BLUE BIO CLUSTERS

Deliverable 6.4

Action Plans for the Blue Bioeconomy with Monitoring and Evaluation

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Abstract	This report looks at the development of action plans for the Blue Bioeconomy, grounded in a collaboratively defined regional vision and a comprehensive analysis of barriers, opportunities, and solutions. The first section presents the regional action plans created through Community of Practice collaboration, with the November 2024 Amsterdam workshop translating local needs into SMART objectives and monitoring and evaluation, assigning owners and quick wins, and feeding outputs back into each CoP to drive delivery. The second section, co-developed with BBC partners, introduces two Blue Bioeconomy action plan frameworks that empower stakeholders to tailor and adopt specific components from both action plans and shows how the workshop outputs operationalize these plans in practice, ensuring alignment with their unique circumstances and objectives.
Keywords	BlueBioClusters, blue bioeconomy, CoP

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1.0	31.01.2025	Initial version

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Acronyms

BBC	BlueBioClusters
CoP	Community of Practice
EU	European Union
EC	European Commission
SMART	Specific, Measurable, Achievable, Relevant, and Time-Bound
M&E	Monitoring and Evaluation
UTartu	University of Tartu
SAMS	Scottish Association for Marine Science
SSIA	Scottish Seaweed Industry Association
KPI	Key Performance Indicators
ES	Ecosystem Services
DAAS	Data As A Service
MRE	Marine Renewable Energy
EMFAF	European Maritime Fisheries and Aquaculture Fund
SDG	Sustainable Development Goals
FAO	Food and Agricultural Organisation of the United Nations
SSAQ	Strategic Steering Committee on Aquaculture
CIA	Commercial and Industrial Activities
SME	Small to Medium Enterprise
LCCD	Rural and Community-Led Local Development
KRSS	Klaipėda Region Specialization Strategy
NGO	Non-Governmental Organisation

Executive Summary

The BlueBioClusters (BBC) project focuses on promoting sustainable blue bioeconomy practices across Europe's coastal regions. This report outlines a framework for regional action plans that balance a vision for blue bioeconomy growth with region-specific challenges and opportunities. Developed in collaboration with local stakeholders, these action plans aim to foster sustainable development by leveraging innovative, practical strategies to build resilient communities, enhance marine resource management, and drive long-term economic growth.

Chapter 1 provides an overview of the regional planning processes, showcasing how each region tailored its approach to align with local needs and opportunities. Communities of Practice (CoPs) anchored this work by convening stakeholders, surfacing constraints and opportunities, and maintaining continuity between planning and delivery.

In November 2024, BBC project partners gathered in Amsterdam for a collaborative workshop that built directly on the CoP process. With CoP members in the room, the workshop translated locally identified needs into Specific, Measurable, Achievable, Relevant, and Time Bound objectives, along with a monitoring and evaluation framework. Outputs were embedded within the CoPs, with named owners, and targeted quick wins to turn plans into execution. Where baselines were missing, a baseline first action safeguarded comparability without slowing progress. The resulting plans integrate environmental, economic, and social objectives with clear metrics for adaptive management, forming a flexible model that other regions can replicate. The outcomes and key takeaways from the workshop are detailed in Chapter 2.

This report offers valuable insights and inspiration for regions looking to revitalise their local economies and unlock their blue bioeconomy potential. It also sets next steps for delivery and learning: complete baselines and first dashboards in 2025, review quick win progress and compare indicators through cross-region peer learning, and from 2026 scale pilots with blended finance while updating SMART objectives annually. By showcasing successful initiatives and providing transferable tools such as a workshop blueprint, an indicator library, and a visual facilitation tool for value chains, the report enables regions to identify and customise actionable elements for their context. Ultimately, these efforts aim to build resilient and prosperous coastal communities across Europe.

Introduction

Communities of Practice (CoPs) are a core element of our work in developing the blue bioeconomy, acting as collaborative hubs for stakeholder engagement, knowledge exchange, and joint strategy development. CoPs bring together a variety of stakeholders, such as government agencies, industry, academic institutions, and local communities, who share a vested interest in promoting sustainable practices. By working together, CoPs enable participants to collectively address regional opportunities and challenges, share best practices, and experiment with innovative approaches to sustainable marine resource management. Effective CoPs have clear objectives and inclusive agendas that encourage stakeholders to co-create and adapt strategies suited to the unique needs and contexts of each region (*see report D6.1 Lessons Learned from Creating Communities of Practice: A Policy Brief*).

The flexible structure of CoPs enables them to operate in various forms and sizes, tailored to regional demands. They may differ in formality, scale, and focus, which enables them to adapt to diverse ecological, economic, and regulatory landscapes. Research has shown that social networks within CoPs can significantly improve resource governance, as they foster a sense of ownership and collective responsibility among participants (Cárcamo et al., 2014). This collaborative approach not only strengthens social equity by incorporating diverse perspectives but also encourages shared responsibility and accountability in marine management efforts (Bennett et al., 2021). These features make CoPs well-suited to the practical work of turning broad visions into actionable regional plans. In the BBC, CoPs are used as the primary vehicle to convene actors and to maintain continuity from visioning to planning and implementation.

The blue bioeconomy is increasingly recognised as essential for sustainable development, aligning with global and EU frameworks such as the UN Sustainable Development Goals (SDGs), particularly SDG 14 (Life Below Water) and SDG 12 (Responsible Consumption and Production). The European Green Deal and the EU Ocean Governance Pact emphasise their role in fostering sustainable use of marine resources, promoting innovation, and reducing environmental impacts. By integrating climate resilience, biodiversity protection, and resource efficiency, the blue bioeconomy is a cornerstone of efforts to ensure healthy oceans and sustainable economic growth.

Within this context, BBC's Deliverable 6.4 (D6.4) moves from vision to execution. Building on the regional "Blue Visions" (D6.2) and the "Inventory Analysis of Barriers and Solutions" (D6.3), this deliverable focuses on operationalising region-specific action plans that local actors can actually deliver. CoPs play a vital role in implementing these actions by coordinating with stakeholders and fostering a continuous environment of shared learning and collaboration.

To keep the regional action plans consistent and comparable, BBC adopts a common structure across all regions: a short set of SMART (Specific, Measurable, Achievable,

Relevant, and Time bound) objectives (environmental, economic and social), a prioritised list of actions with clear ownership and “quick wins”, and a light Monitoring & Evaluation (M&E) plan with a small starter set of cross region indicators for benchmarking. Where baselines are incomplete, each plan includes “baseline first” tasks, allowing monitoring to start immediately rather than waiting for perfect data.

SMART objectives ensure that each action has a clear result, a defined time horizon, and a specific metric. These objectives establish a framework for monitoring and evaluating the effectiveness of each action, ensuring that progress can be tracked and adjusted as necessary. For example, objectives might focus on increasing the number of skilled professionals in the blue bioeconomy, enhancing market access for locally produced blue bio-products, or improving sustainable aquaculture practices. The SMART framework supports both regional and cross-regional monitoring efforts by setting benchmarks that can be used to measure environmental, economic, and social outcomes over time.

To ensure that these action plans remain relevant and effective, this report advocates for a robust Monitoring and Evaluation (M&E) system that allows CoPs to assess the impact of their initiatives. The M&E framework is designed to support continuous improvement by providing real-time feedback on the progress of each action. A small cross-region indicator shortlist—co-created with partners—supports benchmarking and replication across regions. By establishing indicators across regions, the M&E system enables a consistent approach to evaluating success, making it possible to share best practices and lessons learned across different CoPs. This system enhances accountability and fosters adaptability, allowing regions to modify their strategies in response to new insights or changing circumstances.

To operationalise this approach, the BBC combined CoP work with a WP6 co-creation workshop in Amsterdam. BBC used an iterative process: (1) CoPs convened regional stakeholders and codified needs and opportunities; (2) the WP6 Amsterdam workshop translated those needs into SMART objectives and an M&E scaffold; and (3) each CoP validated a short list of concrete actions, owners and timelines. This sequencing matters because many partners benefited from expert support in turning broad intentions into SMART targets. Consequently, local CoP experts co-produced “starter” SMART objectives and an M&E framework during group work in Amsterdam, with CoP members present to carry the legacy home. Workshop outputs (groups, agenda, and indicator prompts) are aligned with the WP6 plan and slide deck and are now embedded inside each regional action plan. This design choice also reflects published evidence that CoPs accelerate consensus, ownership and continuity beyond a single project.

1 Regional action plans from CoPs

This chapter highlights the action plans from eight European coastal regions, each of which focuses entirely or partially on enhancing the blue bioeconomy. These plans represent collaborative efforts and strategic initiatives aimed at driving innovation, sustainability, and economic growth in marine and aquatic sectors across diverse regional contexts.

1.1 Saaremaa, Estonia

The Saaremaa CoP has established a strong working relationship with the Saaremaa Municipality, which oversees the *Saare County Development Strategy 2022–2035*. The development of the strategy began a few months before the BBC project started and is reviewed annually. The University of Tartu (UTartu) has been involved from the outset.

The strategy includes a chapter on Marine Resource Valorisation (*see below*), which introduces the topic, outlines development challenges, and sets goals for 2035. Below are excerpts from the strategy, its accompanying action plan, and the first monitoring exercise related to the blue bioeconomy, in which input from the CoP was provided. The strategy was introduced at the initial BBC CoP meeting, and CoP members have been consistently updated on its progress and developments (e.g., during the CoP meeting on July 6, 2023). In addition to maintaining direct contact with the municipality, CoP members were asked to contribute to the action plan via e-mail between July and August 2023 through the CoP network. Following this, UTartu presented the updates to the municipality.

Marine Resource Valorisation (including Aquaculture)

In the development strategy, this field includes activities such as the cultivation of algae, shellfish, fish, and other aquatic flora and fauna, as well as the valorisation of products derived from them. Saaremaa has a partial foundation of scientific and business resources for this, along with an optimal marine environment for raw material cultivation, characterised by the saltiest water in Estonia. Over recent decades, the Baltic Sea has become significantly cleaner of toxins, but it still contains an excess of nutrients. One of the goals outlined in the strategy for the coming decades should be to reduce nutrient levels in the water by effectively removing them. To ensure this approach is economically sustainable, the focus should be on creating value chains that transform the problem—excess nutrients—into a valuable resource.

Development Obstacles outlined in the strategy:

- The field is new and requires significant capital and knowledge, making the entry threshold high and expensive. Many technologies need to be developed specifically for Estonia. While funding is available for research, there are no investment support measures. Banks cannot assess the risks of marine-related investments due to their large scale, and therefore, loans or guarantees are not issued.

- Estonian legislation regarding marine activities is complex. There is no experimental area where ideas can be quickly and flexibly piloted in the context of scientific work.
- There is a shortage of specialists in the marine sector.
- One of the biggest problems of the Baltic Sea is the abundance of nutrients.

Desired State for 2035

- The environmental condition of the Baltic Sea has improved in terms of phosphorus, nitrogen, and other nutrients.
- The skills to efficiently remove excess nutrients from the Baltic Sea have been developed. Marine resources cultivated for this purpose are integrated into value chains of businesses that fully utilise and valorise their economic and environmental potential.
- This valorisation development work is being carried out in Saaremaa through the BBC project and the creation of collaboration networks.
- A pilot area has been established in the open sea for testing algae, shellfish, and fish farming developments.
- Consumers are aware of and have embraced new products created from marine resources. Topics related to marine resource valorisation are introduced in kindergartens and schools across the county.
- A special funding measure has been established for water infrastructure, offshore construction projects, and innovation initiatives for businesses.

Saare County Development Strategy 2022–2035 Action Plan

The action plan is monitored and reviewed annually.

	2023	2024	2025	2026
Economic Development and Entrepreneurship				
Priority Area 7: Supporting Innovation in the Maritime Industry and Blue Bioeconomy				
Supporting and coordinating the development and innovation of the maritime industry, blue economy, and their related sectors	x	x	x	x

2027	2030	2035	Lead	Finance source	Measure
x	x	x	TalTech Kuressaare College, UT Estonian Marine Institute; Blue Economy CoP		regional

Figure 1 Saare County Development Strategy 2022–2035 Action Plan.

Monitoring of the Strategy and the Action Plan 2022-2023

Effective Valorisation of Marine Resources, including Aquaculture

The first monitoring exercise was conducted in 2024, yielding the following results: TalTech's Kuressaare College has developed a bachelor's degree program called "Sustainable Blue Economy Technologies," which started in 2024. Teaching, research, and development in innovative resource use are emerging as key areas alongside marine engineering and shipbuilding, offering significant growth potential. This supports the college's vision as a nationally and internationally recognised centre of excellence in the blue economy.

Estonian universities and businesses have been successful in applying for European research and innovation grants. The University of Tartu's Estonian Marine Institute (UTartu) is participating in the European Horizon project BlueBioClusters, and the Estonian University of Life Sciences (EMÜ) is involved in the Horizon project BlueRev. Both projects help to promote sustainable blue bioeconomy development in Saaremaa by encouraging active networking. On February 3rd, 2023, a seminar titled "Blue Bioeconomy in the Waters of Western Estonia" was held in Kuressaare with over 100 participants, introducing the community to the challenges and opportunities of the blue bioeconomy.

Figure 2 Seminar "Blue Bioeconomy in the Waters of Western Estonia".

In addition, the universities (UTartu, EMÜ) and local companies (Vetik OÜ, PowerAlgae OÜ, Redstorm OÜ, and Ösel Aquafarms OÜ) are involved in various European Horizon and other international projects aimed at promoting the blue marine economy. In 2023, a local blue bioeconomy company, Est-Agar AS, launched a project to cultivate seaweeds in the marine environment in cooperation with researchers from several Estonian universities. UTartu is also developing a mesocosm facility at the Kõiguste field station in Saaremaa, which will enable the

reconstruction and monitoring of biological communities and their associated habitats under ecologically realistic conditions and defined future scenarios.

The strategy and the action plan (annually updated) are available in Estonian for reference.

In conclusion, the development strategy provides valuable guidelines, supported by an annual review of the action plan. However, it currently lacks clear indicators to measure progress effectively. This limitation is partly due to the reliance on external funding sources. Nevertheless, the strong commitment and support of the Saaremaa Municipality remain a crucial asset. By fostering collaboration between local companies, academia, and public authorities, the region has the potential to mobilise resources and drive the development of a thriving local blue bioeconomy.

1.2 Flanders, Belgium

The production activities within the Blue Bioeconomy and their applications in biotechnology are highly diverse and fragmented in Flanders, with no single dominant player in the value chain. Therefore, the Flemish CoP decided to select representatives from various sectors, including the blue bioeconomy production sector (e.g., aquaculture, micro- and macroalgae, fisheries) and sectors that currently use or have the potential to use blue bio products (e.g., food, chemicals, textiles).

The Flemish CoP on the Blue Bioeconomy was organised midway through the project to gain a comprehensive understanding of the different blue bioeconomy value chains and to ensure that the appropriate representatives were selected before the meeting. Discussions during the meeting highlighted several obstacles that are slowing or obstructing the further development of blue bioeconomy production in the region.

Development Obstacles as noted by CoP:

- It has been noted that Flanders likely lacks sufficient potential production areas for aquaculture development.
- It appears that Belgium is implementing EU legislation for aquaculture too strictly, which is hindering further investment and the development of local aquaculture.
- The low popularity of aquaculture among consumers and the difficulty in attracting investors, who are mostly looking for short-term return on investment, while return on investment in aquaculture could take more than 10 years.

Figure 3 CoP members working in group with the Facilitation tool.

Regional Action Plan

Since most specific value chains had their own CoP activities for developing new strategies, a decision was made to actively participate in these separate strategic processes and provide input for recommendations and actions to be incorporated into their strategies. The following list outlines concrete recommendations proposed by The Blue Cluster to be included in various strategic documents to address the barriers and challenges identified by stakeholders. These strategy documents were either sent to or prepared for the respective policy-making bodies.

1. *Strategy document: "Development Strategy Local Fisheries Group"*

Policy-making bodies: Province West-Flanders

Addressed barrier/challenge: Need for financial instruments to be available to all companies that meet the blue bioeconomy criteria.

Concrete recommendations: 1. To broaden supportive objectives towards aquaculture SME. 2. Include a representative of those aquaculture SMEs in the local group.

Aim of the recommendations: more support for aquaculture SME at the Flemish coast.

Results: The recommendations were implemented, and a specific land-based aquaculture company was selected in the Rural and Community-Led Local Development (LCCD) to represent the regional aquaculture sector.

Reference.

2. *Strategy document: "Priorities for a thriving Flemish aquaculture sector"*

Policy-making bodies: Flemish Ministry of Agriculture and Fisheries.

Addressed barrier/challenge: 1. Lack of sufficient surface area in the Belgian North Sea as well as space on land (high competition, high land prices, specific permits). 2. A big challenge for the successful development of the blue bioeconomy is the low economic viability and the low profitability of the companies engaged in such activities. Therefore, financing instruments should be available to all companies that meet the blue bioeconomy criteria.

Concrete recommendations: Essential for the further development of the marine business ecosystem is a marine spatial plan (MSP) that zones economic activities and addresses their cumulative impact. In Flanders, the process of designation of CIA zones is well underway (zones intended for Commercial and Industrial Activities). These zones could be the seeds for zones suitable for shared use, the so-called Maripark zones. These cluster multiple activities at sea, such as energy supply, monitoring, security, and aquaculture, within a holistic infrastructure. This saves costs, increases efficiency, and speeds up the implementation of innovations.

Aim of the recommendations: Increase opportunities for aquaculture in the Belgian part of the North Sea by designating specific zones for multi-use, such as MariParks. By combining activities within a MariPark, costs can be reduced, and obtaining permits may become easier. This could enable small blue bioeconomy producers, who currently face high costs and administrative barriers, to participate. If successful, this approach may even allow for future upscaling.

Results: Paragraph quoted from the coalition agreement: “At the same time, aquaculture and mariculture are further pursued from the same objectives. We are now converting the ample knowledge and entrepreneurial spirit present within the sector in Flanders into practice. Aquaculture is a recent activity in Flanders. We are investigating whether the Flemish and federal laws and regulations have evolved or been translated from European legislation. Flanders is also examining the implementation of laws and regulations in our neighbouring countries to optimise its own laws and regulations in the context of a sector level playing field. Based on the suggestions and lessons learned from the sector, work will then be done on updating the action plan on aquaculture and mariculture.”

Reference.

3. *Strategy document: “Marine Spatial Planning 2026-2032”*

Policy-making bodies: FOD Health (Belgium).

Addressed barrier/challenge: Lack of sufficient surface area in the Belgian North Sea as well as space on land (high competition, high land prices, specific permits).

Concrete recommendations: For developments around sustainable food production, we base this plea partly on the recommendations of the Strategic Steering Committee on Aquaculture (SSAQ) of Belgium, which clearly shows that the emerging sector needs space close to the coast to achieve policy objectives related to sustainable aquaculture.

Aim of the recommendations: Expanding opportunities for aquaculture in the Belgian part of the North Sea. While this goal aligns with the previous recommendation, it pertains to a different strategic document. One focuses on aquaculture in Flanders at the regional level, including land-based aquaculture, while the other addresses increasing aquaculture opportunities within national marine spatial planning.

Results: Due to the Formation of the new Belgian government, no official document has been published yet.

4. *Strategy document: "Visioning AQUACULTURE in the Belgian part of the North Sea"*

Policy-making bodies: FOD Health (Belgium).

Addressed barrier/challenge: Lack of sufficient surface area in the Belgian North Sea as well as space on land (high competition, high land prices, specific permits).

Concrete recommendations: Show the possibilities of different aquaculture techniques for offshore (further than 6 miles zone) aquaculture and identify possible bottlenecks to address.

Aim of the recommendations: More possibilities and areas for aquaculture on the Belgian part of the North Sea.

Aim of the recommendations: Expanding opportunities for aquaculture in the Belgian part of the North Sea. While this goal aligns with the previous recommendation, it pertains to a different strategic document. One focuses on aquaculture in Flanders at the regional level, including land-based aquaculture, while the other addresses increasing aquaculture opportunities within national marine spatial planning (national).

Results: To be further implemented.

Reference.

In addition to the efforts mentioned above, ongoing interactions are taking place with the City of Ostend in response to their "Ambition Note with Action Plan for the Blue Economy in the Mid-Coast Region." This note identifies aquaculture and fisheries as targeted sectors. The outcome of these interactions will be a policy brief outlining specific actions to support the further development of the Blue Bioeconomy in the Ostend region.

1.3 Brittany, France

In Brittany, marine bioresources have a major economic impact on coastal areas. The production of shellfish, fish and other sources of protein in inland and coastal waters is an age-old activity. These industries provide local jobs with significant technological development. As defined in the action plan for the region, the use of marine resources by the fishing, aquaculture and biotechnology sectors must meet growing food requirements and diversify the raw materials used by a variety of economies (cosmetics, health, materials, etc.).

Strategically, all actors involved in marine living resources are increasingly committed to addressing environmental challenges while maintaining their economic profitability. In the years to come, this effort to limit the impact on the environment alongside operating costs (fuel in particular) and the development of efficient cultivation processes will be the pillars of the long-term future of these industries.

The CoP in Brittany aims to cover all aspects of marine and freshwater biological production as part of the land/sea continuum (fish farming, macro and microalgae, etc.), with a focus on sustainable development and a strong potential for innovation, notably, on three major sub-sectors: (1) sustainable fishing, (2) sustainable aquaculture and (3) blue biotechnology.

Within the CoP, the Pôle Mer Bretagne Atlantique has identified four main challenges:

(1) Define solutions for CO_2 sequestration using microalgae, aquaculture and the restoration of macro-algae forests and flat oyster beds.

(2) Companies in the region deploy Marine solutions for land-based agriculture (crop and livestock production) and support the decarbonisation of agriculture by limiting or replacing the use of chemical fertilisers, reducing the use of pesticides, and helping to reduce greenhouse gas emissions from livestock.

(3) The development of the biomaterials of the future, whether derived from microbial biotechnologies or from fish and aquaculture resources, which will make it possible to replace non-biodegradable petroleum-sourced products (surfactants, plastics, etc.) or terrestrial plant fibres (which consume water, inputs and energy), as well as to innovate on new medical devices.

(4) The resilience of ecosystems to climate change. Restorative aquaculture projects must be taken into account within the various socio-ecological systems of the CoP's perimeters, integrating sustainability sciences.

Another aspect that has been identified as key in the development of the blue bioeconomy in this region are market segments. We have divided these into three main ones:

Sustainable fishing

The fishing market is made up of shipping companies, producer organisations, wholesalers, distributors and equipment manufacturers (mechanical, electronic, digital services, fishing gear, etc.) or suppliers of various consumables, but also players in the design, manufacture and dismantling of all these production tools, beyond the vessels covered by the naval and nautical sector. Innovative adaptations of fishing vessels could be addressed by the sustainable development of the marine biological resources sector.

Sustainable aquaculture

The target markets for aquaculture are fish farming, shellfish farming and seaweed farming (macro and microalgae), including those opened by new species (worms, sea

cucumbers, sea urchins, etc.). In addition to producers, the CoP has identified other market targets linked to designers of production tools (cages, bags, packaging, etc.), feed suppliers, veterinarians and processors of aquaculture products, as well as the developers of digital tools, water monitoring, AI, and Internet of Things to improve production processes.

Blue biotechnologies

This sector offers immense potential that remains under-exploited. The end markets targeted are **nutrition and cosmetics** (ingredients, additives, and molecules of interest); **biosourced chemicals** (agricultural supplies, biostimulants, biomaterials, and enzymes); **health and pharmaceuticals** (therapeutic molecules and medical devices); and **energy/industrial ecology** (surfactants, biofuels, effluent treatment, waste heat, and CO2). Intermediate markets include strains and associated products, primary processing of marine co-products, and associated equipment and inputs (photobioreactors, maintenance).

These market segments represent almost 22,000 jobs, or 36% of the various maritime sectors.

For the action plan, the weight and strengths of innovation players in the regions have been defined per subsector; this allows us to present to policymakers concrete figures and examples for the development of the blue bioeconomy. Therefore, under the fishing sector, the region accounts for 62% (150,000 tonnes) of the tonnage and 61% (€475 million) of the value of fresh and frozen fishing in mainland France, excluding seaweed and freshwater fishing. The presence of shipping companies in port towns contributes to the creation of wealth and innovation in the areas concerned. The large shipping companies, whose vessels are used for deep-sea fishing or offshore fishing, make a major contribution to this (La Compagnie des pêches in Saint-Malo, Porcher in Saint-Brieuc, La Houle and Armement bigouden in Guilvinec, Scapêche and APAK in Lorient, ACAV in Les Sables d'Olonne, etc.). The equipment manufacturers based around the ports make a major contribution to innovation in the fields of fishing gear, ship materials and fittings, as well as ship and gear positioning systems and other sensors (Le Drezen, Morgère, Marport, iXBlue, Thalos, etc.).

Regarding aquaculture, more than 56,000 tonnes (€208M in value) of shellfish, mainly mussels and oysters, are produced annually in the Pôle Mer Bretagne Atlantique area, representing 42% of French production volume (38% in value). Although seaweed farming is increasing, production is still marginal (150 to 300 tonnes a year).

As for, marine biotechnologies, the Pôle Mer and CoP's territory is home to a large number of major private-sector players across the entire value chain: industrial groups (Roullier, Olmix, etc.) and numerous VSEs/SMEs driven by the sector's strong growth and collaborative R&D projects (Hémarina, Algosource, Abyss Ingrédients, Phosphotec, Perha Pharmaceutical, Polymaris, etc.), academic players with expertise in blue bioresources (CNRS-UMPC Roscoff, UBO-IUEM, Ifremer, GEPEA, UBS-IRD, etc.), as well as a number of private-sector players with expertise in marine

biotechnologies), academic experts in blue bioresources (CNRS-UMPC Roscoff, UBO-IUEM, Ifremer, GEPEA, UBS-IRDL, MNHN, etc.), platforms (Algosolis, Biogenouest, Biodimar, etc.) and technical and transfer centres (BSB, CEVA, SMIDAP, etc.).

Alignment with public strategies and policies in Brittany region

At the European level, the Green Deal is one of the main initiatives directly linked to the development of the blue bioeconomy in the region. One of the aims of the Green Deal is to develop a sustainable blue economy, in particular, to ensure sustainable food production. For aquaculture and fisheries, the FAO has written a report entitled 'Blue Transformation' 2022-2030 for aquatic food systems. These documents are key to the definition of objectives in the action plan.

A global level, we also identified the United Nations, sustainable development goals (SDGs) (https://sdgs.un.org/goals), notably the following ones are linked to the action plan for the blue bioeconomy in Brittany:

Figure 4 SDGs relevant to blue bioeconomy in Brittany.

The Brittany region implements the European initiative on Smart Specialisation strategies, which aims to boost regional innovation by contributing to growth and prosperity, helping and enabling regions to focus on their strengths. The Pôle Mer Bretagne Atlantique has integrated this approach from the beginning, and therefore, the CoP contributes to the region's goals of promoting partnerships between businesses, public entities, and knowledge institutions.

At the national level, the blue bioeconomy is part of various initiatives, programmes, and policies. Among the most relevant are the Sustainable Fisheries Plan, the Aquaculture Plan for the Future and the link between European and national levels under the European Maritime, Fisheries and Aquaculture Fund (EMFAF).

In 2021, the French government launched an initiative called "France 2030": an investment plan for France with a budget of €54 billion; this plan is designed to make up for France's industrial lag, invest massively in innovative technologies and support

the ecological transition. The blue bioeconomy sector is included in the plan and therefore, this initiative drives the local action plans and notably Objectives 6 & 7.

Objective 6: Invest in healthy, sustainable and traceable food to accelerate the agricultural and food revolution in which France is a leader.

Objective 7: Produce at least 20 biomedicines in France, in particular against cancers and chronic diseases, and develop and produce innovative medical devices.

https://www.economie.gouv.fr/france-2030

https://www.info.gouv.fr/grand-dossier/france-2030

At the regional level, the objectives of development are aligned with the regional Smart Specialisation Strategy (S3) and the Regional Innovation Strategy, a Roadmap for the development of the subsectors in some cases and regional calls from the EMFAF.

https://www.bretagne.bzh/app/uploads/sites/5/2023/06/S3_Strategie_regionale_recherche_innovation_2021_2027.pdf

https://europe.bzh/aides/fiches/feampa-2021-2027-pre-demandes-des-aides/

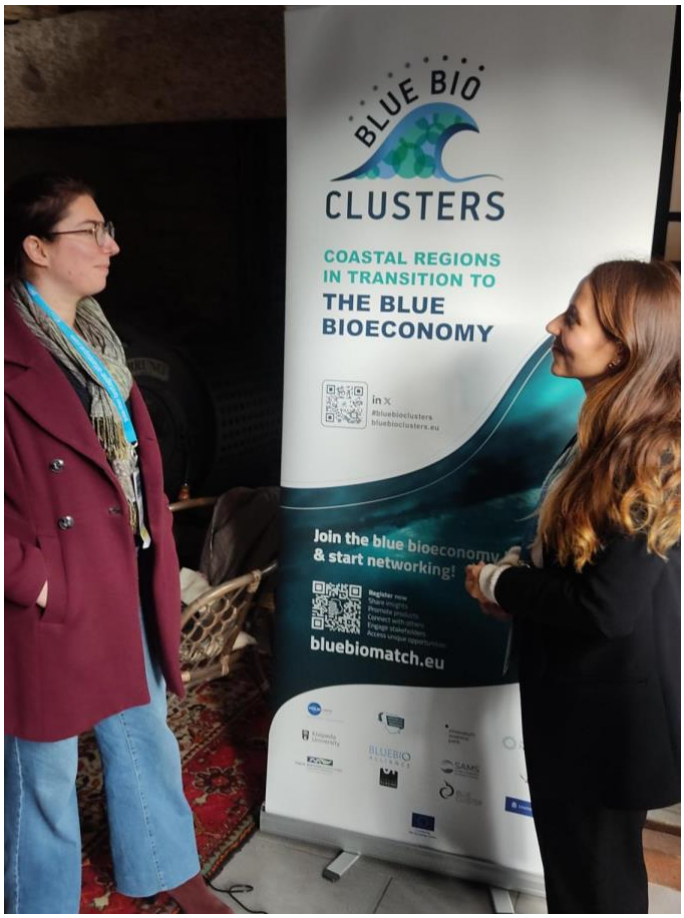

Figure 5 Pôle Mer Bretagne Atlantique introducing BlueBioMatch in a CoP meeting.

Action plan updates

Pôle Mer Bretagne Atlantique, with all the actors from the CoP, has distilled the discussions in the following table. This information was collected after the different

meetings (CoP and co-creation workshops). It aims to gather the principal challenges, main obstacles and how we can tackle them, with some examples. Moreover, these challenges have been related to the different objectives at the regional, national and international levels and we have defined if the objectives could be met in the mid or long term.

Table 1 Britanny CoP: overview of challenges and objectives in mid-long term

Defined challenges	***Main obstacles***	***Examples***	***4 years***	***10 years***	***France 2030***	***SDG***	***SRI/S3***
Optimising fishing industries and their value chains	Reducing the environmental footprint and energy costs	- Reducing carbon emissions and the impact on fish stocks and ecosystems - Driving the boat of the future	✅	✅	***6***	***13, 14***	**Blue Growth** **Food for eating well**
	Diversify and develop fishing practices and gear Develop fisheries monitoring systems	- Enable co-activity between fishing and MRE sites - Pursue innovative fishing techniques - Improve knowledge of resources	✅	✅	***6***	***14***	
	Enhanced catch value and product safety	- Enhancing the circular economy of the resource - Enhancing product traceability and quality - Pooling processing tools	✅		***6***	***2, 14***	
Optimising aquaculture sectors and their value chains	Changing farming practices in the face of climate change Supporting diversification	- Identify and select the best species and grow them on a large scale - Develop product traceability, encourage organic certification (AB) - Support diversified production (AMTI) - Develop digital monitoring tools	✅		***6***	***2, 14***	**Blue Growth** **Food for eating well**
	Reindustrialisation priority to develop offshore and onshore aquaculture production sites	- Studying aquaculture systems associated with floating wind turbines - Promoting common aquaculture services - Developing different production systems (extensive, open, semi-	✅	✅	***6***	***2, 14***	

		open or closed circuit aquaculture)					
Developing sustainable marine biotechnologies (in particular algae)	Developing knowledge of resources, mastering industrialisation and adding value to all biomass	- Optimising the choice of strains and culture conditions for productivity - Support the screening of new ingredients - Mastering eco-efficient bioprocesses to optimise recovery - Encouraging organic certification (AB)	✅		***6***	***13, 14***	
	Accelerate the development of biotechnologies by strengthening cooperation between research, start-ups and education	- Leading the network of regional and national players in research and industry (companies, craft producers, start-ups) - Supporting to pool R&D facilities	✅	✅	***6***	***3, 13***	**Blue Growth**
Social acceptability and environmental performance	Undertake a comprehensive approach to the sustainable development of marine bioresource production activities	- Promoting knowledge of seafood products - Develop animal protection - Systematically analyse the life cycle to optimise processes	✅		***6***	**-**	**Blue Growth**
	supporting changes in the fishing, aquaculture and blue biotechnology professions	- Promote cross-disciplinary work between business, research and training - Encouraging innovation to tackle complex challenges	✅		***6, 7***		**Increase competitiveness**

Figure 6. Pôle Mer Bretagne Atlantique CoP meeting.

1.4 Iceland

The blue vision for Iceland is focused on the development of blue technology (particularly around AI, Internet of Things and Data As A Service (DAAS)), enhancing the environmental and economic sustainability of blue bioeconomy value chains and enhancing the development of enabling technologies for primary and secondary processing and further downstream value creation. Iceland aims to be a testbed for blue ideas. The CoP for Iceland will continue this vision-building in January 2025 to map out some of the collective blue bioeconomy aims across different sectors and explore how more collaboration can be generated. It was raised in a previous CoP discussion that there is a real gap in ocean data around the waters of Iceland that needs to be addressed to support the emerging and growing blue bioeconomy, e.g. seaweed cultivation & multi-use at sea and expanding into mariculture. The January 2025 CoP will highlight priorities for data collection and collaboration. There is currently no blue economy strategy for Iceland; however, the most recent CoP in Autumn 2024 highlighted this gap to the incoming government, emphasising the need to raise innovation and a blue economy on the agenda.

Regional Action Plan

A comprehensive Regional Action Plan is under development, but key priorities of this action plan have been set.

Establish key topics for collaboration and mutual opportunity for key blue stakeholders and organisations in Iceland to increase impact.

The first steps of this work have been established through the first CoP and through a co-creation workshop to explore the shared challenges and opportunities and the

compatible strengths and weaknesses of different blue bioeconomy actors at different stages of the supply chain and sectors in Iceland. This was also explored trans-nationally in a preliminary co-creation workshop with Sweden, which strengthened both the domestic and international thinking on this topic.

The next phase took place in January 2025, as part of further Blue Visions work, where key blue stakeholders were asked to envision the blue future of Iceland and identify specific topic areas and partnerships that they could explore to develop projects, innovations, and activities. This was done as an in-person interactive workshop at the Iceland Ocean Cluster House.

Developing the connections between the blue industry actors & entrepreneurs.

Although there are several blue innovation ideas and accessible, early-stage funding available in Iceland, a major challenge identified is ensuring a strong product-market fit for many of these ideas. Therefore, a key part of the Regional Action Plan relates to increasing the matchmaking, contact and flow of ideas between industry, innovators and the research community in Iceland.

The first steps of this increased contact and conversation were initiated during the blue bootcamp (Verbúð), a programme that ran alongside the North Transnational Bootcamp of the BBC project. Key blue innovation challenges of major Icelandic companies were presented to entrepreneurs and startups at the Blue Bootcamp, and business development support was provided, with special attention to fostering dialogue with the industry. This first attempt was a learning curve, but it was considered a successful model that could be developed and expanded further in 2025 with additional industry partners.

Developing blue bioeconomy value chains that are circular.

A co-creation workshop as part of the BBC project focused on an emerging side stream from the growing land-based aquaculture sector in Iceland – how to create value instead of waste from sludge (uneaten food and faeces). This is a model, along with the existing and expanding 100% Fish programme (Figure 7) of the Iceland Ocean Cluster, to support novel blue bioeconomy value chains from resources once considered “waste” in Iceland. This is a key part of the Regional Action Plan and one that is a focus of cross-sectoral organisations like the Circular Economy Cluster and the energy sectors.

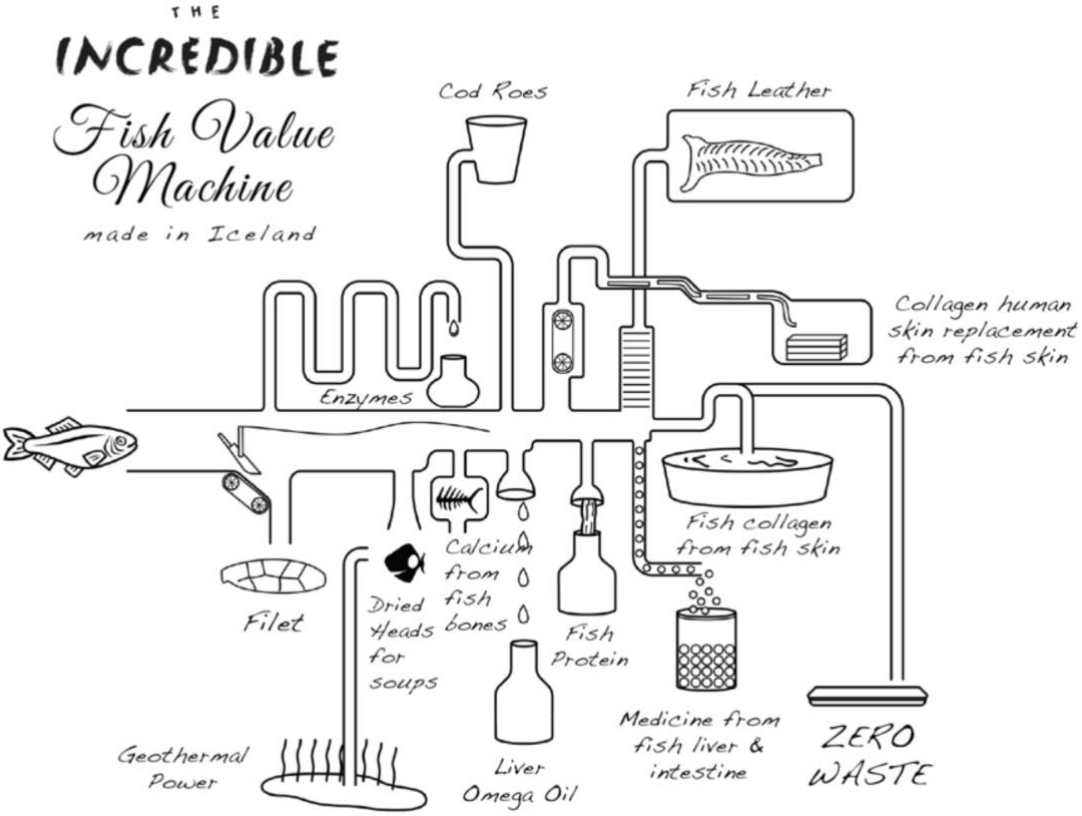

Figure 7 100% Fish by Iceland Ocean Cluster.

Developing emerging and under-exploited blue bioresources, e.g. new pelagic fisheries, new aquaculture, new mariculture.

A CoP met with key political leaders in November 2024 to highlight the needs of blue bioeconomy companies and discuss how the new government in Iceland might support these needs. A key theme that emerged was the need to support the sustainable exploration and exploitation of new blue bio-resources. For example, seaweed harvesting occurs in Iceland, and there are many seaweed biotech, cosmetic and nutraceutical companies emerging, but currently, there are no existing legal frameworks to farm seaweed in the ocean, limiting the growth of this high-potential sector in Iceland.

A key component of the emerging Regional Action Plan will also be to support the *development of strategically important blue bioeconomy value chains through collaboration* with industry stakeholders, entrepreneurs, marine research organisations, and policymakers.

1.5 Klaipeda, Lithuania

The CoP established within the BBC project has been actively developing the Blue Vision for the Klaipeda Region. This vision is aligned with the *Klaipėda Region Specialisation Strategy* (hereinafter - KRSS) (Klaipeda Region, 2021) and the vision for the Klaipėda Region: *Western Lithuania – delivering leadership in the sustainable*

maritime economy within the Baltic Sea Region, providing a rich experience for visitors, and ensuring a harmonious modern lifestyle for locals.

The Blue Vision for the Klaipėda Region builds on this broader regional vision, emphasising leadership in the blue economy at the national level. This strategy underscores the region's commitment to leveraging its coastal resources to foster economic growth, enhance local quality of life, and safeguard the marine environment. The aim is to transform the Klaipėda Region into a dynamic and sustainable coastal community.

CoP discussions on the blue vision deepened understanding of the KRSS priority areas, particularly *Maritime Economy* and *Bioeconomy*, and their implementation plans. It was noted that these priority areas could be refined to better incorporate blue bioeconomy objectives, specifically by integrating actions that promote the sustainable use of marine resources within the *Bioeconomy* framework.

The timing of the CoP meetings in Lithuania was particularly significant, as they coincided with the Klaipėda Region Association's initiative to review the KRSS at the end of 2024. Several CoP members, representing various stakeholder institutions in the Klaipėda Region, had been actively involved in KRSS development since 2017 as part of expert groups. These same expert groups were invited to contribute to the revision of KRSS priority directions, action plans, and indicators. This alignment presents a valuable opportunity to further refine and implement the Blue Vision through the strategic actions outlined in the KRSS.

Regional Action Plan

CoP members, representing multiple stakeholder institutions, were approached by the expert group guiding the review process of KRSS via interviews and actively contributed. The primary aim of the CoP was to strengthen alignment between the *Maritime Economy* and *Bioeconomy* strategies, reassess measures and indicators and develop a robust monitoring and evaluation framework to track progress and ensure strategic coherence.

The KRSS identifies the following five directions for regional specialisation until 2030:

1. *Maritime Economy*: to become a modern and attractive investment leader in the maritime economy in the South-Eastern Baltic Region by 2030
2. *Bioeconomy*: to become a leading bioeconomy region by 2030 at both the national and Baltic Sea macro-regional level
3. *Sustainable Maritime and Coastal Tourism*: to strengthen the regional competitiveness of maritime and coastal tourism in accordance with the principles of sustainable development
4. *Advanced Industrial Economy*: to develop an internationally competitive industry in the Region based on innovative solutions

5. *Service Economy*: to increase the share of service economy in the Region by ensuring the necessary preconditions for sustainable competitiveness and development.

The expert group, consisting of multiple stakeholders from the maritime sector, academic and public institutions, including CoP members from Klaipeda University and Klaipeda Science and Technology Park, contributed to the revision of the KRSS priority direction, *Maritime Economy*.

The review process outputs were presented and discussed during the January 2025 meeting.

A major achievement in implementing the Blue Vision was the successful integration of all blue bioeconomy-related actions under a single priority direction, *Bioeconomy.* In the previous version of the KRSS, the *Fishery* was categorised under *the Maritime Economy*.

Establish the Blue Bioeconomy Competence Centre.

The establishment of a Blue Bioeconomy Competence Centre at Klaipėda University, the only university in Lithuania with a Marine Research Centre and a member of the European University Alliance EU-CONEXUS, to develop the centre's curriculum and research agenda focusing on blue bioeconomy.

Looking at the long-term perspective, plans are in place to *establish the Klaipėda Region (Blue) Bioeconomy Council.*

The council will comprise representatives from local authorities, businesses, academia, and NGOs. The initial meeting is scheduled for Q2 2025 to define the roles, responsibilities, and objectives of the council, as well as to develop a governance framework and establish a regular meeting schedule. CoP members are interested in contributing to the ongoing implementation of initiatives dedicated to promoting the blue bioeconomy within the region.

Challenges and opportunities

Defining national leadership in the blue economy for the Klaipėda region faces several obstacles. Primarily due to a lack of national attention and disregard for the blue economy as a key sector for Lithuania's economic development. The implementation of regional steps outlined in the KRSS and the Blue Vision action plan, along with close collaboration with national and local policy actors, provides an opportunity to foster the development of the National Maritime Strategy, which has been on the Agenda of the Lithuanian Parliament for several years.

Klaipėda Region Specialization strategy.

Klaipėda Region Specialization Strategy 2030 action plan.

1.6 Møre & Romsdal, Norway

There is an established collaboration between the companies in NCE Blue Legasea cluster, the administration of the cluster and Møre and Romsdal County administration. The working group for the **Møre and Romsdal R&D strategy** (2016–2024, spanning two strategy periods) included members from both the marine and biomarine sectors. Additionally, the cluster administration contributed to the development of the strategy and participated in the reference group for Green Industrial Lift Møre and Romsdal—an industry analysis commissioned by the Møre and Romsdal County Council and Innovation Norway. The industry analysis maps regional competitive advantages, as well as barriers to the green transition and industry development in the county.

Regional marine and biomarine development has been a key focus in all strategic efforts, with the work carried out by NCE Blue Legasea CoP providing valuable inspiration and input to these initiatives. The finalised reports and strategies have been promoted across various cluster activities.

"A Biomarine initiative" was highlighted in the "*Green Industrial Lift Møre og Romsdal*" report as one of three strategic focus areas for regional transition and growth in the coming years. The rationale is that the biomarine sector, along with its potential for further growth, leverages Møre and Romsdal's competitive advantages while capitalising on the emergence of new species, business opportunities, and technologies to secure an even stronger competitive position.

In parallel to the work done in the "*Green Industrial Lift Møre og Romsdal*" report, NCE Blue Legasea was also invited to the stakeholder group, giving input to the OECD's "Circular Møre and Romsdal report" in January 2024. This report primarily focused on policy making on circularity in Møre and Romsdal, but the blue bioeconomy growth opportunities and obstacles were also part of the discussions.

Development obstacles

Future growth in the marine and biomarine sectors will be affected by the following obstacles:

Power: Access to power and the grid is the biggest barrier to transition and new value creation.

Capital: Transition requires capital, and the capital market is changing to support the transition.

Expertise: Møre and Romsdal must ensure enough expertise and workforce for the business community in the green transition.

Area: While there is ample land available for business, the absence of a comprehensive plan to prioritise and organise this space poses a challenge that must be addressed to foster innovation and accelerate the transition.

In addition to these factors, regulatory requirements and framework conditions impact innovation and innovation speed, as well as funding support.

Desired state

"Green Industrial Lift Møre and Romsdal" set up three main overall goals:

1. Strengthen green and circular projects with growth and scaling potential.
2. Be a catalyst for the emergence of green value chains across sectors.
3. Accelerate the green transition in businesses in Møre and Romsdal.

The biomarine sector was highlighted in the report as one of three strategic sectors that will contribute to reaching these goals. The main actions should be within the full utilisation of bioresources, production of sustainable feed and new products, utilisation of new technology and production methods, and sustainable harvesting of resources from the ocean and seabed.

Møre and Romsdal Development Strategy and Action Plan

As of November 2024, the R&D strategy for Møre and Romsdal County is undergoing revision. The work will be finalised during spring 2025. The final result of the COP work on the blue vision for the region will be submitted to the committee responsible for this strategy in Møre and Romsdal County.

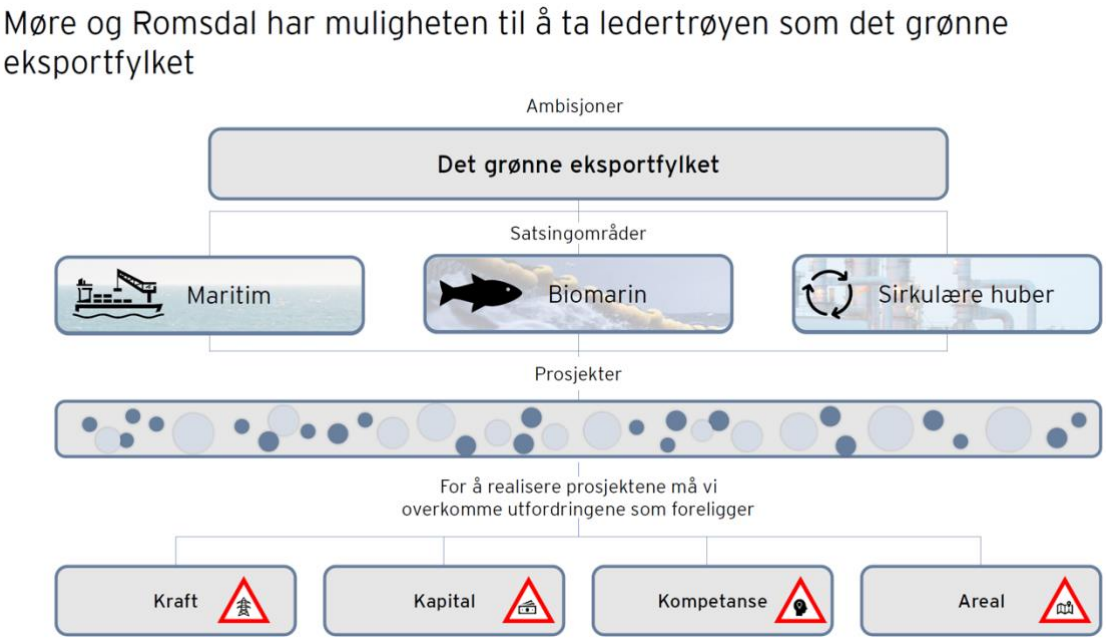

Figure 8 shows the biomarine/blue bioeconomy as one of three core areas for lifting Møre and Romsdal as a lead green export county.

Regional development reports for Møre and Romsdal.

1.7 Peniche, Portugal

Peniche has a centuries-old tradition when it comes to its inhabitants' relationship with the sea. Nowadays, it is maintained with infrastructures and a strong connection to

economic and research-linked activities related to the sea. Exposure to the sea and the importance of its natural blue capital are key to the region's development.

Over time, and especially in the 20th century, fishing activities underwent a profound transformation, where traditional vessels and capture techniques gave way to modern trawlers and productive purse seine fishing methods. This transition led to the development of numerous economic activities related to fishing, which are still prevalent in the region today, including port management, shipbuilding, the processing of frozen and fresh fish, salt fish production, the canning industry, and the production of fish oils and fishmeal.

The west coast region around Peniche also has dense populations of macroalgae in the sublittoral plateau of the central zone of the Portuguese coast, and this reveals a potential to use and valorise macroalgae research for new applications, fostering novel algae-based solutions widely used in microbiology, biotechnology, medicine, cosmetics, and the food industry. Agar-agar extraction from macroalgae is already an established industry.

These activities have been intrinsically linked to improving the quality of life of Peniche's inhabitants and represent a significant source of income for them. Consequently, initiatives are already in place for collaborative work on specific strategies to ensure the sustainability of blue bioresources in the region. Some examples of collaborative approaches in the region are presented below:

- Regulation of the Berlengas Natural Reserve Management Plan (Council of Ministers Resolution No. 180/2008), which defines the natural values of the Berlengas Archipelago and the surrounding marine area, which includes the issue of fishing as well as the organisation and monitoring in order to reconcile the sustainable development of economic activities compatible with their defence.
- CO-PESCA Project Report - Scenarios for a fisheries co-management process in the Peniche-Nazaré axis (financed by the Fisheries Operational Program - PROMAR), which includes a diagnosis of the region's fisheries and a co-management proposal that could contribute to the three pillars of sustainability: economic, social and environmental.
- Political and strategic guidance reports, namely "The Economic value of oceans in Portugal" developed by "The Gulbenkian Oceans Initiative", Calouste Gulbenkian Foundation, which presents data and guidelines for the Peniche region, namely with the themes of sardine fishing and trawling;
- BBC supports developing a local CoP to enhance the region's sustainable transition based on the value chain that uses fish as a bioresource.

Taking the example of the Regulation of the Berlengas Natural Reserve, there is already an awareness of the ecosystem services that the natural capital of the Archipelago can provide to the region in symbiosis with the need for local communities to continue to have access to fishing activities to provide food and income through

commercial fishing. With the aim of promoting the protection of the natural values of the Archipelago and the surrounding marine area, and also to organise, control and improve its recreational potential, the regulation aims to encourage the sustained development of economic activities compatible with its defence and was classified as a World Wildlife Reserve Biosphere by UNESCO in 2011. In the Berlengas Natural Reserve, commercial and recreational fishing activities are integrated with economic activities to combine them with scientific knowledge and cooperation, ensuring that the marine ecosystem continues to provide its services (Art. 43, Resolution of the Council of Ministers No. 180/2008). The same article also prioritises “the activity of adjacent fishing communities that depend on local fishing”.

Methodology Tools and Measurement

Following the collaborative work initiated by the BBC, a CoP was established in Peniche, aiming to support a sustainable transition in the region by leveraging its established value chains, which are grounded in regionally available marine bioresources, particularly those targeted by fishing activities and macroalgae. A research and data collection methodology was used, bringing together scientific knowledge, ongoing project showcases, and testimonies that were subsequently analysed and combined with tools developed throughout the BBC project: 1) the Interactive visual value chain facilitation tool (Figure 9); 2) the Ecosystem Approach Wheel. This methodology enabled a more comprehensive reflection, classification, quantification, and understanding of ecosystem services, value chains, and their potential in the region.

Figure 9 Value Chain Identification Using the BBC Visual Facilitation Tool

CoP Peniche’s sessions, developed under the BBC project, reinforced collaborative work among different stakeholders based in Peniche, contributing directly and indirectly to the identified value chains, such as support services for the blue economy in the region. A 5-Helix approach was crucial in ensuring diverse perspectives and visions for the region in the short to medium term. Participants represented academia, including professors and students, as well as public institutions, companies (startups, SMEs, and large companies), and the community and other related associations.

Three CoP sessions were organised based on collaborative workshops to set the priorities and action plans for the region based on two priority value chains. In the mapping phase, information was collected from studies and projects to support a better framing and understanding of the theme in the region to support the CoP

sessions' interactions and reflections. The result of the 2nd CoP session was a list of challenges and opportunities for each value chain (fish and macroalgae) to support strategic decisions, informing the ideation of two projects through the input of the 5-helix participants. The collaborative approach to co-managing these two value chains is a crucial factor in incorporating different perspectives, a necessity based on the actors' own contexts. The 3rd CoP session was dedicated to kicking off action plans for two regional projects with potential benefits for the stakeholders involved.

The completion of this work allowed us to delve deeper into the theme of ecosystem services, assess indicators and drivers for change that are vital for a better understanding of how to promote sustainable management of blue resources. The techniques, tools and methodologies used for evaluating, monitoring and valorising marine ecosystems in Peniche were crucial for generating knowledge that can contribute to sustainable societal and business development. They are presented in the section below.

Identifying Challenges and Opportunities

The CoP Peniche group began by reflecting on the region's challenges and hurdles in sea-related activities. The results from the 1st CoP session presented below (Figure 10) were intended to maximise the economic value of value chains related to fish and macroalgae by exploring new products, technologies, and services in a sustainable and circular approach.

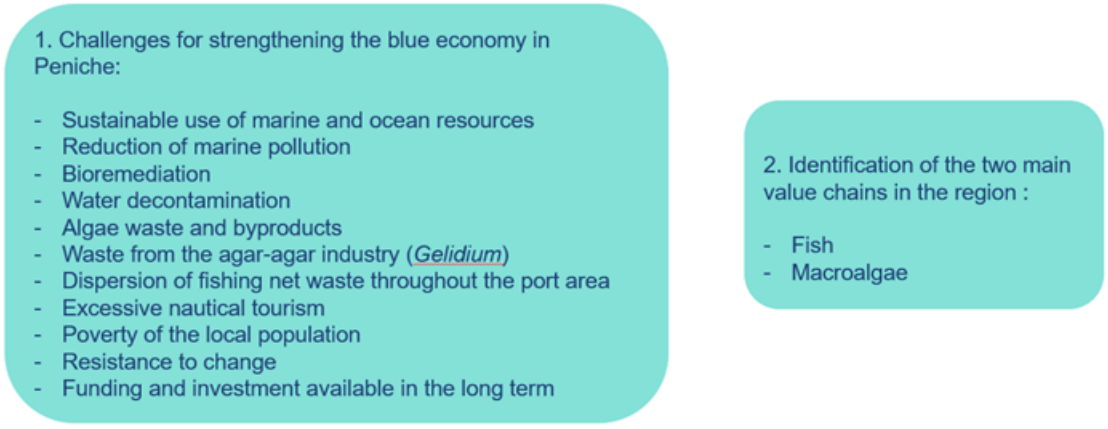

Figure 10 1st CoP meeting.

The 2nd CoP session's objective was to set a Blue Vision of potentialities and challenges (Figure 11) to promote a sustainable approach, transition and integration of the prioritised value chains in Peniche (fish and macroalgae).

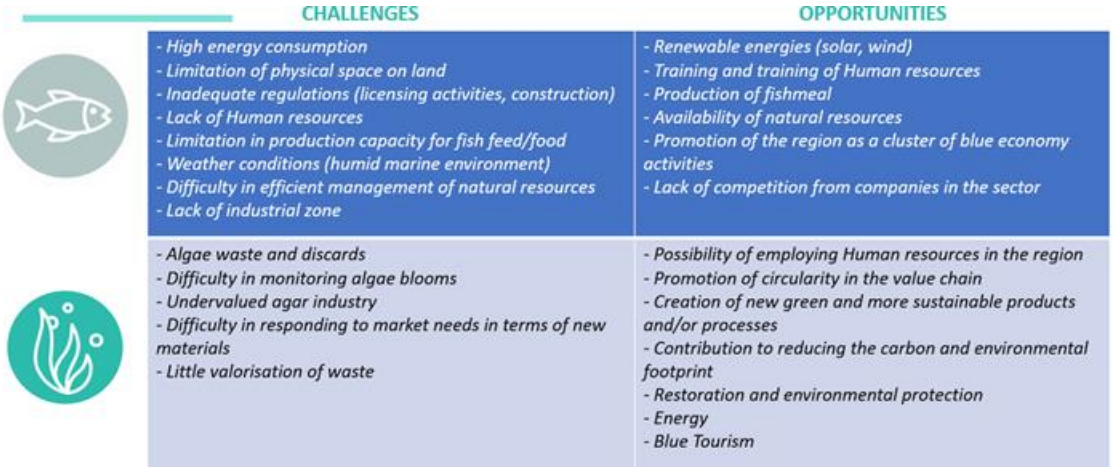

Figure 11 2nd CoP meeting.

In the case of the Peniche region, the sustainability challenges listed are related to energy consumption practices based on fossil fuels and the scarcity of bioresources. New perspectives on the byproducts of these value chains, which have traditionally been considered end-of-life waste or low-value products, are being developed with a focus on reducing environmental impact. On the other hand, the needs inherent to human nutrition are at the basis of the relevance of this topic, as satisfying these needs requires an increasingly sustainable and circular food response. The challenges extend to other levels, such as regulation and governance, financing, and distribution chains; therefore, the organisation of the intervening agents, as well as consumers, allows for more effective approaches in implementing these new products in the market. Collaboration and co-creation of successful strategies for the value chains are key to contributing to the objective of a circular approach in the Peniche region. An alliance between economic, scientific knowledge and governmental activities can add value and support strategic decisions regarding the regulation, management and support for the circularity and sustainability approaches.

The outcomes of the 3rd CoP included the conceptualisation of two strategic projects, intended for development in the region beyond the scope of the BBC project. These projects are detailed in the following sections.

Goals

Based on the results of each session for both value chains, a collaborative reflection was crucial to set a common vision among all participants. This considers the intellectual, technological, and operational resources available that can be utilised in the action plan supporting strategic decisions for the development of the two projects, which can contribute to a sustainable transition in the region.

Project 1: FISH – “Fish from Peniche”

Create a Stamp/Certification to prove that fish from Peniche (harvesting, processing, packaging, and distribution) ensures sustainability standards throughout the value chain. This Stamp/Certification is a recognition for fisheries, aquaculture, the canning industry and processed fish (fresh, frozen) for the higher valorisation of fish from

Peniche. Through a Stamp/Certification, the goal is to increase the commitment to preserving the marine ecosystem, transparency in sustainability, and circularity practices of processes (fishing, processing, packaging and distribution, etc.), raise awareness on the customer side for more informed decisions and increase their decisions on sustainable products, addressing the traceability for the final consumer about the distinction of quality and promoting an economic valorisation of the final product 'Fish from Peniche'.

Project 2: MACROALGAE - Valorisation of macroalgae byproducts

Increase compound valorisation from macroalgae blooms in the region after the extraction of the ágar-ágar. The goal is to create conditions for industrial extraction in Peniche to track and valorise the byproducts in the region. Allow the valorisation of residual biomass after the use of agar-agar, using green and sustainable technologies and more efficient processes to add more value to macroalgae waste.

The results are expected to identify new processes, products, and applications that can enable new economic and commercial activities in the region through innovative market applications, such as microbiology, biotechnology, medicine, cosmetics, food and feed, nutraceuticals, and cosmetics.

Regional Action Plan

Overall, continuous technical and regulatory advancements, combined with scientific knowledge and effective monitoring, can support the sustainable development of value chains. By aligning with market trends and resource availability, these efforts can help create long-term value for the region while prioritising sustainability. Thus, bilateral sessions and meetings will be promoted in 2025 to define an action plan for both projects, establishing a roadmap, SMART goals, and KPIs to measure the impact in the region. The starting point for the two value chains differs in terms of their establishment. Overall, there is work to be done at different levels in both value chains.

In short, many complementary actions and measures can be applied to increase the efficiency of this assessment and monitoring for the ecosystem under analysis:

• Inform the community (namely, companies operating in the ecosystem as they interact directly with the ecosystem);

• Create co-management groups for bioresources (or groups of bioresources) that are targeted for economic purposes;

• Regulate and certify methods and entities according to sustainability practices and low impact on the ecosystem;

• Support agents involved in activities in terms of training, qualification, more efficient and less impactful technical provision, including financial support;

• Promote research and development to generate knowledge about the ecosystem.

Project 1: FISH – "Fish from Peniche"

The preliminary work developed under Project 1 was to map the relevant actors that work and support the value chain (direct and indirect). Not only is fish the focus of the project “Fish from Peniche”, but industry and digital technologies, packaging, and delivery solutions contribute to the sustainable use of the marine bioresources targeted by the fishing sector. Along the value chain, agents are organised, ranging from fishing and aquaculture, processing and distribution, to supporting activities such as transportation, port management and research and development. Other stakeholders were mapped and showed their availability upstream of the value chain. An example of the stakeholder and process configuration of this value chain and the identified agents involved in it in the Peniche region is presented in Figure 12.

Figure 12 Value chain project 1(still in development).

Project 2: MACROALGAE - Valorisation of macroalgae byproducts

The new applications for byproducts generated by the agar-agar extraction open up many possibilities for novel utilizations of its compounds responding to global challenges such as 1) the transition to a circular economy, 2) reducing the environmental impacts generated by discarded waste, 3) creating of new products and biotechnological innovation, and 4) greater economic appreciation of available macroalgae and their sustainable use. In the initial phase, this approach is only possible with the contribution of science to the study and discovery of these new paths. Science can thus continually contribute to the detection of compounds of waste from the sector that can be valued, and for other sectors, presenting possible applications, the state of the art and the challenges inherent to this transformation. Thus, research and development centres are crucial to different value chain phases, contributing to the circularity of processes.

By mapping the projects in the region, a relevant scope of projects already explored is evident, including the human and animal food sector, agriculture, medicine, biotechnology and biomaterials, textiles, cosmetics, and pharmaceutical industries based on Gelidum. Not only the use of these byproducts from macroalgae on its circularity, but also the way in which the transformation and revaluation of the

byproducts are carried out, taking into account the methods to be used. The selection and discovery of new methods with reduced environmental impact and less generation of other waste go hand in hand with the scientific research that can be introduced into these processes. Therefore, strengthening science and research with industry is a key factor in this transition sector to a circular economy. At the moment, collaboration across the value chain between public and private agents can encourage circularity and finance the ongoing projects that are being established. It is considered vital to leverage these practices to promote circularity and consolidate it in the market.

Downstream in the value chain are consumers who lack information and accreditation of these processes to have greater confidence in the consumption of these newly generated products. Thus, sector regulation and communication strategies enhance the consolidation of the value chain as a whole. New products also require agility in legal terms for their final validation and entry into the market. Various actors, such as legislators, industry, distribution, research centres, support and supervision agents, technology suppliers, and training and qualification institutions, must collaborate in the value chain approach, especially with a view to increasing the valorisation of co-products, promoting greater circularity in the fishing sector. Collaborative supply chains can drive cost efficiency and a more efficient business strategy. Circularity in the sector attracts new perspectives on established, typically linear business models, challenging their adaptation and evolution within the sector and global challenges. This sets the basis for the upcoming work around the action plan.

1.8 Argyll and Bute, Scotland, United Kingdom

The blue biotechnology sector within Scotland is well developed and supported through an industrial network, the Industrial Biotechnology Innovation Centre, and the Scottish Governments' National Plan for Industrial Biotechnology (IBioIC, 2022). Argyll and Bute Council area (governmental municipality/ region) has a strong blue economy sector and is host to the primary production of fish (farmed and wild-caught), shellfish (farmed and wild-caught), and seaweed (cultivated and wild-harvested), with several SME's and start-ups focusing on the development of products from side streams or within a biorefinery approach. For example, Oceanium creates bioactive ingredients from seaweeds for human consumption, and CuanTec creates Chitosan from shellfish shells. The municipality is also host to two Higher Education and research institutes operating in the marine sector, the Scottish Association for Marine Science (SAMS) and the University of Stirling, as well as the European Marine Science Park, which hosts 14 (at the time of writing) businesses working within the blue economy sector.

Regional Action Plan

The governance level of strategies/ action plans for the blue bioeconomy are set at national level within Scotland, as noted above. However, there are actions being taken by governmental and arms-length governmental agencies and CoPs at a regional

level which support the development of the regional blue bioeconomy and feed into national level strategies, which we describe below.

The blue bioeconomy sectors operating within Argyll and Bute are diverse, and, as such, the reporting on this regional action plan focuses on the seaweed sector. The seaweed sector is an expanding and developing industry with operations across the value chain located in the Council area. Argyll and Bute Council (the municipality's governmental organisation) funded a feasibility study for the development of seaweed aquaculture in the Council area waters (Stanley et al., 2019). This evidence informed the inclusion of blue infrastructure (including blue bioeconomy infrastructure) within the Argyll and Bute Council's Local Development Plan 2, which provides the local planning framework for the Council area over the next 10 years (2024-2034) (Argyll and Bute Council, 2024). The seaweed sector in Argyll and Bute has had a CoP for several decades, of which SAMS is a part. This CoP has developed into an industry body, the Scottish Seaweed Industry Association (SSIA), which has been in operation since 2014. The SSIA and its members are supported by two public bodies, the Crown Estate Scotland and the Highlands and Islands Enterprise, which co-fund a full-time Business Development Manager position.

The CoP meets every year for a conference to share information, present experiences and data, and discuss upcoming development challenges and opportunities. In 2023, the SSIA conference theme was "Responsible Expansion", with biosecurity, environmental stewardship, safety, and social responsibility covered within conference talks (where SAMS presented on social responsibility). In 2024, the theme was "Celebrating 10 years of SSIA" and focused on two areas of growth which are considered both a challenge, in that they are difficult to do properly, and an opportunity, in that, if done properly, could be commercially competitive: biostimulants and biorefinery approaches to seaweed processing and products. Within this, there were also elements of social responsibility and biosecurity to build the sustainability of production and processing operations. The SSIA conferences feed into resources available for members and some available for free on the SSIA website (https://www.ssia.scot/resources), as well as supporting informal and project-based networks. The SSIA is now developing good practice guidelines for seaweed cultivation in Scotland, which aims to support the sector across all areas, from nursery through to planning and community engagement.

Development obstacles

The major challenges for the seaweed CoP in Argyll and Bute are routes to market and the development of products that are valuable enough to legitimise high production costs (Stanley et al., 2019). Intensifying the complexity of finding solutions to these challenges are the social and regulatory environments, as well as the existential threat of climate change. Regulations are currently considered unsuitable for this purpose (Griggs, 2022), and social license to operate for seaweed farming is conditional (Billing et al., 2023; Bjørkan & Billing, 2022). Poor consultation practices within the planning process by one company have already led to negative press at a

national level (e.g. Butler, 2024) and a petition to review the environmental impacts of seaweed farming across several Council areas in England (see, for example, https://saveourbays.org.uk/port-quin). This poor practice may have ramifications for operators in other areas of the UK, including Argyll and Bute (Billing et al., 2021; Moffat et al., 2016; Morrisson, 2014). As the seaweed industry in Argyll and Bute develops, it must simultaneously address the challenge of climate change impacts on its operations, including issues with diseases and pests, ocean warming, and extreme weather events, disrupting cultivation and lowering yields (Veenhof et al., 2024). Argyll and Bute are, however, in a good position to develop solutions to these challenges, given the well-developed seaweed CoP, research and development infrastructure locally at SAMS and the University of Stirling, as well as national infrastructure available through the Industrial Biotechnology Innovation Centre.

Desired State for 2035

The National Plan for Industrial Biotechnology includes marine biomass and has six priority areas to support sustainable growth: policy, industry engagement, innovation, skills, sustainable manufacturing, and infrastructure. Key areas for the seaweed CoP in Argyll and Bute include improving policy (which also involves developing public acceptance and trust in biotechnology, a requirement for viable markets), supporting sustainable manufacturing and scaling biomass processing, which is linked with infrastructure, and processing for a biorefinery approach, in particular. The National Plan for Industrial Biotechnology runs until 2045 but is likely to be updated in 2025-26.

2 Action Plans with SMART Objectives & Monitoring and Evaluation Framework

During the project meeting in Amsterdam on November 28, 2024, the University of Tartu facilitated an interactive workshop to develop action plans with SMART objectives and a Monitoring and Evaluation (M&E) framework. The session, targeting project partners involved in CoP activities, provided tools and strategies to create measurable and actionable plans aligned with broader project goals.

Workshop Structure and Outcomes
Participants were divided into two groups:

- Group 1 (6 members): Focused on a broad perspective of the blue bioeconomy, initially working individually with Post-it notes to organise their thoughts before engaging in structured discussions. Struggled to define environmental objectives and key performance indicators (KPIs).

- Group 2 (7 members): Concentrated on a specific value chain, using a collaborative brainstorming approach without individual preparation. Found it challenging to articulate social objectives.

By synthesising the outcomes of both groups, a flexible framework for coastal regional action plans can be established, highlighting the importance of adaptability to diverse regional needs and funding opportunities.

Figure 13 Starting the group work.

Steps for Collaborative Development of Action Plans

1. Identifying Priorities for Action (20 minutes)

- Task: Each group selects one urgent/feasible target/goal per dimension: environmental, economic, and social.
- Output: Agreed list of priority actions for each development dimension.

2. Developing SMART Objectives for the Actions (20 minutes)

- Task: Group Work on SMART Objectives
- Output: Draft action plan with SMART objectives for environmental, economic, and social objectives.

3. Designing Monitoring & Evaluation Indicators (15 minutes)
Discuss and reflect

- What metrics will reflect progress for each SMART objective?
- Can these indicators be standardised across Blue Regions for benchmarking?
- How will data be collected and shared?
- Output: A list of key performance indicators (KPIs) for monitoring and evaluation.

The workshop emphasised collaboration and adaptability, providing a robust foundation for action plans that address regional needs and foster sustainable blue bioeconomy development.

2.1 Results

Group 1: wider approach

Circular Solutions, Ecosystem Services, Energy Efficiency (Reduction of GHGs), Resilience, and Nature Restoration.

Environmental Objectives

- Reduce the environmental impacts of industries through decision support tools, validation processes, and emission reduction (energy focus).
- Promote the use of bycatch and whole fish to minimise waste.
- Enhance marine health and improve coastal habitats through ecosystem-based approaches.
- Increase the application of circular solutions in seafood processing, with a focus on valorisation and high-value biomass.
- Implement the "Ecosystem Approach Wheel" (WP3) to promote sustainable activities.
- Drive value-added processes for biomass, creating more revenue through R&D and the circular economy.

Indicators

- Number of initiatives applying circular solutions in seafood processing.
- Reduction in industry-related negative impacts.
- Improvement in marine health metrics and coastal habitat restoration.

Economic Objectives

- Drive local land-based value creation to higher-value industries, such as medical applications.
- Increase wages and overall economic value from blue bioeconomy resources and byproducts.
- Promote circular economy principles, targeting funding for innovative solutions that improve ecosystem services.
- Generate growth and resilience in the blue bioeconomy.
- Increase value-added seafood products, benefiting companies financially and expanding opportunities.
- Expand the number of companies engaging in seafood value chains and fostering synergies with other sectors.
- Secure additional funding to highlight ecosystem services (blue bioeconomy as more than a product). See more in BBC report D3.2 (Report on the regional strategies to valuate ecosystem services of the blue bioeconomy, including lessons learnt, overview of techniques, and best practices).

Indicators

- Growth in regional economic activity with more companies involved in the seafood value chain.
- Increased funding for ecosystem services and innovative projects.
- Higher wages and overall income stability in coastal regions.

Social Objectives

- Increase the participation of women in fisheries and aquaculture industries.
- Enhance employment opportunities, encouraging population growth in coastal areas and reducing job seasonality.
- Promote coastal community growth through year-round employment and economic stability.
- Integrate blue bioeconomy principles into education, creating skills training opportunities for youth and underserved groups.
- Upskill the workforce for more permanent (non-seasonal) jobs, supporting market demand shifts.

Indicators

- Number of women employed in the blue bio industry.
- Number of permanent, year-round jobs created.
- Number of training programs for the blue bioeconomy.
- Number of students participating in skill development programs.
- Collaboration initiatives with employment agencies.

Initiatives and Activities

Valorisation Activities:

- Identify and select products to valorise in the most relevant value chains.
- Support new companies engaging in value chain processes.
- Develop links to transport and logistics to reduce emissions (measured in tons of CO_2) in existing sectors.

Training and Employment:

- Establish new training programs for the blue bioeconomy.
- Promote student participation in education initiatives.
- Upskilling programs targeting market demands.

- Support for start-ups and companies through dedicated funding programs.

Ecosystem Services and Energy Efficiency**:**

- Enhance energy efficiency (measure: kilowatts produced per kilogram of fish species).
- Promote carbon sequestration and nitrogen reduction initiatives.
- Reduce the costs of ecosystem maintenance through ecosystem services (ES).
- Advocate for legislation changes to reduce insurance needs through ES.

Biodiversity and Habitat Restoration:

- Increase the number of autochthonous species supported.
- Restore and enhance key habitats.
- Launch projects to improve biodiversity dynamics.

Key Indicators for Environmental and Ecosystem Services:

- Number of key habitats restored or enhanced.
- Number of biodiversity-focused projects initiated.
- Metrics for CO_2 emission reductions in transportation and logistics.
- Energy efficiency gains (e.g., kilowatts per kilogram of processed fish).

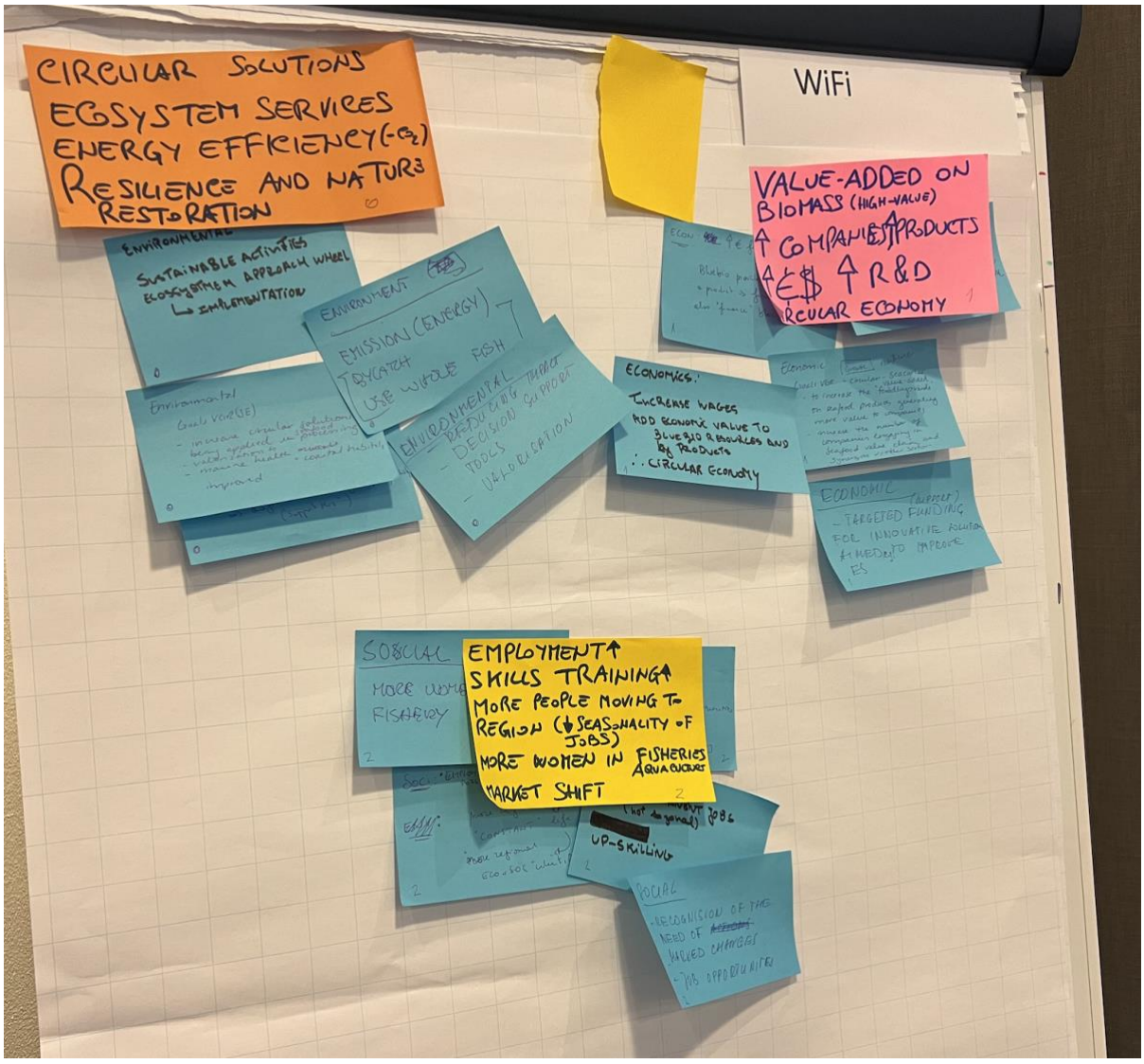

Figure 14 Group work of group 1.

Group 2: narrower approach

Empowering Coastal Regions through Sustainable Blue Bioeconomy Development, focusing on the fish value chain.

Environmental Objectives

- Reduce fish processing wastage by …%.

Indicators

- Identify X number of top-volume waste species.
- Map hotspots of waste.
- Determine the most interesting characteristics of waste.

Objective

Within 4 months, map the volumes, locations, and types of fish processing wastage along with their characteristics.

Economic Objectives

- Achieve greater valorisation of fish processing cut-offs by creating more co-products and blue bio-value chains (% target).

Indicators

- Identify X number of potential products based on waste.
- Conduct comparative market analyses.
- Assess the cost/pricing for the highest-potential products.
- Create X partnerships/projects with start-ups and research institutions.

Objectives

- Identify potential products with a focus on "low-hanging fruit."
- Perform a market demand analysis.
- Assess business model feasibility.

Social Objectives

Target Groups: Coastal regions, formerly industrial regions, fisheries heritage communities, underserved communities, migrant communities requiring reskilling.

- Reskill and train unemployed or re-entering workforce members in value creation businesses within the blue bioeconomy.
- Increase the number of reskilled workers from underserved/minority groups by …% in fish co-product creation.

Indicators

- X number of reskilled individuals from underserved communities.
- Align reskilling efforts with the most promising products.

Objectives

- Map the demand for trained employees.
- Identify the needs of underserved communities.
- Design an entry-level certified course for initial training.

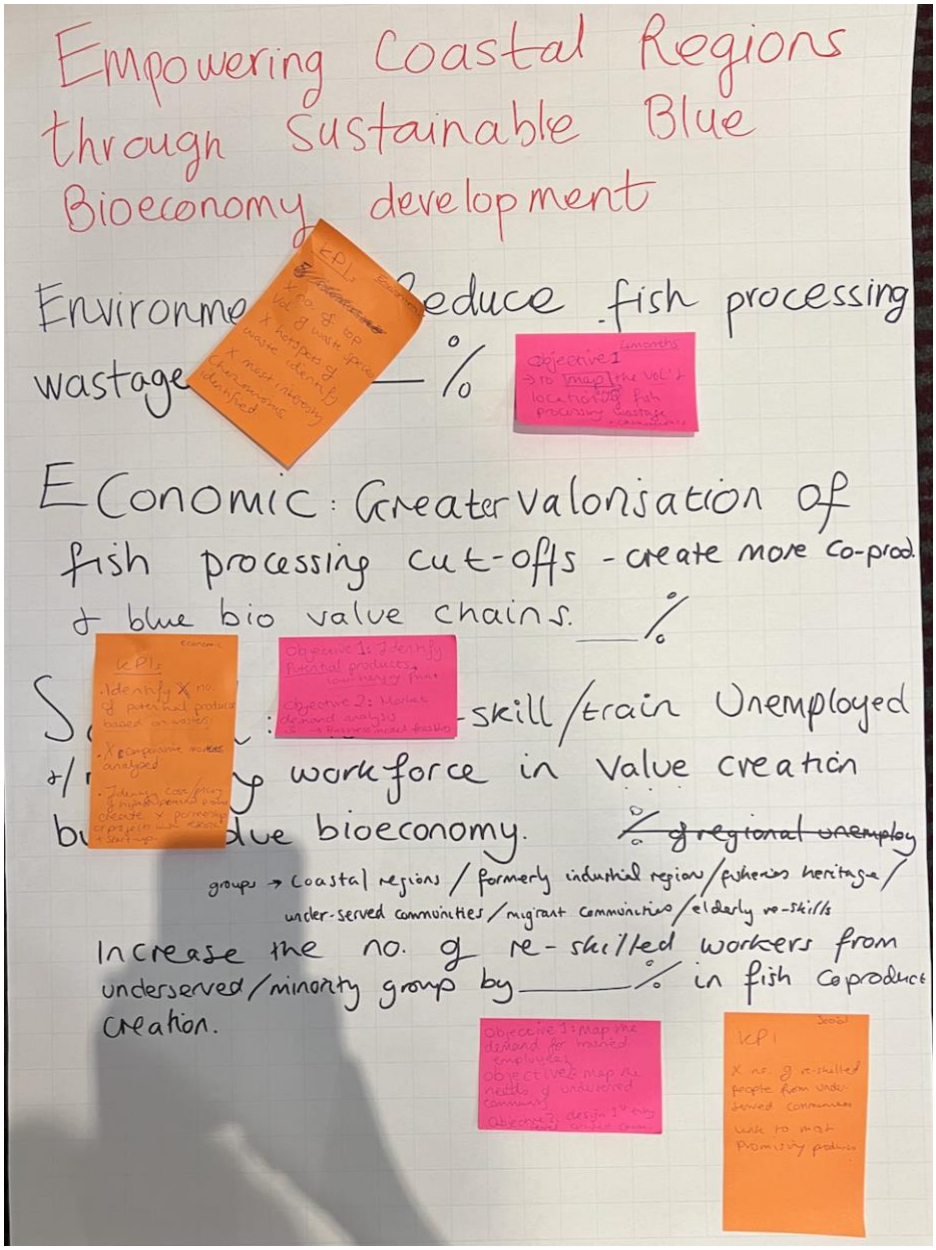

Figure 15 Group work of group two.

The workshop highlighted the importance of collaboration and diverse approaches when developing action plans for the blue bioeconomy. The two groups took different but complementary paths—one focusing on broader, ecosystem-based strategies and the other on specific value chains like fish processing.

The combined outcomes of the groups emphasise the need for adaptable strategies that account for the unique needs of coastal regions, including funding, community participation, and environmental sustainability. By integrating these insights, stakeholders can develop action plans that drive innovation, enhance ecosystem services, and create sustainable employment opportunities. This collaborative effort supports the blue bioeconomy and fosters long-term resilience and prosperity for coastal communities.

Regional SMART and M&E overview

This subsection summarises each region's SMART objectives and M&E plan using a shared three-part template that was developed in a workshop in Amsterdam. The session equipped CoP with practical tools to turn priorities into measurable actions, and this template now frames environmental, social and economic goals, assigns owners and quick wins, and supports cross-region benchmarking.

Each region follows the same three-part structure integrating SMART and M&E:

• SMART Objectives (E/S/Ec): Three concise SMART objectives (Environmental, Social, and Economic) plus 1–2 indicators each, including baseline, target, timing, and data source.

• Action list with owners & quick wins: A prioritised list of actions stating "who does what, by when, with what resources," highlighting quick wins (≤6–9 months) and links to Key Exploitable Results (KERs)/post-project opportunities.

• Monitoring & Evaluation plan: A light, replicable plan with responsibilities, frequency, and learning loops. Where a region lacks precise baselines, the CoP will complete "baseline first" actions in 2025 using the WP6 workshop templates.

Cross-region benchmarking candidates (from the WP6 workshop): # CoP meetings/year; # actors engaged (5-helix); # new pilots; % female participation; # valorisation initiatives; tonnes/by-% of waste or by-catch valorised; GHG-intensity proxy; jobs created; training completions; € of follow-on finance.

Saaremaa, Estonia

Saaremaa's plan is anchored in a municipality-led strategy that includes a "Marine Resource Valorisation" chapter and is reinforced by a growing higher-education offer at TalTech Kuressaare College, active firms and projects, and the new mesocosm facility at Kõiguste. By December 2026, the region aims to enable two pilots that measurably remove nutrients, such as through seaweed or mussel cultivation, using the Kõiguste mesocosm and one in-sea pilot, with documented methods to estimate nitrogen and phosphorus removal; success will be tracked by the number of pilots, the presence of a validated method, and an annual N/P removal estimate. By June 2026, two blue-bio modules will be integrated into the "Sustainable Blue Economy Technologies" BSc, and at least 40 students will be trained, with women representing a minimum of 40 per cent of participants; indicators include the number of modules, enrolled students, and the gender balance. Economically, by December 2026, the plan targets three new valorisation initiatives, covering by-catch, whole-fish, or seaweed co-products, in collaboration with at least two local SMEs, with progress measured by the number of initiatives and public/private funds leveraged. Immediate actions include, within nine months, convening a permitting "sandbox" taskforce to scope an experimental area and monitoring protocol (owned by Saaremaa Municipality with support from UTartu, TalTech, and Est-Agar/Vetik, producing draft terms and a monitoring checklist); co-designing the two BSc modules on valorisation and

ecosystem services using CoP case material (owned by TalTech Kuressaare College with support from UTartu/EMÜ and companies, producing syllabi and a guest-lecturer pool); and launching "100% Fish – Saaremaa edition" with processors to valorise side streams (owned by local processors and UTartu with municipal support, producing two product-track briefs and a market scan). To strengthen comparability, the region will apply the BBC Visual Facilitation Tool for value-chain mapping and the WP6 indicator set. Monitoring and evaluation are coordinated by the Municipality with UTartu using a method conducted on a semi-annual basis, drawing on project logs, course enrolments, and pilot reports.

Table 2 SMART objectives, actions and M&E summary

Element	**Summary**
Context anchor	Municipality-led strategy with a "Marine Resource Valorisation" chapter; growing higher-education offer (TalTech Kuressaare College); active firms/projects; new mesocosm facility at Kõiguste.
SMART — Environmental *(to be validated in 2025)*	By Dec-2026, enable two nutrient-removal pilots (e.g., seaweed/mussel) using the Kõiguste mesocosm + one in-sea pilot; **KPIs:** # pilots; presence of documented method; annual N/P removal estimate.
SMART — Social *(to be validated in 2025)*	By Jun-2026, integrate two blue-bio modules into the "Sustainable Blue Economy Technologies" BSc and train ≥40 students, with ≥40% women; **KPIs:** # modules; # students; % women (TalTech).
SMART — Economic *(to be validated in 2025)*	By Dec-2026, launch three new valorisation initiatives (by-catch/whole-fish/seaweed co-products) with ≥2 local SMEs; **KPIs:** # initiatives; € public/private leveraged.
Actions & quick wins (owners)	**E-1 quick win (≤9 months):** Permitting "sandbox" taskforce and monitoring protocol (Owner: Saaremaa Municipality; Support: UTartu, TalTech, Est-Agar/Vetik; Output: draft terms + checklist). **S-1 quick win:** Co-design two BSc modules using CoP cases (Owner: TalTech Kuressaare College; Support: UTartu EMI/EMÜ, companies; Output: syllabi + guest-lecturer pool). **Ec-1:** "100% Fish – Saaremaa edition" with processors (Owner: Local processors + UTartu; Support: Municipality; Output: 2 product-track briefs + market scan).
KERs/Tools	Apply BBC Visual Facilitation Tool for value-chain mapping; use WP6 indicator set for comparable reporting.

M&E	Owner: Municipality (coordination) + UTartu (method); Cadence: semi-annual; Data: project logs, course enrolment, pilot reports.

Flanders, Belgium

Flanders is tackling fragmented value chains and regulatory and spatial constraints by advancing the Maripark concept and aligning multiple policy inputs, including LCCD, aquaculture priorities, and the 2026–2032 Maritime Spatial Plan. By 2027, at least one multi-use "Maripark"-ready zone will be designated in Belgian waters with aquaculture as an eligible co-use, evidenced in the MSP draft text. By 2026, aquaculture SMEs will have ongoing representation in two policy fora (LCCD and one national process), tracked via seats held and attendance records. Economically, by 2027, the region will close two blended-finance gaps for pilot aquaculture SMEs, land-based or nearshore, using regional instruments and EMFAF, measuring the number of deals and total volume. Near-term steps include producing a "compliance map" that synthesises MSP and coastal CIA/Maripark options to speed pre-feasibility (owned by The Blue Cluster with support from FOD Health and SSAQ and delivered as a one-pager and map); formalising SME seats in LCCD (completed) and one national aquaculture group (owned by Province West-Flanders and the Flemish Ministry with confirmed terms of reference); and publishing a blended-finance "how-to" for aquaculture SMEs (owned by The Blue Cluster with investors and the EMFAF desk, resulting in term-sheet templates and a clinic series). M&E is led by The Blue Cluster on an annual cycle, drawing evidence from MSP drafts, meeting minutes, and closed finance transactions.

Table 3 SMART objectives, actions and M&E summary

Element	**Summary**
Context anchor	Fragmented value chains; regulatory/space constraints; Maripark concept; multiple policy inputs (LCCD, Aquaculture priorities, MSP 2026–2032).
SMART — Environmental *(to be validated in 2025)*	By 2027, designate ≥1 multi-use "Maripark"-ready zone in Belgian waters with aquaculture as an eligible co-use; **KPI:** MSP draft text shows designated zone(s) + aquaculture co-use.
SMART — Social *(to be validated in 2025)*	By 2026, secure ongoing representation of aquaculture SMEs in two policy fora (e.g., LCCD + one national process); **KPIs:** seats held; attendance records.
SMART — Economic *(to be validated in 2025)*	By 2027, close two blended-finance gaps for pilot aquaculture SMEs (land-based or nearshore) using regional + EMFAF instruments; **KPIs:** # deals; € volume.

Actions & quick wins (owners)	**Reg-1 quick win:** "Compliance map" of MSP + coastal CIA/Maripark options (Owner: The Blue Cluster; Support: FOD Health, SSAQ; Output: 1-pager + map). **Gov-1 quick win:** Formalise SME seat(s) in LCCD (done) and one national aquaculture group (Owner: Province West-Flanders + Flemish Ministry; Output: confirmed TORs). **Fin-1:** Blended-finance "how-to" for aquaculture SMEs (Owner: The Blue Cluster; Support: investors + EMFAF desk; Output: term-sheet templates + clinic series).
M&E	Owner: The Blue Cluster; Cadence: annual; Data: MSP drafts, meeting minutes, finance closes.

Brittany, France

Building on a strong base in fishing, shellfish, and marine biotech, and aligned with S3, EMFAF, and "France 2030" objectives 6 and 7, Brittany will, by 2027, deploy three LCA-backed eco-efficiency upgrades in aquaculture and biotech pilots focused on energy, inputs, and circularity; progress will be captured via the number of pilots and LCA summaries. By 2026, two cross-disciplinary training pathways spanning business, research, and training will be delivered to at least 50 trainees, tracked through cohort counts, completions, and gender balance. By 2027, four valorisation products in biomaterials or bio-ingredients will be advanced to TRL 6–7 using pooled facilities such as Algosolis and Biodimar, with TRL evidence as the key indicator. Immediate actions include publishing a shared "facility menu" that clarifies who offers what, when, and at what cost to accelerate SME access (a quick win owned by Pôle Mer Bretagne Atlantique with platform and lab partners); launching joint training in eco-design and bioprocess scale-up (PMBA with academic partners, producing two short courses and micro-credentials); and running a "demand signals" sprint with buyers in biostimulants, medical devices, and cosmetics to guide the top four TRL pushes (owned by PMBA and delivered through three buyer roundtables). M&E is coordinated by PMBA via a semi-annual dashboard tracking pilots, trainees, and TRL movement.

Table 4 SMART objectives, actions and M&E summary

Element	Summary
Context anchor	Strong fishing, shellfish and biotech base; alignment with S3, EMFAF, and "France 2030" objectives 6 & 7.
SMART — Environmental	By 2027, implement three LCA-backed eco-efficiency upgrades in aquaculture/biotech pilots (energy, inputs, circularity); **KPIs:** # pilots; LCA summaries.

SMART — Social	By 2026, run two cross-disciplinary training pathways (business–research–training) with ≥50 trainees; **KPIs:** # cohorts; completions; gender balance.
SMART — Economic	By 2027, advance four valorisation products (biomaterials/bio-ingredients) to TRL 6–7 using pooled facilities (e.g., Algosolis, Biodimar); **KPIs:** # products; TRL evidence.
Actions & quick wins (owners)	**R&D-1 quick win:** Publish shared "facility menu" for SME access (Owner: PMBA; Partners: platforms & labs). **Skills-1:** Joint training in eco-design + bioprocess scale-up (Owner: PMBA + academic partners; Output: 2 short courses + micro-credentials). **Market-1:** "Demand signals" sprint with buyers (biostimulants/medical devices/cosmetics) to guide top-4 TRL pushes (Owner: PMBA; Output: 3 buyer roundtables).
M&E	Owner: PMBA; Cadence: semi-annual dashboard; Metrics: pilots, trainees, TRLs.

Iceland

Iceland pursues a "testbed" vision that addresses data gaps, builds on the 100% Fish model, and advances sludge-to-product co-creation, while recognising the need for a seaweed farming framework and stronger industry–startup matchmaking through blue bootcamps. By 2026, a land-based aquaculture sludge valorisation pilot will be completed with independently verified product potential, documented through a verification memo. By the same year, two blue bootcamp cycles will engage at least 20 entrepreneurs and five industry challenge-owners, tracked by the number of cycles, participants, and industry partners. By 2027, the region aims to stand up an open ocean data commons prototype focused on priority variables for seaweed and mariculture siting, with three institutional data partners and a live platform hosting datasets. Early actions comprise a sludge valorisation scoping exercise with the Circular Economy Cluster and energy partners (a quick win owned by the Iceland Ocean Cluster, delivering a feedstock map and the two most promising product lines); a concise seaweed farming framework note to government that benchmarks options and proposes a level playing field (owned by the CoP core, delivered as a six-page brief); and a "North Atlantic Open Data Sprint" that aligns variables, formats, and QA (a quick win owned by the CoP with research institutes, producing an alpha catalogue). The CoP secretariat leads M&E through an annual "testbed" review based on pilot reports, bootcamp statistics, and data-portal logs.

Table 5 SMART objectives, actions and M&E summary

Element	Summary

Context anchor	"Testbed" vision; data gaps; 100% Fish model; sludge-to-product co-creation; need for seaweed farming framework; industry–startup matchmaking via blue bootcamps.
SMART — Environmental	By 2026, complete one land-based aquaculture sludge-valorisation pilot with independently verified product potential; **KPIs:** pilot completion; verification memo.
SMART — Social	By 2026, run two blue bootcamp cycles with ≥20 entrepreneurs and ≥5 industry challenge-owners; **KPIs:** # cycles; # participants; # industry partners.
SMART — Economic	By 2027, establish one open-ocean data-commons prototype (priority variables for seaweed/mariculture siting) with three institutional data partners; **KPIs:** platform live; # datasets.
Actions & quick wins (owners)	**Pilot-1 quick win:** Sludge-valorisation scoping (Owner: Iceland Ocean Cluster; Output: feedstock map + top-2 product lines). **Policy-1:** Seaweed farming framework brief to government (Owner: CoP core; Output: 6-page note). **Data-1 quick win:** "North Atlantic Open Data Sprint" on variables/formats/QA (Owner: CoP + research institutes; Output: alpha catalogue).
M&E	Owner: CoP secretariat; Cadence: annual "testbed" review; Data: pilot reports, bootcamp stats, data-portal logs.

Klaipėda, Lithuania

Aligned with the Klaipėda Region Specialisation Strategy (KRSS), Klaipėda is establishing a Blue Bioeconomy Competence Centre and planning a (Blue) Bioeconomy Council to strengthen governance and delivery. By Q4 2025, the Council will be formed with an adopted Terms of Reference and an annual agenda aligned to KRSS, with monitoring via formal establishment, ToR approval, and meeting cadence. By 2026, two competence-centre curricula, one on valorisation and another on ecosystem services and monitoring, will be delivered to at least 50 learners, tracked by course and learner counts. By 2027, two valorisation pilots will be incubated with Klaipėda University, the Science & Technology Park, and SMEs, measured by the number of pilots and TRL progression. Immediate priorities include convening the inaugural Council meeting in Q2 2025 to ratify membership and the indicator set (a quick win owned by Klaipėda University and AKR); co-developing the two syllabi with EU-CONEXUS peers (a quick win owned by KU); and running a value-chain clinic for SMEs using BBC tools to produce two pilot briefs (owned by KU and KSTP). M&E is overseen by the Council secretariat at KU through an annual KRSS-aligned review using meeting minutes, enrolment data, and pilot logs.

Table 6 SMART objectives, actions and M&E summary

Element	Summary
Context anchor	Alignment with Klaipėda Region Specialisation Strategy (KRSS); creation of a Blue Bioeconomy Competence Centre; plan for a (Blue) Bioeconomy Council.
SMART — Governance (S/Ec)	By Q4-2025, establish the Klaipėda (Blue) Bioeconomy Council and adopt ToR + annual agenda aligned to KRSS; **KPIs:** Council formed; ToR adopted; meeting cadence.
SMART — Skills (S)	By 2026, deliver two competence-centre curricula (valorisation; ES/monitoring) and train ≥50 learners; **KPIs:** # courses; # learners.
SMART — Economic	By 2027, incubate two valorisation pilots with KU/Science & Technology Park + SMEs; **KPIs:** # pilots; TRL movement.
Actions & quick wins (owners)	**Gov-1 quick win:** Inaugural Council meeting in Q2-2025 to ratify membership and indicator set (Owner: Klaipėda University + AKR). **Skills-1 quick win:** Co-develop two syllabi with EU-CONEXUS peers (Owner: KU; Output: 2 syllabi). **Pilots-1:** Value-chain clinic for SMEs using BBC tools (Owner: KU + KSTP; Output: 2 pilot briefs).
M&E	Owner: Council secretariat (KU); Cadence: annual KRSS-aligned review; Data: minutes, enrolment, pilot logs.

Møre & Romsdal, Norway

Within the “Green Industrial Lift” priorities and a strategic focus on biomarine industries, Møre & Romsdal addresses bottlenecks in power, capital, expertise, and area planning under the leadership of NCE Blue Legasea. By 2027, the region will enable two “full-utilisation” pilots that maximise whole-fish and bioresource use with documented ESG benefits, tracked by the number of pilots, utilisation percentage, and ESG notes. By 2026, a regional talent pathway linking vocational training to cluster internships will involve at least 30 participants, with progress measured through training numbers and placement rates. By 2026, a power-access and industrial land prioritisation map will also be published to guide blue-bio investments, as evidenced by the publication and the number of sites cleared. Near-term actions include a quick-win brief on power and grid bottlenecks for biomarine processors (owned by the County Administration and NCE Blue Legasea); a cross-sector valorisation sprint to generate two pilots (owned by NCE Blue Legasea); and an investor day focused on transition projects (owned by the County and Innovation Norway). The County strategy unit leads M&E on an annual cadence, using pilot KPIs alongside training and site-readiness metrics.

Table 7 SMART objectives, actions and M&E summary

Element	Summary
Context anchor	"Green Industrial Lift" priorities; biomarine as a strategic focus; constraints in power, capital, expertise, area planning; NCE Blue Legasea leadership.
SMART — Environmental	By 2027, enable two "full-utilisation" pilots (whole-fish/bioresources) with documented ESG benefits; **KPIs:** # pilots; utilisation %; ESG note.
SMART — Social	By 2026, deliver one regional talent pathway (vocational → cluster internships) with ≥30 participants; **KPIs:** # trained; placement rate.
SMART — Economic/Infrastructure	By 2026, publish a power-access and industrial-land prioritisation map for blue-bio investments; **KPIs:** map published; # sites cleared.
Actions & quick wins (owners)	**Map-1 quick win:** Power & grid bottleneck brief for biomarine processors (Owner: County Administration + NCE Blue Legasea). **Pilot-1:** Cross-sector valorisation sprint (feed/new products/biotech) to generate two pilots (Owner: NCE Blue Legasea). **Capital-1:** Investor day for "transition" projects (Owner: County + Innovation Norway).
M&E	Owner: County strategy unit; Cadence: annual; Data: pilot KPIs; training metrics; site-readiness.

Peniche, Portugal

Peniche builds on deep fisheries heritage, a macroalgae/agar industry, and its UNESCO Biosphere Reserve status; the CoP has prioritised two value chains and designed two flagship projects: the "Fish from Peniche" stamp and macroalgae by-product valorisation. By 2026, the stamp will be implemented across one full supply-chain cohort with audited traceability, measured by standard approval and the number of certified actors. By the same year, two co-management groups, one for fish and one for macroalgae, will operate with publicly available minutes and annual priorities, tracked through visible outputs. Economically, by 2027, the region will validate two macroalgae by-product applications (post-agar extraction) at pilot scale with local firms, as measured by product count and TRL evidence. Immediate work includes convening a stamp working group to finalise sustainability, circularity, and QA criteria and to define a basic digital traceability specification (a quick win owned by the Municipality and BBA with the port authority, industry, and R&D partners); conducting a green-process scan for residual biomass to chart lab-to-pilot pathways (owned by BBA and R&D centres, producing notes on the top two processes); and

delivering a short course on ecosystem services and co-management for stamp adopters (a quick win owned by BBA, delivering one cohort). M&E is shared between the Municipality and BBA on a semi-annual cycle, using certification records, co-management minutes, and pilot logs.

Table 8 SMART objectives, actions and M&E summary

Element	Summary
Context anchor	Deep fisheries heritage; macroalgae/agar industry; UNESCO Biosphere Reserve; CoP prioritised two value chains and designed two projects ("Fish from Peniche" stamp; macroalgae by-product valorisation).
SMART — Environmental	By 2026, implement the "Fish from Peniche" sustainability stamp across one full supply-chain cohort with audited traceability; **KPIs:** standard approved; # certified actors.
SMART — Social	By 2026, deliver two co-management groups (fish + macroalgae) with public minutes and annual priorities; **KPIs:** groups active; outputs published.
SMART — Economic	By 2027, validate two macroalgae by-product applications (post-agar extraction) at pilot scale with local firms; **KPIs:** # products; TRL evidence.
Actions & quick wins (owners)	**Stamp-1 quick win:** Working group to fix stamp criteria (sustainability + circularity + QA) and basic digital traceability spec (Owner: Municipality + BBA; Support: port authority, industry, R&D). **Macro-1:** Green-process scan for residual biomass, lab-to-pilot pathway (Owner: BBA + R&D centres; Output: top-2 process notes). **Skills-1 quick win:** Short course on ecosystem services & co-management for stamp adopters (Owner: BBA; Output: 1 cohort).
M&E	Owners: Municipality/BBA; Cadence: semi-annual; Data: certification records, co-management minutes, pilot logs.

Argyll and Bute, Scotland, United Kingdom

Argyll and Bute uses a mature seaweed Community of Practice (SSIA) with annual conferences and a strong R&D base at SAMS and the University of Stirling, while addressing policy/regulatory hurdles and social licence challenges through the development of good-practice guidelines. By 2026, the region will publish and pilot these guidelines, covering biosecurity, social responsibility, and monitoring, with five farms and processors, using guideline publication and the number of pilots as indicators. Also by 2026, two reskilling programmes for coastal communities in entry-level biorefinery and processing will train at least 40 participants, with training totals and placement rates as measures. By 2027, two biorefinery lines, such as

biostimulants and chitosan, will be advanced to bankable pre-FEED, tracked by the number of lines and investor-readiness evidence. Priority actions include finalising and socialising the guidelines via the SSIA resources page and a clinic series (a quick win owned by SSIA with support from SAMS, HIE, and Crown Estate Scotland); delivering short courses with IBioIC and SAMS on biorefinery safety and quality assurance (producing two cohorts); and publishing a "better consultation" toolkit to help safeguard social licence (owned by SSIA and SAMS, with case clinics as outputs). SSIA's secretariat leads M&E on an annual basis, using guideline adoption rates, training statistics, and pre-FEED milestones to track progress.

Table 9 SMART objectives, actions and M&E summary

Element	Summary
Context anchor	Mature seaweed CoP (SSIA) with annual conferences; R&D base (SAMS/University of Stirling); policy/regulatory and social licence challenges; development of good-practice guidelines.
SMART — E/S	By 2026, publish and pilot good-practice guidelines with five farms/processors (biosecurity, social responsibility, monitoring); **KPIs:** guidelines published; # pilots.
SMART — Social	By 2026, deliver two reskilling programmes for coastal communities (entry-level biorefinery/processing) with ≥40 participants; **KPIs:** # trained; placement rate.
SMART — Economic	By 2027, advance two biorefinery lines (e.g., biostimulants/chitosan) to bankable pre-FEED; **KPIs:** # lines; investor-readiness evidence.
Actions & quick wins (owners)	**Guide-1 quick win:** Finalise and socialise good-practice guidelines via SSIA resources page + clinic series (Owner: SSIA; Support: SAMS, HIE, Crown Estate Scotland). **Skills-1:** Short courses with IBioIC + SAMS on biorefinery safety & QA (Output: 2 cohorts). **Engage-1:** "Better consultation" toolkit to safeguard social licence (Owner: SSIA + SAMS; Output: toolkit + case clinics).
M&E	Owner: SSIA secretariat; Cadence: annual; Data: guideline adoption, training stats, pre-FEED milestones.

3. Conclusion

This report outlines a collaborative framework for advancing the blue bioeconomy across Europe's coastal regions, aligning regional action plans with broader goals such as the European Green Deal and the UN Sustainable Development Goals. Through Community of Practice (CoP) engagement, tailored strategies built around SMART objectives address regional challenges (regulatory barriers, funding gaps,

and skill shortages) while fostering collaboration among key stakeholders. In practice, CoPs act as continuity engines, convening the right actors, surfacing local constraints, and sustaining momentum beyond one-off workshops. Embedding workshop outputs back into the CoPs, with clear owners and targeted quick wins, turns plans into execution. SMART and monitoring & evaluation (M&E) are applied as practical tools rather than abstractions; where baselines were missing, a “baseline-first” action preserved comparability without sacrificing speed.

Quick wins are central to building trust and demonstrating value. Concrete examples include Saaremaa’s education pathway, coupled with a pilot-area approach; Iceland’s sludge-to-product scoping, paired with an open-data sprint; Peniche’s stamp working group; and Argyll & Bute’s guideline pilots, each designed for delivery within the next six to nine months, with named owners.

Post-project key exploitable results and opportunities are also clear. The BBC Visual Facilitation Tool for value chains, a workshop blueprint and indicator library, emerging training modules, and good-practice standards (for example, on seaweed cultivation) can be deployed both within regions and across the wider network to accelerate uptake and learning.

Next steps and ownership cut across regions and timelines. Between Q2 and Q3 2025, regions will complete baselines, finalise indicator definitions, and publish first dashboards, with regional owners identified in each chapter. In Q3 and Q4 2025, quick-win delivery will be reviewed, and a cross-region peer-learning session will compare indicators and troubleshoot common challenges. From 2026 onward, pilots will be scaled with blended finance, and SMART objectives will be updated annually to embed continuous improvement.

Key achievements to date, spanning innovative value chains, ecosystem restoration, and capacity building, highlight the importance of adaptability, rigorous monitoring, and knowledge sharing. Together, these efforts lay the foundation for resilient, prosperous coastal communities, and the BBC project demonstrates the blue bioeconomy’s transformative potential to drive sustainability and shared prosperity across Europe’s coastal regions.

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