcome of the thematic pillars.

Digitalisation

Digitalisation provides rapid, remote data on marine environments and maritime activities, alongside new disruptive technologies. The EU Destination Earth (DestinE)^o flagship initiative as well as the digital ocean concept will grant access to digital tools, while Digital Ocean Twins advance science, education, innovation, and governance. Digitalisation further supports start-ups, SMEs, and existing enterprises in creating new business models, products, and services, while also enhancing sustainability and performance in existing blue economy sectors. Additionally, digitalisation can advance **ocean literacy**, thereby fostering a more informed society with a stronger connection to the ocean and seas. This will be important to engage the young generation, attract young talents to the blue economy sectors, whilst digital skills development will form an important driver ‘to leave no one behind’.

FAIR data

Access to reliable, quality-controlled and harmonised research and monitoring data across marine disciplines and human activities is vital for a sustainable blue economy (c.f. Enabler: Science for evidence-based decision-making). This data supports innovation, enhances our understanding of marine ecosystems, assesses human (cumulative) impacts, reduces costs for maritime operators, informs decision-making, promotes good governance, and boosts ocean literacy. Data adhering to Responsible Research and Innovation (RRI) principles will align with FAIR principles, addressing temporal, spatial, and thematic data gaps.

Sound data management is a prerequisite for unlocking the full potential of data, enabling

organisations to derive insights, drive innovation, and achieve their goals effectively and responsibly. Well-managed data provides the foundation for informed decision-making whether in scientific research, business operations, or policymaking. Therefore, the Partnership contributes to the future EU initiative on ocean observation, including research infrastructures, in the development of a common European ocean data space connected to the European Open Science Cloud (EOSC) and European Green Deal data spaces, and contribute to the development of Digital Twin Ocean and the EOOS. Industry partners as key stakeholders are also encouraged to support EOOS development.

Human capacity building

Addressing skills gaps requires closer science-academia-industry cooperation. Enhancing human resources involves not only training, reskilling, and upskilling individuals for emerging blue economy sectors, but also incorporating blue skills into the equation. This involves aligning higher-education curricula with early career networks, offering transdisciplinary MSc and PhD programs with a focus on blue skills, and promoting mobility exchanges. Additionally, preparing the next generation involves connecting them to e-mentoring platforms, establishing virtual incubators, and leveraging digital technologies for training in blue skills. These ocean- and seas-related skills are competencies and knowledge areas specifically relevant to industries and activities associated with the marine environment including marine sciences, maritime engineering, navigation, fisheries, aquaculture, marine technology, conservation, policy, and Ocean Literacy.

Ocean literacy

An ocean literate society contributes to better ocean stewardship, increases the possibilities for sustainable blue innovation, and drives investments in sustainable blue economy enterprises. Educating and enhancing societal understanding of the importance of ocean health and of the resources and services the seas and ocean offer to

society, encourages behavioural change. Citizen science and social innovation deepen engagement, raise awareness of ecosystem services and human impacts, and promote social responsibility among not only European citizens, but also targeting industry from the blue economy sectors and beyond.

Infrastructures

Leveraging national investments and optimising the use of the research infrastructure serving marine and maritime R&I activities is the key to support a coherent, strategy-led approach. These actions require pan-European collaboration with global outlook, i.e. cooperation at international scale for R&I sharing and access to infrastructure to leverage the complementarity of various observation platforms. With its activities, the Partnership complements the European Strategy Forum on Research Infrastructures (see ESFRI Roadmap 2021 [41]), its associated projects and matured *Environment Landmarks* such as EURO-ARGO ERIC [42], and the Advance Marine Research Infrastructures Together (AMRIT) initiative. Openness and access to commercial facilities for education, testing, demonstration or technology transfer will provide science extension services and contribute to increased public awareness and societal involvement.

Social innovation

As reasoned in the *EU Strategy on Adaptation to Climate Change* [43] and the **Green Deal**, climate change will impact at all levels of the society and across all sectors of the economy, so adaptation actions must be systemic. However, actions strongly depend on awareness about climate risks and the opportunities a sustainable blue economy offers, societal preparedness, and social acceptance as premise for investment in and scaling-up of mitigation actions. Social innovation can result in changes of attitude, behaviour and perception, lead to new or improved ways of collaborative action and develop new institutional structures [44], thereby contributing to systemic change, the *socioecological transition*. It can help to identify shared value opportunities amongst different stakeholders and result in new solutions to environmental

problems by providing a local context to global issues. This will be fundamental to translating overarching R&I objectives into local solutions and will facilitate community-led innovation. The improved exchange of knowledge, new expertise, innovations and solutions are strengthened through the 5'-helix model (**Fig. 3**) and can be, or at least offer, a solution for the challenges of sustainable development under the aspect of global warming. [15]

Sustainable finance

Public finances of EU member states face substantial risks from climate change, even in the near-term. Costly climate extremes can result in increased government expenditures, reduced tax revenues, lower credit ratings, and increased cost of borrowing [45]. **Sustainable finance** has a key role to play in enabling the transition of the blue economy to sustainability. By supporting sustainable economic activities, it reduces the pressures on the marine environment and its resources, taking social and governance aspects into account. This will ensure increased **long-term investments in sustainable projects** and activities. It will also incentivise key blue economy actors to undertake the required transition to a climate neutral, climate-resilient, resource-efficient, and just blue economy. Recently introduced EU taxonomy disclosures, corporate sustainability requirements and the broader EU framework for sustainable finance, are likely to improve predictability and oversight of the risks and opportunities in improving sustainability [45]. The Partnership will support projects that are EU taxonomy compliant and qualify for financing by the European Investment Bank under the InvestEU Programme.

Multi-stakeholder and multidisciplinary approach

Transformative change requires the ability to transfer strategies to programs and actions at local level. Within the blue economy, this is demanding due to complexity and fragmentation of the very broad range of stakeholders and sectors involved from regional to pan-European level. Developing a **Community of Practice** (CoPr) as an open discussion platform can be important to deliver on the

^o <https://destination-earth.eu>

Partnership vision at strategic and operational level. Multidisciplinary approaches are essential to integrate diverse perspectives, expertise, and methodologies to approach the complex challenges addressed by all pillars. Together, multidisciplinary and multi-actor approach are the key to reaching the objectives of this SRIA, enhancing the reliability, demand-driven nature, and societal relevance of the R&I processes and their outcomes. The Community of Practice will contribute to long-term alignment, generate higher efficiency, and strengthen Europe's competitive position in an inclusive manner. Connectivity to other ERA actions, in particular relevant partnerships and missions under Horizon Europe [46], will be an important asset to nourish ideas on how the SRIA can evolve and foster synergies with neighbouring initiatives. Relevant results such as those of the **European Blue Forum** [47] discussions and position papers can be considered and connection with existing communities promoted, such as with the **Energy Transition Partnership for EU fishery and aquaculture** [48]. As the current SRIA addresses a wide range of complex global issues aligned with the SDGs, engaging with international organisations in the ocean sphere can also offer a valuable platform for gathering ideas to incorporate into the Partnership under the Community of Practice purview.

Science for evidence-based decision-making

Dialogues between policy, industry, society, science and academia play a crucial role in **supporting evidence-based decision-making**. By using scientific knowledge to inform policy frameworks, policymakers can develop more effective and trustworthy policies, evaluate their impact, and adapt them as needed to ensure the sustainable adaptive management of marine resources and protection of the marine environment. Scientific evidence also allows for the **adaptation of policies in response to changing environmental conditions, emerging challenges, and new scientific insights**. By harnessing these digital capabilities, stakeholders can better understand the complex dynamics of the ocean and seas' environment and develop policies and strategies that promote sustainable

management and protection of marine resources, while ensuring that decision-making remains evidence-based and responsive to changing conditions. Conversely, research performing organisations and funding programmes enhance their societal relevance by generating knowledge and data to be used by policymakers. It is imperative that policy-science needs and scientific projects align with, and address knowledge gaps identified in policy research agendas, while ensuring data is available in formats accessible to policy makers. On this account, the Partnership activities align with those of the regional sea conventions. Moreover, beyond the sphere of public governance, science can play an integral role in decision-making in for-profit businesses across the blue economy sectors, e.g. decision science in **support of risk management strategies** or in understanding **customer preferences and behaviour**.

Internationalisation and science diplomacy

International cooperation is crucial to unlock economic opportunities, foster sustainable development across borders, protect the marine environment, promote innovation, and strengthen diplomatic relations at global scale. Enabling international cooperation involves liaising with relevant EU and international countries and organisations, promoting openness, a level playing field, and respect for fundamental rights and values. This includes facilitating access for new countries through contributions across various assets, including funding and research infrastructure sharing.

Internationalisation in climate and environmental science is indispensable for evidence-based decision-making to combat the climate and biodiversity crises, reduce vulnerability, and enhance technological strategic autonomy. Collaborating with other countries in the blue economy domain builds mutual bonds, fosters trust, and advances shared goals (e.g. security and sustainable development). As a global leader committed to climate neutrality, the EU continues to spearhead international efforts and address environmental challenges alongside major world economies and greenhouse gas emitters by pooling global efforts to tackle global challenges together [49].

Science diplomacy strategies play a major role in accelerating the transition to climate neutral and sustainable practices. The internationalisation strategy outlined in the Partnership not only emphasises cooperation but also pursues **widening** as an element of internationalisation. Multilateral R&I draws on inspiration from successful models such as the All-Atlantic Ocean

Research and Innovation Alliance (AAORIA) [50]. Alliances such as AAORIA serve as valuable frameworks for collaboration, knowledge exchange, and joint action, facilitating the achievement of common objectives in ocean research and innovation. By building on proven models of cooperation, a **sustainable development at a transnational level** can be further strengthened.



Fish market in Barcelona, Spain



Cargo ship transport

4. IMPLEMENTING THE STRATEGY

The **SRIA** outlines the original overarching goals and priorities of the Partnership, and the **Implementation Plan** (see paragraph 4.2) translates these strategic objectives into actionable routes. The connection between these two, i.e. the strategy and its operational development, essentially ensures effectiveness in meeting sustainability and innovation goals.

4.1 Impact pathway

The **Impact Pathway approach** underpinning the intervention logic of the Partnership towards the implementation phases can be schematically divided into four stages: *inputs, outputs, outcomes, and impacts*^p. Consistent with the EU Sustainable blue economy agenda, the four central pathways to impact of the Partnership comprise:

- ▶ *Contribute to the green, digital and social transition.*
- ▶ *Catalyse the transformation of ocean economy value chains towards climate neutrality by 2050.*
- ▶ *Deliver ocean knowledge and impact-driven R&I for supporting smart, green and digital solutions.*
- ▶ *Enable R&I cooperation in response to international, EU and national regulations and policies.*

The Partnership's **impact orientation** implies that its activities will be measured on its ability to transform the blue economy making it more sustainable and digital (products, processes, technologies, services to the public and private sectors). To ensure this, the impact orientation is embedded from the vision through the SRIA to the implementation and Partnership activities. Only then, solutions have the potential to reach the market and/or be integrated in policy. Despite substantial investment in research and the generation of innovative ideas, many initiatives struggle to overcome the hurdles of regulatory approval, funding for large-scale deployment, market readiness, and industry adoption. To enhance its impact orientation on this account, the Partnership puts efforts into supporting its co-funded projects in overcoming the 'valley of death'^q by informing about pitfalls and providing guidance on funding opportunities at higher Technology Readiness Levels (TRL). The activities will be implemented through a fit-to-purpose co-design process, **engaging potential users of project outcomes** from the start, to ensure that inventions are transformed into innovations across public, societal, and private sectors. At the project level, private sector investment, including through suitable instrument and typology of contribution will be encouraged where relevant to impact, according with the TRL.

^p Impact pathway approach: Mapping out the sequence of events, activities, and causal relationships between inputs (resources and efforts), activities (actions taken), outputs (direct results of activities), outcomes (immediate changes or effects), and impacts (longer-term changes or effects) of a program, project, or initiative.

^q The "Valley of Death" refers to the critical gap between research and innovation (R&I) and the successful commercialization or implementation of new technologies, products, or solutions. It describes the stage where promising projects fail to move from the development phase to the market or broader application. For the blue economy, it is particularly significant due to the complex and multidisciplinary nature of the marine and maritime sectors. Despite substantial investment in research and the generation of innovative ideas, many initiatives typically struggle to overcome the hurdles of regulatory approval, funding for large-scale deployment, market readiness, and industry adoption, project, or initiative.

Additionally, measures will be explored to leverage private sector funding, creating synergies, critical mass, and complementarities with other actions, Missions, and Partnerships.

The SRIA and the Implementation Plan describe the general objectives of the Partnership (long-term societal impacts), its specific objectives (expected outcomes), and operational objectives (actions). This alignment is in accordance with the general monitoring and evaluation framework of European Partnerships, facilitating the progress towards the Horizon Europe's objectives and EU priorities. The joint performance of actions by the Partnership is anticipated to lead to the expected outcomes and to deliver the Partnership's impacts.

In line with the objective of Horizon Europe to generate impact-driven R&I projects and to create significant societal and environmental impacts, the Partnership will assess the impact of the projects funded through calls, that are expected to articulate how specific activities and inputs will lead to desired outcomes and how they contribute to the overall impacts defined (**Theory of Change**). This encourages a holistic and forward-thinking approach to program design, emphasizing the need to consider both short-term and long-term outcomes and impacts. By weaving innovation tightly with strategy at each stage of development, from inception to scaling, one can harness inherent strengths and industry expertise to deliver innovative solutions that not only advance sustainable practices but also contribute tangibly to bottom-line sustainable growth.

Self-monitoring and evaluation are key component of an initiative oriented to impact. A set of **Key Performance Indicators** (KPIs) to monitor progress and track advancement toward the objectives has been developed by the Partnership and will be relevant also to inform the EC Biennial Monitoring Reports (BMRs) [51].

4.2 Implementation plan

The Partnership establishes impact-oriented **Intervention Areas** that identify specific needs for research, innovation activities, and investments, offering actionable routes and concrete steps to tackle the challenges, tensions, and opportunities within the blue economy. As the objectives of the Partnership are interconnected, each Intervention Area covers several objectives spanning across more than one thematic pillar.

The implementation of the SRIA through Intervention Areas requires a concerted and well-planned effort. To ensure a timely and focused approach that covers the full range of key themes within the Intervention Areas, the Partnership is developing an **Implementation Plan**. This plan offers operational guidance setting out in detail the timeframes and action modalities through which the Intervention Areas will be implemented over a three-year period. The modes of implementation can be through **actions** such as joint R&I calls, alignment of Thematic Annual Programming (TAP), portfolios of projects, alignment of monitoring programmes, sharing of research infrastructures, knowledge hubs, living labs, training/education actions, hackathons, dissemination or other typology of activities. The Implementation Plan ensures that all dimensions and themes of the strategy are adequately addressed over time and with the relevant tools. The Implementation Plan will be publicly accessible and will serve as support to partners in planning their engagements in the partnership as well as to external actors (applicants, stakeholders) to follow the progress and current and upcoming activities and priorities within the Partnership. The development of the Implementation Plan is informed through analysis of previous calls and activities, input from a dedicated group of partner representatives, invited external experts, and the developments in the wider R&I landscape in Europe. A flexible approach is adopted whereby the Intervention Areas and the Implementation Plan are subject to regular adjustments and revisions where needed.

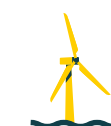
4.3 Intervention Areas

At present, the Partnership is targeting five Intervention Areas[†].



Digital Twins of the Ocean

This Intervention Area proposes a multidisciplinary, long-lasting research and innovation activity that focuses on the development of twin technology for spatially limited areas at sea basin level. The activity aims to improve our understanding of the relations among essential systems at sea basin level and ultimately support the development of AI based simulation and prediction capabilities for European seas and ocean.



Transitioning Blue Economy Sectors

The Intervention Area covers in principle holistically all sectors of the blue economy, focusing on the prerequisites and impact-driven opportunities for a green and digital transition of these sectors and on the conditions for co-existence and multi-use of activities and infrastructures at sea. The main aim of the Intervention Area is to support the optimised use of resources in European ocean and seas in terms of space and material flows while ensuring the conditions for sustainability through the application of the ecosystem-based approach and reduction of environmental pressures.



Management of Sea Uses

The Intervention Area addresses the need for innovative tools and approaches to the sustainable ecosystem-based planning and management of sea-uses, interlinking Maritime Spatial Planning (MSP), the Marine Strategy Framework Directive (MSFD), Common Fishery Policy (CFP), and the Marine Protected Areas (MPAs) with a focus on the regional dimension.



Blue Bioresources

The Intervention Area addresses research and innovation needs to support a just transition to the sustainable production and utilization of blue bioresources, with emphasis on production and processes that minimise the environmental impacts while meeting the demand for healthy and affordable blue food, feed, and other biobased products.



Resilient Coastal Communities and Businesses

This Intervention Area tackles the risks and opportunities for coastal communities, businesses, and infrastructures in the context of climate change and marine environmental degradation, addressing coastal and maritime tourism as well as the conditions for coastal social-ecological systems to deliver ecosystem-services for nature and people. The aim is to support interdisciplinary R&I to enable a just and efficient transition to low-impact, sustainable tourism, fostering resilience and delivering new economic opportunities and thriving coastal communities.

[†] The Intervention Areas for 2025 are currently under construction and the descriptions remain provisional.



Laminaria digitata

APPENDIX – STRUCTURE OF THE PARTNERSHIP

The **General Assembly** (GA) is the formal decision-making body and consists of delegates of all partners of the Partnership. The General Assembly oversees the Partnership strategy and implementation and provides strategic policy guidance on R&I programs. The Ex Comm comprises all work streams leaders and co-leaders, is responsible for the operational implementation, functions as reference group for quality control, and report to the General Assembly. For effective conduct, the Partnership is organised into eight interlinked workstreams representing its operational framework:

- *Partnership coordination and management* oversees the Partnership, ensures smooth implementation and enforcement, welcoming the inclusion of new partners. The overall performance and its widening will lead to the intermediate and final legacy outputs and is subject to self-monitoring and evaluation.
- *Strategic co-design* supports strategic planning and co-creating the overall strategy, scoping and updating the SRIA, defining Intervention Areas and the Implementation Plan, as well as preparing the basis for calls, while developing strategic recommendations.
- *Implementation of Calls* manages joint co-funded calls and calls for access to research infrastructures, from topic definition to launch and conduct.

- *Monitoring and follow-up of calls and funded projects* monitors co-funded projects using KPIs developed under and provides feedback to improve the call process and enhance project impact.
- *Communication, dissemination and ocean literacy* manages overall communication, outreach, and the Community of Practice (CoPr), with a focus on Ocean Literacy, including towards citizens and industry.
- *Building the community (Brussels Cellule)* connects with sea basin initiatives, EU Partnerships, Missions, and global organizations, supporting the community building.
- *Exploitation and Impact Network* ensures that R&I impacts society, policy and industry, including through market uptake of results, with measurable outcomes against established KPIs.
- *Funding synergies and Additional Activities* focuses on exploring synergies with other funding streams and supporting additional activities beyond competitive calls, demonstrating EU added value.

The Partnership is also equipped with a strategic political body, the **Steering Committee** (SC), constituted by delegates from Member States (MS) part of the Partnership consortium, Associated and Third Countries (AC/TC) and the EC, and which is co-chaired by the Partnership Coordinator and the European Commission. The Steering Committee is responsible for overseeing the strategy of the Partnership and

ensuring that it remains relevant and responsive to emerging challenges and opportunities.

Other **supporting structures** ensure the due functioning of the governance and proper implementation of the Partnership. In brief, the **coordinator** of the Partnership is the Ministry of Universities and Research (MUR) of Italy; the co-coordinator is the Research Council of Norway (RCN). The **Partnership Secretariat** supports effective Partnership coordination, management, and monitoring, closely guiding the entire strategic process. The **Brussels Cellule** assists the coordinator and the Secretariat in strategic liaison with sea basin initiatives, EU projects/programmes, and supranational organizations to build the community. It receives support by Italy (MUR), France (ANR), Germany (FZJ) and Norway (RCN). The **Call Steering Committee** (CSC) is composed of Participating funding agencies (PFO) delegates, mandated by their MS/ACs, and manages international joint call activities, acts as the decision-making body and handles technical administration. The Intergovernmental Oceanographic Commission of UNESCO (IOC/UNESCO) acts as an observer for UN Ocean Decade-related calls. The **Joint Call Secretariat** (JCS) coordinates joint call procedures, manages applications, and serves as a helpdesk, following the Memorandum of Understanding (MoU) for each Joint Call. In addition, **dedicated bodies** can

be established by the Partnership on ad hoc basis to support selected activities, including for the alignment of national funding by means of Thematic Annual Programming, alignment of monitoring programmes, and sharing of research infrastructures. The **multi-stakeholder Community of Practice** ensures that blue-economy stakeholders from diverse groups⁵ are engaged in the activities, with attention to balanced geographic, sectoral, career-stage, and gender representation. In this respect, the Partnership is constantly and openly committed to support dialogues and engagement between:

- Research funding organisations (RFO) and marine/maritime policy organisations:
These entities provide strategic guidance at global, European, national, regional, and sea basin level, aligning research with policy priorities and global perspective.
- Research funding organisations and Research performing organisations (RPO):
This ensures the smooth implementation of actions, turning strategic goals into praxis.
- Research performing organizations and policy, industry stakeholders, and investors:
This collaboration facilitates the application and scaling of research outcomes into policies, industry practices, and investments.



REFERENCES

1. Horizon Europe candidate partnership (2021) A climate neutral, sustainable and productive blue economy. Draft Strategic Research and Innovation Agenda. https://www.bluepartnership.eu/sites/bluepartnership.eu/files/documents/2023-07/Sustainable%20Blue%20Economy%20Partnership%20draft%20SRIA_V101_0.pdf.
2. Directorate-General for Maritime Affairs and Fisheries European Commission, Joint Research Centre. Borriello, A., Calvo Santos, A., Codina López, L. et al. (2024) The EU blue economy report 2024. <https://data.europa.eu/doi/10.2771/186064>.
3. Sea basins. https://oceans-and-fisheries.ec.europa.eu/ocean/sea-basins_en.
4. OECD (2016) The Ocean Economy in 2030. OECD Publishing. <https://doi.org/10.1787/9789264251724-en>.
5. IPCC, 2023: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland. 1-34.
6. United Nations Environment Programme Global Environment Outlook. <https://www.unep.org/geo/geob6>.
7. UN General Assembly (2015) Transforming our world: The 2030 Agenda for Sustainable Development, A/RES/70/1. <https://www.refworld.org/legal/resolution/unga/2015/en/111816>.
8. European Commission, Communication from the Commission to the European Parliament, the European Council, the Council, the European Social and Economic Committee and the Committee of the Regions: The European Green Deal, COM(2019) 640 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52019DC0640>.
9. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: 2030 Digital Compass - the European way for the Digital Decade, COM/2021/118 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0118>.
10. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: The EU budget powering the recovery plan for Europe, COM/2020/442 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2020%3A442%3AFIN>.
11. Decision (EU) 2022/591 of the European Parliament and of the Council of 6 April 2022 on a General Union Environment Action Programme to 2030. <http://data.europa.eu/eli/dec/2022/591/oj>.
12. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on a new approach for a sustainable blue economy in the EU - Transforming the EU's Blue Economy for a Sustainable Future, COM/2021/240 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2021%3A240%3AFIN>.
13. EU Mission: Restore our Ocean and Waters. <https://missionoceanwaters.eu/#/>.
14. High Level Panel for a Sustainable Ocean Economy (Ocean Panel) (2021) 100% Sustainable Ocean Management: An Introduction to Sustainable Ocean Plans. Washington D.C.: 1-27.
15. E.G. Carayannis, Barth, T.D., Campbell, D.F. (2012) The Quintuple Helix innovation model: global warming as a challenge and driver for innovation. Journal of Innovation and Entrepreneurship 1: 1-12. <https://doi.org/10.1186/2192-5372-1-2>.
16. H. Breakey (2022) Chapter 23: Ethics in the blue economy. In: Cadman T. & Sarker T. (eds.) De Gruyter Handbook of Sustainable Development and Finance. Berlin, Boston: De Gruyter. 511-542. <https://www.degruyter.com/document/doi/10.1515/9783110733488-023/html>.
17. Intergovernmental Oceanographic Commission. Vision 2023: The Ocean Decade's strategic ambition setting process on the road to 2030. 2021. <https://oceandecade.org/vision-2030/>.
18. G7 FSOI Working Group. G7 Future of the seas and ocean initiative <https://www.g7fsoi.org/>.
19. G20 Environment and Climate Ministers' Meeting (2023) Outcome Document and Chair's Summary. <https://www.env.go.jp/content/000150578.pdf>.
20. K. M. Gjerde, Clark, N. A., Chazot, C., Cremers, K., et. al., (2022) Getting beyond yes: fast-tracking implementation of the United Nations agreement for marine biodiversity beyond national jurisdiction. *npj Ocean Sustainability* 1. <https://www.nature.com/articles/s44183-022-00006-2>.
21. Joint Communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Setting the course for a sustainable blue planet - Joint Communication on the EU's International Ocean Governance agenda, JOIN/2022/28 final. <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=JOIN%3A2022%3A28%3AFIN>.
22. Regulation (EU) 2017/1004 of the European Parliament and of the Council of 17 May 2017 on the establishment of a Union framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the common fisheries policy and repealing Council Regulation (EC) No 199/2008 (recast). <http://data.europa.eu/eli/reg/2017/1004/oj>.
23. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. <http://data.europa.eu/eli/dir/2000/60/oj>.
24. Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). <https://eur-lex.europa.eu/eli/dir/2008/56/oj>.
25. Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013 laying down common provisions on the European Regional Development Fund, the European Social

⁵ Typical stakeholder groups include, **Governments and public authorities**, which develop and implement policies, provide funding, and coordinate international cooperation; **Academic and research institutions**, which conduct research, provide education, and share knowledge to advance sustainable practices; **Industry and business sector**, which adopt sustainable practices, invest in innovative technologies, and collaborate in public-private partnerships; **European institutions and agencies**, which align policies with EU strategies, provide funding, and monitor the impact of blue economy initiatives; **International organisations**, which contribute to global policy development, facilitate cross-border cooperation, and support capacity building; **Financial institutions and investors**, which provide sustainable financing, incorporate Environmental, Social and Governance criteria (ESG) and support innovation; **Non-Governmental Organisations** (NGOs), which advocate for sustainable practices, engage communities, and monitor environmental impacts; **Local Communities and Indigenous Groups**, which integrate traditional knowledge, participate in co-management, and engage in sustainable livelihoods.

Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund and laying down general provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund and the European Maritime and Fisheries Fund and repealing Council Regulation (EC) No 1083/2006. <http://data.europa.eu/eli/reg/2013/1303/oj>.

26. Regulation (EU) 2021/1058 of the European Parliament and of the Council of 24 June 2021 on the European Regional Development Fund and on the Cohesion Fund, PE/48/2021/INIT. <http://data.europa.eu/eli/reg/2021/1058/oj>.

27. Council Regulation (EU) 2021/2085 of 19 November 2021 establishing the Joint Undertakings under Horizon Europe and repealing Regulations (EC) No 219/2007, (EU) No 557/2014, (EU) No 558/2014, (EU) No 559/2014, (EU) No 560/2014, (EU) No 561/2014 and (EU) No 642/2014. <http://data.europa.eu/eli/reg/2021/2085/oj>.

28. European Commission: Directorate-General for Budget (2022) EU budget policy brief #3 – The EU as an issuer: The NextGenerationEU transformation. Publications Office of the European Union.

29. Commission implementing decision of 10.12.2021 adopting the Instrument for Pre-Accession Assistance (IPA III) Programming Framework for the period 2021-2027. https://neighbourhood-enlargement.ec.europa.eu/commission-implementing-decision-10122021-adopting-instrument-pre-accession-assistance-ipa-iii_en.

30. Regulation (EU) 2021/947 of the European Parliament and of the Council of 9 June 2021 establishing the Neighbourhood, Development and International Cooperation Instrument – Global Europe, amending and repealing Decision No 466/2014/EU of the European Parliament and of the Council and repealing Regulation (EU) 2017/1601 of the European Parliament and of the Council and Council Regulation (EC, Euratom) No 480/2009. <http://data.europa.eu/eli/reg/2021/947/oj>.

31. BlueInvest. https://oceans-and-fisheries.ec.europa.eu/ocean/blue-economy/blueinvest_en.

32. V. Ryabinin, Barbière, J., Haugan, P., Kullenberg, G., et. al. (2019) The UN Decade of Ocean Science for Sustainable Development. *Frontiers in Marine Science* 6. <https://doi.org/10.3389/fmars.2019.00470>

33. W. Thomson (1889) Popular lectures and addresses in three volumes. Volume 1. Constitution of matter: Electrical Units of Measurement. MacMillan and Company, London (UK). 73-74.

34. Committee on Transport and Tourism (2023) Report on building a comprehensive European port strategy (2023/2059(INI)). https://www.europarl.europa.eu/doceo/document/A-9-2023-0443_EN.html.

35. International Tribunal for the Law of the Sea (2023) Request for an advisory opinion submitted by the Commission of Small Island States on climate change and international law: Amicus brief submitted to the International Tribunal for the Law of the Sea by the UN special Rapporteurs on Human Rights & Climate Change (Ian Fry), Toxics & Human Rights (Marcos Orellana), and Human Rights & the Environment (David Boyd) <https://climatecasechart.com/non-us-case/18416/>.

36. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: EU Biodiversity Strategy for 2030 - Bringing nature back into our lives, COM/2020/380 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52020DC0380>.

37. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Region: Pathway to a Healthy

Planet for All - EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil', COM/2021/400 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0400>.

38. T. B. Atwood, Romanou, A., DeVries, T., Lerner, P.E., et al. (2024) Atmospheric CO₂ emissions and ocean acidification from bottom-trawling. *Frontiers in Marine Science* 10. <https://doi.org/10.3389/fmars.2023.1125157>

39. European Economic and Social Committee (2024) Towards a European Green and Social Deal, based on a wellbeing economy. <https://www.eesc.europa.eu/en/agenda/our-events/events/towards-european-green-and-social-deal-based-wellbeing-economy>.

40. I.E. Fleming, Landrigan P. J., et al. (2024) How can a healthy ocean improve human health and enhance well-being on a rapidly changing planet? <https://oceanpanel.org/publications/ocean-human-health/>.

41. European Strategy Forum on Research Infrastructures (ESFRI) (2021) Strategy Report on Research Infrastructures in Europe. <https://www.esfri.eu/esfri-roadmap>.

42. Euro-Argo ERIC: European contribution to the Argo programme. <https://www.euro-argo.eu/>.

43. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Region: Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change, COM/2021/82 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021>.

44. K. Soma, Van den Burg, S.W.K., Hoefnagel, E.W.J., Stuiver, M., Van der Heide, C.M. (2018) Social innovation – A future pathway for Blue growth? *Marine Policy* 87: 363-370. <https://doi.org/10.1016/j.marpol.2017.10.008>.

45. European Environment Agency, European climate risk assessment, Report No 1/2024. <https://www.eea.europa.eu/publications/european-climate-risk-assessment>.

46. European Commission Decision C(2024) 2371 (2024) Horizon Europe: Work Programme 2023-2025. https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2023-2024/wp-9-food-bioeconomy-natural-resources-agriculture-and-environment/horizon-2023-2024_en.pdf#page=21.

47. European Commission. European MSP Platform. European Blue Forum: Building Europe's Blue Community <https://maritime-spatial-planning.ec.europa.eu/european-blue-forum>.

48. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Energy Transition of the EU Fisheries and Aquaculture sector, COM/2023/100 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52023DC0100>.

49. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Global Approach to Research and Innovation - Europe's strategy for international cooperation in a changing world, COM/2021/252 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:252:FIN>.

50. All-Atlantic Ocean Research and Innovation Alliance: Creating an All-Atlantic Ocean Community. <https://allatlanticocean.org>.

51. European Commission: Directorate-General for Research and Innovation (2022) Performance of European Partnerships - Biennial Monitoring Report (BMR) 2022 on partnerships in Horizon Europe, Publications Office of the European Union. <https://data.europa.eu/doi/10.2777/144363>.

Photo credits:

Front cover: Vlad Chețan, Magda Ehlers | Pexels; Karen Cann, Katherine McCormack, Jesse de Meulenaere, Jan Tielens, Amber Wolfe | Unsplash; Benjamin Kürten

Back cover: Engin Akyurt, Manan Chhabhay, Patrick Federi, Chait Goli, NOAA, Venti Views, Vladimir Vishnyak, Rob Webbon, Ben Wicks | Unsplash; Benjamin Kürten

Page 3, 11: Benjamin Kürten

Page 7: Vlad Chețan | Pexels

Page 9: Jesse de Meulenaere | Unsplash

Page 23: Magda Ehlers | Pexels

Page 35: Chait Goli | Pexels

Page 36: Venti Views | Unsplash

Page 40: Ben Wicks | Unsplash

