i34BLUE GROWTH

green innovation for blue growth

D6.3 Sustainability plan

Including possible future investment plans and policy recommendations

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I. Introduction and project context

The **I3-4-BLUE-GROWTH** is an EU-funded interregional project aimed at strengthening innovation ecosystems in the sustainable blue economy. It brings together **10 partners across 8 countries** including less-developed coastal regions in Portugal, Spain, Poland, and Croatia alongside advanced "mentor" regions in the Netherlands, Italy, Finland, and France. The primary objective is to build capacity in these regions for developing a sustainable and smart blue economy by equipping regional stakeholders and SMEs with technical know-how, investment readiness support, and networking opportunities. The project focuses on **two critical blue economy value chains**:

- **Value Chain 1:** sustainable seafood, aquaculture, and the valorisation of blue resources (including fisheries, aquaculture, and marine biomass utilization).
- **Value Chain 2:** maritime renewable energy & decarbonisation of the maritime sector (including offshore renewable energy, green shipping, and port sustainability).

This dual focus is designed to deepen understanding of interregional value chains, facilitate knowledge transfer of best practices, and identify a pipeline of innovative investments that can drive sustainable growth in these sectors. By targeting these high-priority domains, the project addresses pressing global challenges such as climate change (through clean energy and low-carbon shipping) and food security (through sustainable aquaculture), while also creating economic growth opportunities in coastal regions.

The **Sustainability Plan** presented here outlines how the results and outputs from I3-4-BLUE-GROWTH will be sustained and amplified beyond the project's lifetime. It provides strategic **investment plans and policy recommendations** to ensure that the collaboration continues in the two value chains. The plan is formal and strategic in tone, aimed at European policymakers and regional innovation stakeholders. It builds on insights from the project's key deliverables and activities translating analysis and stakeholder input into concrete future investment opportunities and policy actions. This plan also addresses **financial sustainability and post-project continuity**, proposing how internal and external funding sources can be used to maintain the initiative's impact after the project ends.

1. Deliverables overview and evidence base

Several project **deliverables** form the evidence base for this Sustainability Plan. Each deliverable provided specific inputs, ensuring that the plan's recommendations are grounded in the consortium's research and stakeholder engagement:

Deliverable 2.1 Handbook on innovative best practices: documented successful case studies and best practices in blue economy innovation relevant to the targeted value chains. This handbook showcased proven approaches (e.g. innovative aquaculture techniques, port decarbonisation pilots) from across Europe, providing a knowledge base of what works in practice.

Deliverable 2.2 Report on trend analysis and ecosystem mapping: provided an overview of **blue economy trends** and mapped the regional innovation ecosystems of partner regions. This report analyzed how the two value chains are represented in each region's Smart Specialisation Strategy (RIS3) and identified major stakeholders across the "quadruple helix" (industry, academia, government, and civil society).

Deliverable 2.3 Meetings of the quadruple helix working groups: summarized outcomes of a series of stakeholder workshops (working group meetings) conducted for each value chain. This deliverable provided a clear picture of the gaps and opportunities perceived "on the ground" by practitioners, which directly shaped the project's action plans.

Deliverable 2.4 Summary report targeted value chains and I3 opportunities: consolidated the findings of the working groups into a systematic analysis of the main needs, challenges, and innovation investment priorities for each value chain across all regions. It quantified and categorized stakeholder inputs, highlighting cross-cutting issues versus value-chain-specific ones.

Deliverable 2.5 Action plan for the improvement of the regional innovation ecosystem: built upon the earlier findings to propose an **action plan for strengthening support systems** in the blue economy. It outlines strategic goals and domains of intervention, and provides detailed **policy recommendations** at multiple levels (EU, national, and regional) for both value chains.

Deliverable 3.3 Open innovation & challenge programme: described the project's open innovation calls and challenge programme which solicited innovative solutions from SMEs and startups. The resulting **portfolio of projects and business ideas** (including winners of challenge contests and B2B matchmaking events) provided concrete examples of investment opportunities.

Deliverable 3.4_**Capacity-building workshops:** The capacity-building programme serves comprehensive content guidelines including support material on essential topics for effective comprehension of the management of innovative projects on technical, business and investment readiness

Deliverable 3.5 **B2B Matchmaking Events**: B2B matchmaking events to promote the development of a sustainable and smart blue economy in the identification of interregional

innovation and investment projects contributing to the development of a sustainable and smart green and blue economy.

Deliverable 4.3 Joint I3 regional roadmap and baseline for blue regional mission: developed a medium-to-long term roadmap (2-5 years) for interregional innovation and investment, tailored to the consortium regions. This joint roadmap informs the Sustainability Plan's collaboration approach and ensuring that the plan aligns with a longer-term vision beyond the project.

Deliverable 4.4 Action plan to create synergies with S3 platforms: a draft action plan focused on aligning the project's efforts with relevant European Smart Specialisation (S3) thematic platforms. By fostering such S3 synergies, the Sustainability Plan aims to **embed the project's value-chain innovations into broader European networks**, enhancing their sustainability and scaling-up potential beyond the project's lifetime.

Deliverable 5.2 Regional policy roundtables (web-based materials): collected insights from a series of **regional policy dialogue roundtables** held during the project. The **findings from these dialogues**, many of which were held in early 2025, reinforced certain needs - stakeholders strongly called for simplifying permitting processes and harmonizing standards across countries.

Deliverable 5.4 Action plan for internationalization: presented a strategy and roadmaps for the **internationalization of the blue economy ecosystems and SMEs** in the partner regions. It includes tailored "Internationalization Strategy Roadmaps" for specific regional clusters. Each roadmap is structured in phases (establishing a foundation, strengthening innovation & international readiness, scaling up) and provides guidance on how regional actors can access global value chains and markets.

All the above deliverables are **inputs** to this Sustainability Plan. They ensure that analysis reflects verified data and stakeholder needs, that investment plans are backed by concrete opportunities and best practices, and that policy recommendations align with the multi-level insights and strategies already developed. The project's **website** provided qualitative insights.

2. Methodological approach

This Sustainability Plan was developed through a **synthesis methodology** that integrates results and outcomes of I3-4-BLUE-GROWTH. The approach ensured that the plan is **grounded in evidence** and co-created insights, following these steps:

- **Review and synthesis of project deliverables:** an in-depth review of each relevant deliverable was conducted extracting key findings, data points, and recommendations. It was ensured that **every major need or gap identified in these reports appears as a point of action in plan** creating a connection from problem to solution. Deliverables quantified or categorized issues guided how the recommendations were structured.
- **Integration of stakeholder inputs:** this included qualitative inputs from the quadruple-helix workshops and feedback from participants in policy roundtables and capacity-building events. Compiled notes and summaries from these events were used as elements to incorporate into recommendations or investment ideas. This **bottom-up validation** ensures the plan has broad stakeholder legitimacy.
- **Open innovation and pipeline development process:** the project's open innovation programme was another methodological pillar. Through competitive calls and matchmaking, I3-4-BLUE-GROWTH identified dozens of innovative project ideas, startups, and collaborations addressing challenges in the two value chains. These concrete opportunities were used for the Investment Plan making it a reflection of real projects that stakeholders are ready to implement.
- **Alignment with EU and regional frameworks:** it was mapped the plan's proposals against existing relevant frameworks and upcoming opportunities and suggested investments are align with funding instruments (like Horizon Europe calls, European Maritime, Fisheries and Aquaculture Fund - EMFAF priorities, or national Recovery and Resilience Plans) to ensure funding viability. Policy recommendations are timed with policy cycles. This alignment ensures plan's implementation with actual funding.
- **Financial sustainability and continuity analysis:** as part of the methodology, a specific analysis was carried out to address how project initiatives and cross collaborations can continue post-funding. Possible **internal funding sources** (such as regional budget allocations, cluster membership fees, or public-private investment initiated by partners) and **external funding sources** (EU programs, international grants, and private sector investment) to support each major recommendation were examined.

3. Mapping results and ecosystem insights

In this chapter, we analyze the data and insights gathered on the two value chains. This includes trends, regional ecosystem mappings, and identified needs/challenges that will be used to create the investment plans and policy recommendations. The analysis use data available in Deliverable 2.2 (Report on trend analysis and ecosystem mapping) and the outcomes of stakeholder engagements.

3.1. Value Chain 1: Sustainable seafood, aquaculture & valorisation of blue resources

Mapping results and regional needs: Value Chain 1 spans sustainable fisheries (wild-catch management), aquaculture (fish farming/mariculture), and valorisation of blue bio-resources (algae/seaweed/fish by-products). Mapping and stakeholder input identified domain-specific and cross-cutting needs:

- **Sustainable fisheries:** overfishing and ecosystem pressure remain central issues; many stocks are stressed. Regions need more effective management and enforcement (quotas, bycatch reduction, tackling IUU), plus alternative income options to ease dependence on overfished stocks and support small-scale fleets.
- **Aquaculture:** a critical growth sector constrained by limited coastal space, complex multi-agency licensing, and high entry costs. Gaps in infrastructure (hatcheries, feed, cold chain, logistics) and skills impede expansion, while stringent, often inconsistent environmental rules add burden. High CAPEX for advanced/offshore systems limits uptake; access to capital and risk-sharing (grants, concessional loans, insurance) is needed to enable technology adoption.
- **Valorisation of blue resources:** converting marine biomass (fish waste, seaweed, algae) into high-value products (nutraceuticals, bio-packaging, cosmetics, pharma) faces scale-up barriers from pilot to market. Startups/spinoffs struggle for investment; licensing and product approvals are not well tailored to novel marine products, creating regulatory uncertainty. Market education and demand creation must accompany capacity growth, supported by ecosystems with accelerators, test facilities, and biotech-savvy investors.
- **Common cross-cutting challenges:** capacity-building and knowledge transfer (training for fishers, farmers, entrepreneurs) are widely needed. Stakeholder networking is weak (fishers, producers, researchers, processors often unconnected); technology transfer from universities to industry is underexploited. Administrative streamlining (simpler licensing, faster permits,

single-window services) would lower entry barriers. Consumer awareness is vital for acceptance of sustainable seafood and new blue bio-products. Climate change (warming, acidification, stock shifts) is an emerging pressure requiring resilience measures.

- **Regional specificities:** the Azores (PT) pair strong wild fisheries with emerging aquaculture; Andalusia (ES) has significant aquaculture and leading marine biotech; Pomorskie (PL) targets algae/mussel farming for Baltic nutrient extraction; Croatia has mariculture potential (tuna, shellfish) but needs modernization and technology uptake. Less-developed regions aim to move up the value chain via local processing and marine biotech, with many priorities embedded in RIS3 to align future funding.

Innovation development insights: despite challenges, substantial innovation/investment opportunities were identified via open calls and consultations.

- **Aquaculture 4.0 (digitalization):** IoT sensors, AI-driven feeding, and automated water/health monitoring to optimize feed, cut waste, detect disease early, and reduce impacts. A proposed real-time digital platform for small farms would also share data with regulators to improve compliance and productivity; pilotable in one region then transferable. Suitable for blue digitalization and innovation grants.
- **Integrated multi-trophic aquaculture (IMTA):** co-culturing fish, shellfish, and seaweed to turn one species' waste into another's input, reducing pollution and diversifying outputs. A finfish-mussel-seaweed pilot (interest in PT/ES) would demonstrate environmental and economic benefits, enable cross-innovation between fish farms and algae cultivators, attract public funding, and generate data for wider adoption.
- **Breeding and genetics programs:** selective breeding and improved hatchery technology to enhance disease and climate resilience. Example: a regional hatchery/R&D center (e.g., Azores or Andalusia) developing hardy local strains, partnering with universities, and supplying quality juveniles while training farmers.
- **Valorisation of fishery/aquaculture by-products:** bio-refinery concepts to extract oils, proteins, and biomaterials from processing waste (fertilizers, Omega-3, fish leather); scaling seaweed cultivation/processing for bio-packaging, feed supplements, food additives. Interregional know-how from Brittany (FR) and Algarve (PT) can support pilots, e.g., linking an aquaculture farm, a seaweed farm (IMTA), and a biotech start-up to produce a nutraceutical, showcasing circular bioeconomy value capture.
- **Traceability and market access:** blockchain-enabled traceability for fisheries/aquaculture (e.g., Croatian farmed tuna to end-market) to assure quality/sustainability, combat IUU/fraud, and unlock premium markets for small

producers. Pilot funding could combine digital innovation sources and retailer/exporter partnerships.

- **Knowledge exchange and capacity projects:** an interregional staff exchange for young blue economy professionals (technicians, biologists) to obtain hands-on experience in leading institutes/companies; a Blue Economy Innovation Hub/Network to sustain mentorship, internships, and start-up exchange beyond the project. Erasmus+ and interregional funds can back these "soft" enablers alongside hardware investment.

Value Chain 1 has strong potential but faces environmental (overfishing; aquaculture impacts), regulatory (permits/standards), financial (CAPEX, market access), and social (skills, awareness) challenges. Addressing them requires targeted technological innovation (digital aquaculture, IMTA, breeding, valorisation, traceability) coupled with ecosystem strengthening (skills, networks, streamlined administration, market education) to move regions up the value chain and align with RIS3-supported investment.

3.2. Value Chain 2: Maritime renewable energy & decarbonisation of the maritime sector

Mapping results and regional needs: Value Chain 2 covers the shift to clean energy and low-carbon technologies in the maritime domain: offshore renewables (wind, wave, tidal), green/smart ships (battery-electric, hydrogen, ammonia, advanced biofuels), and decarbonized ports and logistics (electrification, alternative-fuel infrastructure, energy-efficient supply chains). Based on Deliverables 2.2-2.4 and stakeholder inputs, the main needs and challenges are:

- **Green ships (maritime transportation):** regions with shipbuilding/shipping capacity (e.g., Poland, Finland) need to advance low/zero-emission vessel design and efficiency (alternative fuels, optimized hulls, wind-assist). High CAPEX for newbuilds/retrofits and unclear ROI slow adoption without strong regulation or incentives. Integrated supply chains are required (shipyards, equipment makers, fuel suppliers) so vessels and bunkering evolve together. Workforce skills must expand (naval architects, marine engineers, crews) for high-voltage systems and cryogenic/alternative fuels. Decarbonisation therefore requires both technology deployment and system-level coordination.
- **Green ports and logistics:** ports are emission nodes and energy hubs. Key hurdles include complex, sometimes misaligned regulations when adding shore power or alternative-fuel bunkering (LNG, hydrogen), and gaps in physical infrastructure and grid capacity, especially in less-developed regions. Significant capital and coordinated planning among port authorities, utilities, and government are needed. Training for port operators/logistics firms is

essential (safe handling of hydrogen, operating electric cranes/vehicles). Partner ports vary in maturity; all require clear policies and investment pathways to become cleaner and more efficient.

- **Marine renewable energy (offshore):** maturity varies widely (e.g., NL/FR advanced in offshore wind; Azores/Adriatic regions seek first deployments). Challenges include high capital intensity and perceived risk (difficult for regions without track record), SME participation barriers (references/certification), maritime-space permits and EIAs, and timely grid connections. Digitalization (digital twins, IoT) can improve O&M and performance but needs upfront investment and skills. To kick-start new regions: combine finance de-risking, knowledge transfer from leaders, and streamlined permitting.
- **Common cross-cutting challenges:**
    - **Stakeholder collaboration:** decarbonisation is interdependent (ports, shipowners, energy providers, regulators). Formal platforms and networks are needed to co-develop viable projects (e.g., port-utility hydrogen pilots). Interregional visits (e.g., Vaasa energy cluster) proved acceleration benefits.
    - **Financing:** wind farms, port retrofits, and zero-emission vessels require blended finance (EU/national/private). Dedicated blue-decarbonisation windows, guarantees, and PPPs are needed to overcome high upfront costs and longer paybacks.
    - **Innovation and standardisation:** ongoing R&D/demonstration for wave, fuel cells, marine batteries, and port storage; quadruple-helix collaboration is key. Safety/interoperability standards (e.g., shore power interfaces, hydrogen handling) must advance in parallel.
    - **Regulatory complexity:** multi-level rules (EU fuels/emissions, national energy/env permits, local port/MSP rules) can conflict or delay projects. Streamlining/harmonizing (one-stop permitting, aligned technical standards) and clear EU guidance are recurring needs.
    - **Workforce & skills:** new curricula and joint training for alternative propulsion, offshore O&M, and port electrification are required; shared centers of excellence can train across regions.
- **Regional specificities:**
    - **Finland (Ostrobothnia) & Netherlands:** advanced in electrification/hydrogen vessels and renewable integration; act as mentor regions with firms and institutes already delivering solutions.
    - **Poland (Pomorskie) & coastal Croatia:** strong interest in Baltic offshore wind, green shipbuilding, and greener Adriatic short-sea shipping; need capacity building and investment to modernize fleets and ports.

- **Azores (PT):** potential in wave/OTEC and cleaner inter-island shipping; requires external know-how and finance. Used as a pilot "mission" region to model niche leadership via interregional expertise.
- **Andalusia (ES):** large ports (e.g., Algeciras) prioritize port decarbonisation and Mediterranean green corridors; strong renewables base enables integration.

Across regions, RIS3 and national plans increasingly reflect these priorities. Interregional mapping (D2.2) shows active clusters (e.g., Baltic Sea & Space Cluster; Pôle Mer) and informs the D4.3 roadmap pairing mentor "offers" with follower "demands" (e.g., Dutch port-electrification know-how to Croatian ports; Finnish energy-systems expertise to Azores).

Innovation development insights: the project identified a set of demonstration-ready and scalable opportunities:

- **Offshore renewable pilots:** small-scale offshore wind or wave devices in less-developed regions (e.g., Azores as testbed) with technical support from advanced partners. Objectives: prove survivability, grid integration, and bankability; generate data and local know-how; position regions for future commercial scale. Suitable for Horizon Europe/I3 calls; success can crowd-in private capital.
- **Green-shipping demos:**
  - **Hydrogen/electric prototype:** interregional development of a hydrogen harbor craft or short-sea ferry (e.g., Croatian or Azorean route) with Finnish/Dutch fuel-cell expertise; builds skills, informs safety and refueling rules, aligns with FuelEU Maritime.
  - **Retrofit wins:** convert existing small vessels (tour/fishing) to battery-electric for fast, visible benefits (quiet/zero-exhaust in sensitive areas) and local shipyard upskilling.
- **Green-port upgrades:** shore power at a medium-sized pilot port; pilot hydrogen or LNG bunkering; replication via a learning cohort of other ports. Contribute to EU standardisation work (connectors, protocols) with EMSA/standard bodies. Funding via CEF/national green-port programs plus port co-investment.
- **Digital twins & smart-port solutions:** deploy a port digital twin or real-time emissions/traffic optimization module (IoT + analytics) to cut congestion and fuel use. Involves tech SMEs (NL/PL clusters) with port authorities; relatively low-CAPEX, high-impact efficiency gains; scalable to other ports.
- **Alternative-fuel production and green corridors:** create a green-hydrogen hub linked to local renewables and use it for ferries, port equipment, or industry. Pilot a cross-border green corridor (paired ports each providing the same

alternative fuel) to demonstrate end-to-end decarbonized routes; pursue EU Green Deal/bilateral funding.

- **Interregional training and exchanges:** joint programs for port technicians/maritime engineers on shore power, hydrogen safety, electric propulsion, and offshore O&M. Shared curricula among maritime academies; staff exchanges (e.g., Croatian/Polish engineers training in Dutch ports). Ensures effective operation/maintenance and institutionalizes interregional ties.

Value Chain 2 presents high-impact opportunities that align with EU Green Deal goals while building regional industry and skills. Decarbonizing maritime transport and ports, and deploying offshore renewables, demand blended finance, coordinated stakeholders, enabling regulation/standards, and targeted skills programs. The innovation development insights above translates these needs into investable pilots and scalable projects that can turn partner regions into hubs of green maritime technology and future-proof their economies.

4. Future investment plan

This chapter presents the investment plan for the two value chains, outlining how future opportunities can be realized through concrete projects and financial strategies. It covers prospective **investment opportunities for Value Chain 1 and Value Chain 2**, including business cases and SME matchmaking results from the project, relevant funding sources and financial instruments, and an action plan for regional investment readiness. The aim is to ensure financial sustainability by combining internal and external funding sources (EU programs, national/regional funds, and private capital) and to prepare regions to attract and absorb these investments.

Key principle of the investment plan is to **blend funding sources** combining EU funds, national/regional public funds, and private sector investments through public–private partnerships. Given the scale of needs identified (from modernizing ports to funding start-ups), no single funding source can cover everything. The project's analysis recommends increasing public investment and developing strategic investment plans with defined priorities and metrics. Each region and country will need to integrate these priorities into their operational programs and budgets. The investment plan below is structured by value chain, and within each, by major thematic investment areas. It also identifies potential sources of funding and instruments for each area (e.g. structural funds, I3 or Horizon Europe calls, private investment incentives). An Action plan for regional investment readiness follows the value chain plans, outlining steps to ensure regions can effectively mobilize and utilize the investments (capacity building, matchmaking, project preparation assistance, etc.). The investments are conceived to be implemented over the next 3–5 years, which corresponds to the immediate post-project period and aligns with the EU's 2021–2027 funding cycle (and looking ahead to 2028+ programming as needed).

4.1. Investment plan for Value Chain 1 - sustainable seafood, aquaculture & valorisation of blue resources

To drive sustainable growth in fisheries, aquaculture, and blue bioresource industries, **four priority investment domains** have been identified for Value Chain 1, each with specific action lines:

1. Sustainable fisheries management and infrastructure: invest in modernization and improvements that ensure long-term sustainability of fisheries and greater value capture by local communities. This includes targeted investments in monitoring, port infrastructure, selective gear, and climate resilience:

- *Monitoring and surveillance systems:* deploy advanced monitoring systems (e.g. vessel tracking via VMS/AIS, electronic logbooks, onboard cameras) for fishing fleets to improve compliance and data collection. Enhanced monitoring allows better enforcement of quotas and detection of IUU fishing, which helps fish stocks recover. EU and national grants can fund equipping

small-scale vessels with these systems. Better data will help manage stocks adaptively and build trust among stakeholders, sustaining the resource base for the industry.

- *Fishing port upgrades:* upgrade and modernize small fishing ports and landing sites with facilities such as cold storage units, ice machines, hygienic auction halls, and processing areas. Investing in these improves the quality and value of catches (increasing fishers' incomes) and reduces waste through proper preservation. For example, building a **refrigerated storage and fish processing center** in a region like the Azores would allow fishers to preserve and add value to their catch (smoking, filleting, packaging) rather than selling immediately at low prices. Such projects can be co-financed by EMFAF and regional development funds, potentially with cooperatives or local enterprises operating the facilities. They also create local jobs in processing and can encourage more youth to remain in the fishing sector with improved working conditions and profitability.
- *Selective gear and bycatch reduction programs:* allocate funds (grants or low-interest loan programs) for fishers to purchase selective fishing gear that reduces bycatch and habitat impact. This could include devices like turtle excluder devices, circle hooks that reduce unintended bycatch, or modified nets that allow juveniles to escape. Complement gear investment with training on their use and on sustainable fishing practices. Funding can come from national fisheries funds or the European Maritime, Fisheries and Aquaculture Fund's conservation measures. The return on investment is healthier fish stocks and ecosystems, which in turn secure long-term catches and income.
- *Emergency response and climate adaptation:* establish a **fisheries and aquaculture crisis management fund** to aid communities during environmental or market crises (e.g. harmful algal blooms, disease outbreaks, extreme weather events, sudden market collapses). This could be a pooled fund at regional or national level that can be quickly deployed. Having funds to provide temporary income support to fishers when fisheries are closed for conservation (or to buy back licenses to reduce pressure) can make sustainability measures more socially acceptable. Investing in early warning systems, oceanographic sensors to predict algal blooms or temperature spikes that could affect aquaculture and in adaptation infrastructure (like shaded nets for farms during heatwaves or backup oxygenation systems for ponds) ensure protection of the industry against shocks and make it more resilient, which is vital as climate variability increases.

2. Aquaculture expansion and technological innovation: substantial investment is needed to expand aquaculture production in a sustainable manner and to adopt new technologies that increase efficiency and reduce environmental impact.

- *New aquaculture facilities:* support the establishment of new farms and the expansion or modernization of existing ones, particularly in underutilized areas or where there is high potential. This might involve co-investment in **land-based recirculating aquaculture systems (RAS)**, which can be located near urban markets and have minimal environmental discharge, or in **offshore aquaculture installations** in suitable coastal waters (with species and systems that have low impact). For example, a project to build a state-of-the-art land-based RAS hatchery in Croatia for a high-value marine fish species could be funded by a mix of EU recovery funds and private investors, with government guarantees to de-risk the investment. Spain or Portugal, regions could invest in offshore aquaculture pilot farms for species like mussels, sea bream, or macroalgae, which have lower environmental impact and can scale if successful. Such infrastructure projects can use structural funds (ERDF), national blue economy funds, or the European Investment Bank.

- *Advanced technology adoption:* for aquaculture operators (especially SMEs) to adopt advanced technologies such as automated feeders and sensors, underwater drones or ROVs for monitoring cages, AI-based software for stock management and health prediction, and other "Aquaculture 4.0" tools. A possible program is a **regional grant scheme** that covers, say, 30%–50% of the cost for an SME fish farm to install an IoT sensor network and farm management software, or to pilot an AI feeding system that reduces feed waste. The return on investment for the farm is improved feed conversion ratios, lower mortality, and reduced environmental impact per unit of fish produced. Another high-tech area is selective breeding and hatchery technology funding **collaborative projects between research institutes and industry** to develop disease-resistant fry or faster-growing strains, and then distributing them to local farms. Public investment can support the R&D through calls under Horizon Europe or national innovation grants, with industry co-financing once the benefits are proven. These technological upgrades will make regional aquaculture more competitive, sustainable, and attractive to investors.

- *Aquaculture in high-potential regions:* some regions face higher costs or logistical challenges for aquaculture (for example, remote islands, regions lacking infrastructure, or areas with expensive coastal real estate). For instance, the Azores or Madeira in Portugal could receive an "Aquaculture Development Package" to jump-start seaweed farming and shellfish aquaculture, including subsidies for initial setup (equipment, site prep) and support for connecting producers to external markets. Parts of the Polish Baltic coast interested in bivalve farming for nutrient remediation could get regional aid to offset the initial low profitability until scale is reached. The idea is to ensure all regions, not just the mainland or already-developed ones, can participate in the aquaculture boom, which also aligns with cohesion policy goals.

- *Integrated multi-trophic aquaculture (IMTA) and circular systems:* prioritize funding for IMTA projects, which have demonstrated multiple benefits for sustainability and efficiency. Funding could support **demonstration farms** that co-locate fish with shellfish and seaweed, validating business models and environmental performance. For example, an investment could establish an **IMTA demonstration center** in Galicia (Spain) or Brittany (France), where local aquaculturists and researchers collaborate to operate a small IMTA farm. The center would serve both as a training site and a proof-of-concept. The project cost (installing cages, rafts, longlines, monitoring equipment, etc.) could be covered by a combination of EMFAF innovation grants and regional co-funding, possibly with a private aquaculture firm contributing to gain early access to results. The outcome would be open-access data on growth rates, water quality improvements, and economic viability, which can then be disseminated to farmers in all partner regions.

3. Blue bioeconomy and value-addition projects: to fully valorize marine resources and by-products, investments should flow into the blue biotechnology and processing domain, enabling regions to capture more value and diversify products:

- *Bioprocessing facilities:* establish regional **bio-refineries or processing hubs** that can handle marine biomass (fish waste, algae, shellfish by-products) and convert it into high-value products. For instance, an investment could build a fish waste processing plant in Andalusia (leveraging by-catch or processing waste from local fisheries) that produces fish oil, fishmeal for aquafeed, and collagen for nutraceutical or cosmetic uses. Such a plant could be structured as a public-private partnership: public funds (ERDF) cover part of the capital expenditure for equipment and construction, while a private company operates the facility and fishing co-ops provide feedstock under contract. In Poland or the Baltic region, an **algae cultivation and processing facility** could be established to both improve water quality (through algae uptake of nutrients) and create raw material for fertilizers, bio-packaging, or bioenergy. The initial CAPEX for these facilities is significant, but EU regional funds paired with development bank loans (EIB's Blue Sustainable Ocean Strategy, for example) can kickstart them. These facilities create local jobs in processing, reduce waste (improving environmental outcomes), and foster innovation by providing infrastructure that small startups can utilize (e.g. a biotech startup could use the facility's equipment to pilot a new extraction process).

- *Marine biotech incubators:* invest in innovation incubators or accelerators specifically for marine biotechnology and innovative seafood products. This entails funding for **lab space, pilot production equipment, and business support services** tailored to marine bio startups. For example, a region like Algarve (PT) or Brittany (FR) where universities and institutes are active in marine biotech could host a "Blue Bio Incubator." Funding from ERDF could renovate a facility and equip it with labs and small-scale processing equipment, national

innovation agencies could fund operating costs and mentorship programs, and corporate sponsors could contribute for a first look at emerging innovations. It would provide workspace, technical expertise, and access to pilot facilities to develop prototypes and scale up to a level that attracts investors. By investing in such incubators, regions address the gap where promising R&D wasn't reaching market due to lack of commercialization support.

- *Product development and marketing campaigns:* provide **small grants or innovation vouchers** for product development to SMEs in the blue bioeconomy. These grants help companies get from the prototype stage to market-ready products. Consumer and buyer education is a crucial part of building markets for new products, if people understand the benefits and unique qualities of algae-based foods or sustainable fish, demand will grow. Regions can use part of their promotional budgets (often available via European Maritime Day events or similar) to showcase these new products. This addresses the need identified for market development and consumer awareness, ensuring that when new products come online, they actually find uptake and fetch good prices.

4. Human capital and ecosystem support investments: in addition to physical and technological investments, **"soft" investments** in people and networks are crucial for Value Chain 1:

- *Training centers and programs:* invest in establishing or upgrading **training centers for fisheries and aquaculture** in the regions. Some regions might convert existing maritime schools or vocational centers into modern training academies for the blue economy. Funding can be used to update curricula, hire specialized trainers (e.g. in aquaculture engineering or marine biotech techniques), and purchase the latest training equipment (like simulators for boat handling or virtual reality systems for farm monitoring training). These capacity investments are creating a skilled workforce that can sustain and grow the industry and adapt to new methods. The European Social Fund Plus (ESF+) or Erasmus+ could be used for such training initiatives, in combination with industry contributions (e.g. larger aquaculture firms sponsoring apprenticeships).

- *Knowledge networks and advisory services:* allocate resources for **maintaining and expanding the networks** formed by this project. One idea is to finance an ongoing coordination of quadruple helix networks in each value chain essentially a light "cluster organization" or secretariat post-project. This might involve funding an annual **Blue economy stakeholder forum** in each region (where industry, researchers, and authorities convene to share updates and forge partnerships), and supporting a small interregional secretariat that can manage communications, share information on funding calls, and broker project partnerships across regions. Also, **digital knowledge platforms** where

best practices, research findings, and market intelligence are shared in real time among stakeholders. These relatively low-cost investments (compared to building infrastructure) greatly enhance the diffusion of innovation and ensure less-developed regions benefit from the knowledge of leaders. It also helps sustain the **community of practice** that I3-4-BLUE-GROWTH has built.

- *Sustainability and certification programs:* invest in helping producers and companies obtain **sustainability certifications** (such as the Marine Stewardship Council (MSC) for wild fisheries, Aquaculture Stewardship Council (ASC) or organic certifications for aquaculture, or other eco-labels). The investment is justified by the price premium and market access these certifications can enable, reinforcing both economic and environmental sustainability. Invest in **local traceability and transparency systems** (possibly using blockchain or other modern IT) so that certified sustainable products can be traced and verified from origin to market, this protects against fraud and allows producers to command premium prices. For example, a regional project might develop a blockchain app where consumers can scan a QR code on a seafood product and see its journey (fishing vessel or farm, processing, transport), assuring them of its authenticity and sustainability claims. Some of these can be co-funded by industry associations that see value in branding their products as sustainable.

Investments for Value Chain 1 create a **holistic plan**: securing the resource, expanding production in a smart way, extracting maximum value, and empowering people. These investments should be sequenced and coordinated. By implementing these investments over the next few years, we expect to see partner regions increase their sustainable seafood output, introduce new blue bio-products to the market, and establish robust local blue economy clusters that continue to innovate and grow. Each investment area also contributes to broader EU goals (e.g. food security, circular economy, climate adaptation) and thus can attract support from corresponding funding instruments.

4.2. Investment plan for Value Chain 2 (Maritime renewable energy & decarbonisation of the maritime sector

For Value Chain 2, the investment plan focuses on transforming regional maritime industries and infrastructure towards decarbonisation, through **four major investment categories**:

1. Offshore renewable energy development: to harness marine renewable resources, significant capital must be mobilized for project development and enabling infrastructure:

- *Offshore wind farms and marine energy pilots:* while large commercial offshore wind farms will mainly be driven by big industry players, public investment is

crucial in **early-stage development** (feasibility studies, environmental impact assessments, site surveys) especially in new regions or technologies. We propose setting up **regional pre-development funds** that can de-risk some of the initial development costs for offshore wind in places like Poland's Baltic coast or exploratory wave energy in the Azores. For example, a Polish regional fund (possibly supported by national and EU cohesion funds) might pay for geophysical surveys and community consultations for a designated offshore wind zone, making the project more "shovel-ready" and thus more attractive for private developers to bid on. Similarly, for wave and tidal energy which are less mature, public entities (perhaps through an EU Green Deal call or LIFE program) should directly fund **pilot farms or demonstrators**.

- *Grid infrastructure and energy storage:* a major area for public investment is the **electrical grid infrastructure** needed to bring offshore renewable power to shore and distribute it effectively. This includes undersea transmission cables, onshore substations, and reinforcements of the land-based transmission network in coastal regions expecting new generation. Investments in **energy storage solutions in coastal areas** - such as large battery farms, flywheels, or pumped hydro storage if the geography allows (some coastal or island regions have steep terrain suitable for pumped storage). These storage installations help buffer the variable output of renewables, ensuring reliability. A public-funded project could catalyze the first large battery installation near a port or community, which would then showcase value (stabilizing grid frequency, storing excess wind energy at night) and encourage utilities to scale up further. Many of these grid and storage investments can be supported by EU recovery funds and by loans from the EIB.

- *Ports as energy hubs:* invest in adapting ports so they can serve as hubs for offshore energy deployment and servicing. For offshore wind especially, having a nearby port that can handle assembly, maintenance, and logistics is crucial. For example, transforming **Gdynia/Gdańsk in Poland or Split in Croatia** into an offshore wind staging and maintenance hub could be a targeted investment. This might be financed by national recovery plans (since it creates jobs and future revenue) plus private co-investment from port operators and wind developers. The payoff is local economic development: the region becomes part of the supply chain and can attract manufacturing or service activity. Similarly, ports could invest in specialized training centers or simulators for offshore operations (in partnership with wind farm developers or maritime schools), so local workers can qualify for jobs in turbine installation or maintenance. Beyond wind, ports can act as **energy hubs for hydrogen** (where renewable energy is brought in and converted to hydrogen and distributed). A concrete action is to upgrade one pilot port with electrolysers and storage to produce green hydrogen on-site, using off-peak renewable electricity, and supply it to local port users (like forklifts, or a hydrogen ferry if available).

2. Decarbonizing ports and shipping: to green maritime transport, investments must target both shoreside infrastructure and the vessels themselves, ensuring a full ecosystem shift:

- *Shore power ("Cold Ironing"):* roll out shore-side electricity connections at all major and medium-sized ports in the partner regions. This typically involves installing high-voltage transformers and cabling at berths, as well as upgrading the local grid connection to the port. An investment plan can prioritize the ferry terminals, cruise ship docks for initial installations, where the air quality and emissions benefits are greatest (diesel generators of ships produce significant pollution in port cities). Funding can come from a mix of national grants (recognizing the public health and climate benefits), EU funds (CEF Transport has calls for port electrification), and the port authorities' own investments. Shore power addresses the emissions at ports (SOx, NOx, CO2, noise) and was identified as a common need across regions. It also requires cross-border harmonization (standard plugs, voltages) which is being developed at EU level, meaning investments should use those emerging standards for compatibility.

- *Alternative fuel bunkering infrastructure:* develop infrastructure for at least one type of alternative fuel in key ports of each region. Depending on the regional context and shipping routes, this could be **LNG bunkering** (as a transitional fuel) or moving directly to **hydrogen/ammonia bunkering** for future vessels. These installations are complex, involving storage tanks, special piping, and safety systems. A pragmatic approach is to start with smaller-scale solutions: for LNG, begin with **truck-to-ship bunkering** (trucks deliver LNG to the port and fuel the ship) which requires minimal permanent infrastructure, to build demand. If usage grows, later invest in a fixed LNG terminal. For hydrogen, perhaps set up a pilot **hydrogen refueling station** at a port that serves a short-route ferry or port equipment. This could involve on-site production (via a modest electrolyser) and a storage trailer system. Investments in alternative fuel infrastructure likely need heavy subsidy at first because initial demand is low and the business case is weak. By investing early, regions can attract pioneering green ships to their ports and not be left out of emerging green corridor networks.

- *Green port equipment:* invest in **electrifying or decarbonizing port machinery and vehicles** such as converting diesel yard trucks, straddle carriers, cranes, and forklifts to electric or hydrogen fuel cell versions. This requires purchasing new equipment and often modifying infrastructure to support it (installing charging stations for electric vehicles, or a hydrogen dispensing station for fuel cell equipment). A region could pilot a "zero-emission port" project, for example, converting one container handling area or one cruise terminal entirely to electric equipment. Funding can be shared: ports invest in equipment upgrades, while EU or national green funds cover the incremental cost difference between conventional and green equipment. Notably, partners like Merinova (FI) and BSSC (PL) have shown interest in such solutions,

meaning interregional knowledge can be used to choose proven technologies. These investments not only reduce direct emissions but also can improve efficiency and reduce long-term operational costs for ports. They can often tap into climate action funding domestically or be packaged into a larger sustainable port renovation loan from institutions like the EIB.

- *Retrofitting and new green vessels:* support both the retrofitting of existing regional/local vessels to low-emission technologies and the building of new clean vessels. For retrofits: implement a **grant or low-interest loan program** to help ship owners (public or private) install electric or hybrid propulsion in suitable vessels such as short-route passenger ferries, tourist boats, fishing vessels. This could cover components like battery packs, electric motors, and control systems, as well as any necessary hull modifications. Local shipyards would do the retrofit work, which also boosts local employment and skill development. For new builds: co-invest in **prototype or first-of-a-kind vessels** such as a hydrogen fuel cell ferry, an electric research vessel, or a hybrid cargo boat for island communities. Whenever possible, ensure these vessels are built or retrofitted in **local/regional shipyards** to stimulate innovation and employment there. This might require coupling the investment with training for the shipyard workers on new systems (connects to the skills investment mentioned earlier).

3. Digital and smart systems for efficiency: in addition to hardware, complement the physical upgrades with **digital investments** to optimize operations and indirectly reduce emissions:

- *Port community systems and digital twins:* fund the development or enhancement of **Port Community Systems (PCS)**, which are digital platforms integrating data from various port users (shipping lines, terminal operators, truckers, customs, etc.) to streamline operations. Many ports still suffer from fragmented systems leading to inefficiencies like trucks waiting in long queues or ships arriving when berths aren't ready. Investing in an integrated digital platform that provides real-time coordination can cut these dwell times, thereby reducing fuel waste and emissions (trucks not idling, ships not spending extra time maneuvering). One of the project ideas is to support a **pilot PCS upgrade** in one large port (maybe in Andalusia or Poland), with the requirement that the software and lessons learned are shared openly so other ports can adopt them. Another investmen could be **digital twin models** for critical infrastructure - a digital twin of a port's energy system to simulate and optimize the integration of new loads like shore power or charging stations, helping to prevent blackouts and plan expansions efficiently. This could be done by funding a tech partnership (e.g. a university and a port authority) to develop a digital twin that visualizes power flows, predicts peak demands, and suggests mitigations.

- *Smart shipping routes:* develop and deploy ICT solutions for **smarter shipping logistics** - software that enables **just-in-time arrival** for ships. With such systems, ships can slow down to arrive exactly when a berth is available instead of arriving early and waiting, which saves fuel (slower steaming is more efficient) and reduces congestion. A relatively small investment in creating a data platform that connects vessel schedules, port traffic management, and weather info could enable this. This could be pilot on a couple of routes between project ports. This would likely involve working with shipping companies and possibly the European Maritime Safety Agency's digital initiatives. It's a high-tech, low-capex project but could have a significant emissions reduction impact if scaled.

- *Maritime surveillance and environmental monitoring:* invest in systems (satellites, drones, coastal radar, sensors) that monitor environmental conditions and enforce regulations in the maritime domain. For example, deploying **drones or small UAVs** to detect ships that are illegally discharging oily waste or breaking speed limits in emission control areas. Also, sensors that monitor water quality or noise around ports and offshore installations to ensure environmental standards are met. A cluster of regions could invest jointly in a **drone surveillance program** for their coasts, sharing data and costs (one region might host the control center, another provides maintenance, etc.). This indirectly supports decarbonisation by, for example, enforcing speed reductions (less fuel burn) and detecting illegal emissions and provides valuable environmental data that can guide adaptive management (like spotting algal blooms early for aquaculture or detecting pollution incidents).

4. Cluster development and interregional collaboration investments: investment to **strengthening clusters and partnerships**, to ensure innovations are scaled and new projects keep coming:

- *Smart Specialisation and cluster synergy projects:* allocate funds specifically to **foster interregional partnerships** under the S3 platforms focusing on blue economy and clean energy. In practice, this means supporting meetings, exchange visits, and the preparation of joint pilot projects that involve multiple regions' clusters. The investment here is modest (covering workshop costs, travel, part-time coordination staff, and perhaps some materials for a feasibility test) but the outcome could be a larger proposal for Horizon Europe or I3 follow-up funding. This ensures that the **networking and idea-generation** aspect doesn't end with the project.

- *Internationalization pilot actions:* invest in specific actions that connect regional SMEs and innovations to **global markets**. For instance, sponsor regional delegations to major international blue economy trade fairs or conferences (like the global BlueTech Expo, Seafood Expo, WindEnergy Hamburg, etc.) where SMEs can pitch to investors or find partners. Another idea is to host incoming trade missions: invite companies and investors from outside Europe

to visit partner regions' hubs (once those exist) to see opportunities. These investments ensure that technologies and solutions developed within the project find markets beyond the immediate region, making them commercially sustainable and encouraging external investment inflows.

- *Follow-up advisory and I3 hub:* one of the project's goals was to establish an **I3 Hub** for interregional innovation support (essentially a helpdesk or facilitation body for continuing project development). Going forward, invest in maintaining this hub as a **permanent service**. It could be co-funded by the participating regions or by a European facility (perhaps integrated into the European Cluster Collaboration Platform or similar). The hub would continue to provide tailored advisory services to new project consortia, help additional regions join the partnership, and advise on funding opportunities. An annual budget would cover a small expert staff and the upkeep of an online collaboration platform. This is an investment in the **governance continuity** of the initiative. Instead of the consortium disbanding at project end, the hub structure allows it to evolve (potentially into a legal entity or at least a long-term network). Even if direct EU funding for it isn't available, regions might allocate a tiny portion of their innovation budgets to collectively fund.

In implementing the above investment plan, it's critical to **monitor progress and impact** by setting Key Performance Indicators (KPIs) for each major action. Example KPIs could include: megawatts of new offshore renewable capacity installed, number of ships retrofitted or newbuilt to zero-emission standards, reduction in port carbon footprint (tons CO_2 reduced), number of new blue bio-products commercialized (and their market value), jobs created in blue economy sectors, etc. Monitoring these will allow stakeholders to see tangible results (which helps maintain political and public support) and to adjust the plan if something isn't delivering as expected.

The outlined investments are ambitious but necessary. They will require coordinated effort across government levels and with industry. The I3-4-BLUE-GROWTH consortium has identifying what needs to be done and by forming the networks to do it. By following this plan, aligning policy and funding to the two value chains' needs - Europe's coastal regions can become leaders in sustainable blue growth, ensuring environmental health and economic prosperity for the long term.

5. Policy recommendations

Achieving the sustainable transformation of the two value chains will require supportive policies and governance at all levels - European, national, and regional. This chapter puts forward detailed **policy recommendations** to address regulatory, financial, and organizational barriers. The recommendations are organized into (a) cross-cutting policies relevant to both value chains, and (b) specific policies tailored to Value Chain 1 and Value Chain 2 respectively. Within each set, we distinguish actions needed at the EU level, national level, and regional level, to ensure a coherent multilevel approach. Together, these measures form an **ecosystem improvement strategy** and a **policy mix** roadmap that complement the investment plan. Implementing this policy mix will create an enabling environment in which the identified projects and investments can flourish.

5.1. Cross-cutting policy priorities (both value chains)

Before addressing value-chain-specific measures, several policy actions were identified that benefit both value chains:

- **Harmonize and simplify regulations:** topic across the project is the need to harmonize regulatory frameworks across EU countries and regions, reducing fragmentation that impedes interregional projects. The EU should work towards aligned environmental and safety standards for blue economy sectors, whether it's aquaculture licensing or offshore energy permits. This could involve developing EU-wide guidelines or even regulations that set common rules (for example, an **EU directive on sustainable aquaculture practices** or standardized procedures for marine renewable energy consent). Such top-down harmonization would give investors and innovators more certainty (e.g. a device approved in one country could be accepted in another without starting from scratch). In parallel, at national and regional levels, efforts must focus on **simplifying legal and administrative procedures**, digitizing application processes, and establishing one-stop-shops for investors. These efforts lower barriers to entry and speed up project timelines in both value chains.
- **Enhance multilevel governance and coordination: multilevel governance** is critical in the blue economy because responsibilities are split - the EU sets broad policies, national governments create strategies and regulations, and regions implement actions on the ground. To ensure coherence and avoid gaps or overlaps, better coordination mechanisms are needed. We recommend formalizing coordination platforms at each level: for example, at the EU level, establish regular **Blue Economy Policy Roundtables** that bring together the European Commission, Member States, and representatives of coastal regions to review progress and obstacles in these value chains. At the national level, governments should create **inter-ministerial working groups** (linking

environment, energy, fisheries, transport, research ministries, etc.) to implement integrated blue economy strategies. At the regional level, authorities should be empowered to act as conveners of local quadruple-helix stakeholders to tailor and implement these strategies regionally. The project's experience shows the value of such vertical and horizontal dialogues; it fostered peer learning among regions on policy solutions. It is recommended continuing these exchanges beyond the project in a structured way, perhaps via an **annual Blue Economy Policy Forum** under the Committee of the Regions or through twinning programs between advanced and less-developed regions' governments.

- **Increase funding and investment support:** across both value chains, scaling up sustainable solutions will not happen without adequate financing support from the public sector to leverage private capital. On the EU side, the recommendation is to **continue and expand dedicated funding instruments** targeting these blue priorities. The new Interregional Innovation Investments (I3) program itself is a good start; under the next Multiannual Financial Framework, a more substantial **Blue Economy Innovation Fund** could be created. This might function similar to existing EU funds but focused on blue sectors, combining grants with financial instruments. At the national level, governments should integrate these sectors into their mainstream funding programs. Regions, for their part, can set up **regional innovation funds or grant schemes** to co-finance SME projects in these value chains, possibly in conjunction with private investors (using public–private partnership models to increase the pot). Innovative financing mechanisms should be employed: e.g. issuing **blue bonds** or **green bonds** by regional development banks to raise capital for a sustainable blue projects. Tax incentives could also play a role, like providing tax credits for companies investing in eligible blue economy R&D or equipment.

- **Support research, innovation and knowledge transfer:** policymakers must cultivate a fertile environment for ongoing R&D and innovation in the blue economy. At the EU level, this means sustained support for relevant research partnerships and missions. For instance, continue funding Horizon Europe clusters that cover marine biotechnology, climate-neutral shipping, and offshore renewable energy. The new Mission "Restore our Ocean and Waters" and the Mission on Climate Adaptation can be aligned with our goals. The EU can also promote interregional knowledge-sharing **living labs** where multiple regions jointly work on pilot innovations. National governments should invest in **research centers of excellence** on blue economy topics. Regionally, policies can incentivize technology transfer, or support for **incubators and accelerators** specializing in blue economy start-ups. One example action: a region could set up a **Blue Innovation Hub** (perhaps co-located with a university marine station) that offers training courses, demonstration facilities (like test tanks or simulators), and networking for entrepreneurs in both value chains.

- **Engage communities and raise public awareness:** both value chains depend on public support. Policy initiatives at all levels should include **public awareness and engagement campaigns** about the benefits of the sustainable blue economy. At the EU level, broad campaigns can highlight success stories and positive narratives. National and regional authorities should actively involve local communities in planning processes. Educational programs in schools and vocational institutes should also be updated to foster a new generation that is ocean-conscious and innovation-minded. Community engagement was explicitly recommended in the project outcomes – for example, developing community feedback platforms and participatory decision-making in local blue initiatives was discussed as a way to improve trust.

5.2. Policy recommendations for Value Chain 1

EU-level policies (Value Chain 1):

- **Strengthen the common fisheries policy (CFP) for sustainability:** the EU's Common Fisheries Policy should continue evolving to support long-term sustainability. This involves continuing to **tighten and enforce science-based fishing quotas** to address overfishing (no allowance for setting quotas above scientific advice). The CFP could incorporate more provisions for climate resilience, acknowledging that climate change is shifting fish stocks: such as flexible quota systems that allow countries to swap quotas when species migrate, or conservation measures that kick in automatically under certain oceanographic conditions. The EU should push for harmonized certification schemes for sustainable seafood, potentially an **EU ecolabel for sustainable fisheries products** to help drive market demand for sustainably caught or farmed products (complementing private labels like MSC but providing a simpler EU-wide mark). EU can increase funding for data collection and control under the CFP to ensure compliance (e.g. expanding electronic monitoring as mentioned in investments). These measures ensure fisheries management stays adaptive and robust, securing the resource base that Value Chain 1 depends on.
- **Aquaculture guidance and "One-Stop Shop" for licensing:** building on the EU's Strategic Guidelines for Aquaculture (which set broad priorities for sustainable aquaculture development), the EU should help standardize and simplify aquaculture licensing procedures across Member States. One idea is to establish a **common electronic one-stop-shop platform** for aquaculture licensing. This could be an EU-initiated portal where prospective aquaculture operators can see all requirements, submit applications, and get routed to the correct authorities, with progress tracked transparently. While actual permit decisions remain national/regional, the EU can provide the digital backbone

and a model process flow, encouraging Member States to integrate. On the funding side, the EU should increase support for **transnational R&D in aquaculture** through programs like Horizon Europe and partnerships (for example, innovation in alternative feeds, breeding, disease control were identified needs). The EU's role is to reduce the bureaucratic burden through guidance/IT tools and to fund advanced research that individual countries might not.

- **Support the blue bioeconomy and market development:** the EU should craft a dedicated **Blue Bioeconomy Action Plan or Strategy** that parallels efforts in the circular economy and bioeconomy for land. This strategy would foster innovation in marine biomass valorisation. It should include clarifying product regulatory pathways at EU level for novel foods, feeds, nutraceuticals, and biomaterials coming from marine resources reducing uncertainty for innovators. The EU can also use its tools like **green public procurement** to help grow markets for new marine bioproducts. Promotion campaigns could highlight new products like seaweed snacks or fish collagen-based cosmetics, improving public perception. By actively developing this emerging sector, the EU ensures that the push for sustainability and new economic opportunities.
- **Interregional knowledge platform:** the EU can facilitate an **Interregional innovation platform on sustainable seafood and aquaculture**, potentially under the Smart Specialisation (S3) platform that would enable regions to exchange best practices, partner on projects and collectively engage with EU institutions. I3-4-BLUE-GROWTH recommended creating new thematic partnerships in S3 for these areas, which aligns with this idea. The EU's Joint Research Centre (JRC) could support by providing moderation, expertise, and tools for these partnerships. Ensuring continuity of the network built in I3-4-BLUE-GROWTH via an official platform would mean the knowledge exchange doesn't stop; it will draw in other interested regions too.

National-level policies (Value Chain 1):

- **National strategies for sustainable aquaculture and fisheries:** each country with regions involved should update or develop **national blue economy strategies** that emphasize sustainable fisheries and aquaculture, aligned with EU goals and the Green Deal. These strategies should outline the support measures to achieve targets. A key focus at national level is **simplifying licensing procedures** for aquaculture - governments can implement fast-track systems or even a single license that covers multiple aspects (environmental, water use, etc.) for low-impact projects. Some countries have begun one-stop licensing and others should invest in strengthening the capacity of national agencies (fisheries departments, environmental agencies) so they can accelerate necessary assessments and permits without compromising standards.

- **Financial incentives and support programs:** national governments should introduce targeted financial incentives to encourage sustainable practices. For fisheries, this could include **tax breaks or fuel subsidies tied to sustainability**. Also, grants or low-interest loans for establishing new aquaculture farms, particularly in high-cost or remote regions where profitability might initially be challenging, can spur private investment. National governments could set up **Blue Investment Funds** to co-finance projects alongside EU funds.

- **Research, education, and extension services:** national policy should support the knowledge infrastructure for these sectors. This includes funding **marine research institutes** focusing on topics key to Value Chain 1 (marine ecology, aquaculture techniques, fish health, blue biotech). In the education area, incorporate aquaculture and marine biotech into university curricula and vocational training. At a simpler level, ensure fisheries and aquaculture topics are present in agricultural universities and engineering programs.

- **Market and Value-Chain development:** national authorities can help domestic producers by promoting **local sustainable seafood** consumption. For example, a national campaign branded with something like "Eat blue, eat sustainable" could highlight local aquaculture produce and certified fish, influencing consumer choices. Governments can also use their procurement power instructing public institutions like schools, hospitals, and canteens to source a certain percentage of their seafood from sustainable local producers (this was done in some countries for organic food, could be mirrored for sustainable fish). This creates steady demand and can justify scaling up production. Implement or support **labeling schemes**, either the adoption of MSC/ASC labels or national eco-labels and help smaller producers obtain them. Support **producer organizations and cooperatives**: these groups, if strengthened, help fishers and farmers improve their bargaining power and coordinate marketing. Policy can encourage formation of such cooperatives by providing initial seed funding or legal frameworks that make it easy to form them. By improving marketing and organization, producers capture more value which was a goal expressed in regional needs.

Regional-level policies (Value Chain 1):

- **Integrating blue priorities in regional plans:** regions should ensure that sustainable fisheries, aquaculture, and blue bioeconomy targets are embedded in their **Regional Innovation Strategies (RIS3)** and development plans. This formal inclusion means those areas are recognized as priorities and become eligible for structural funds and other support. Some regions have fishing ports that could be converted into multi-purpose "blue hubs" with processing, research labs, and incubators, a regional policy can outline such spatial planning and resource allocation. Aligning with national and EU strategies, regions can tailor the focus: e.g. one region might focus on shellfish

aquaculture and algae whereas another focuses on fish farming and processing.

- **Regional One-Stop Shop and advisory hubs:** each region can establish a **Blue economy single contact point** or one-stop-shop to assist project developers in navigating regulations and accessing support. This hub could be a physical office or an online portal run by the regional development agency or similar body. This directly addresses the local bureaucratic burden by providing hands-on facilitation. Regions could form **regional advisory councils** that include industry, scientists, and community representatives to guide local policy implementation. By institutionalizing stakeholder engagement at the regional level, policies stay adaptive and grounded.
- **Infrastructure and spatial planning:** regions often have authority over spatial planning in coastal and maritime areas. They should ensure that their **marine spatial plans** and coastal zone plans allocate space for aquaculture and protect key areas for fisheries. For instance, a region could identify sheltered bays suitable for shellfish farming and streamline zoning them for that use, while also delineating marine protected areas or no-take zones for conservation. Having clear, conflict-free designated sites makes it easier for investors to come in. Regions can also invest in enabling infrastructure: for example, improve port facilities that serve fishers. They might also invest in or facilitate **shared processing facilities** or logistics centers for aquaculture producers, so that even small producers can get their products processed and transported efficiently.
- **Regional training and incubation programs:** regions should implement targeted training programs for the local workforce to support diversification and upskilling. For example, in fishing communities facing quota cuts, a region could create programs to retrain or **upskill fishermen in eco-tourism or aquaculture** skills. This reduces socioeconomic pressure and fishing effort at the same time. Regions can partner with local vocational schools or NGOs to deliver such courses and possibly provide small grants or stipends to participants. Also, regions can create **incubators/accelerators for blue bioeconomy start-ups**, possibly linked with regional universities or innovation centers. They can provide space, mentorship, and help navigating regulatory approval for new products. By focusing on nurturing local entrepreneurs, regions help ensure that the innovations actually get developed locally rather than elsewhere.
- **Local community engagement and co-management:** at the regional and local level, authorities should facilitate more **community-based management** of resources and active involvement of local stakeholders in decision-making. Engage local NGOs and fisher associations in conservation programs like reef restoration or ghost gear removal by providing small grants or resources empowering them to take actions. For aquaculture, ensure **transparent consultation processes** for new farm sites - hold public hearings, share environmental impact info in accessible ways and consider **benefit-sharing**

models as mentioned earlier. This way the local population sees direct benefits and is more welcoming. Community buy-in is crucial; regions can pioneer creative approaches like festivals to introduce the public to aquaculture products and producers, making the sector more familiar and accepted. Regional policies should not just be top-down but engage those who are affected and can contribute local knowledge.

By implementing these multi-level policy recommendations for Value Chain 1, the operating environment will become far more conducive to sustainable growth. Regulatory hurdles will be lower, financial and knowledge support will be higher and stakeholders will be more actively involved in driving innovation. This comprehensive policy mix, alongside the investments, will help unlock the full sustainability potential of fisheries, aquaculture, and blue biotech in the regions.

5.3. Policy recommendations for Value Chain 2

EU-level policies (Value Chain 2):

- **Comprehensive EU maritime decarbonisation strategy:** while international shipping is partly governed by the IMO, the EU can lead with a more aggressive strategy for maritime emissions reduction as part of the European Green Deal. Building on recent initiatives (FuelEU Maritime, Alternative Fuels Infrastructure Regulation (AFIR)), the EU should set clear targets for reducing maritime transport emissions by 2030 and 2050. One tool is to extend the **EU Emissions Trading System (ETS)** to maritime emissions. The EU can coordinate technical working groups to develop **common standards for shore power connectors and safety guidelines for new fuels**, ideally global standards, but at least European if IMO is slow. By having unified standards, it fosters industry confidence to invest and give European companies a competitive edge in green shipping tech.
- **Simplified permitting for offshore renewables:** the EU's Offshore Renewable Energy Strategy calls for massive expansion of offshore wind and other renewables. A key bottleneck is permitting speed. The EU could issue **guidance or even regulation to streamline offshore renewable project consents** for example, by mandating maximum time limits for environmental permit decisions and promoting integrated procedures. The EU can also support cross-border offshore renewable projects by clarifying how joint projects but also increase funding for **offshore grid infrastructure**. EU, by addressing the bureaucratic and infrastructure aspects at EU level, can accelerate the actual deployment on water.
- **R&D and commercialization support:** the EU should enhance R&D for the critical technologies that Value Chain 2 needs. This means in Horizon Europe maintain or increase calls for **advanced batteries**, **hydrogen fuel cells**, **ammonia engines**, **wind propulsion** and so on. One idea is to create **European joint industrial projects** focusing on zero-emission shipping. Also ensure synergy

between energy and maritime policies: for example, when discussing European energy security and interconnections, include how offshore renewables contribute and what maritime infrastructure (like offshore hubs or energy islands) are needed.

- **Green corridors and international cooperation:** the EU can coordinate the creation of **Green Shipping Corridors**, which are specific maritime routes where the goal is to have only low/zero emission ships operate by a set date, with all necessary infrastructure in place. The EU could designate some priority corridors (for example, a Baltic Sea corridor between major ports, a North Sea feeder route, a Mediterranean short-sea route) and provide funding to the ports involved to install alternative fuel supply and harmonize regulations (like common safety protocols). This concept was endorsed in the Clydebank Declaration internationally; the EU can make it concrete in Europe by 2030. EU policy should encourage macro-regional strategies (Baltic, Atlantic, Mediterranean, Black Sea regions) to include maritime decarbonisation cooperation, since pollution and climate impacts don't respect borders.

National-level policies (Value Chain 2):

- **National maritime decarbonisation plans:** countries should develop or update **national action plans for maritime decarbonisation and alternative fuels**. Some elements may already exist in National Energy and Climate Plans or National Policy Frameworks under AFID, but often they can be more specific. These plans should set out how each country will roll out alternative fuel infrastructure in its ports, how they will incentivize low-emission ships, and how they will contribute to offshore renewable expansion (like auctions or targets for offshore wind). Policy tools can include **reduced port fees** or fairway dues for green ships (some countries already do this; it can be expanded or standardized). The plan should also consider how maritime fits into overall transport decarbonisation.

- **Regulatory reform for project approvals:** similar to the EU-level suggestion but at national level: simplify permitting processes for both **port infrastructure upgrades** and **offshore renewable projects**. Governments can set up special **task forces or "one-stop" authorities** for offshore wind and grid connections, some countries have done this by creating dedicated offshore wind agencies or co-locating officials from environment, energy, defense (for radar issues), etc., to streamline decisions. Often, old laws might not contemplate, say, hydrogen refueling in ports, a proactive regulatory update can prevent bottlenecks. Develop **clear national safety and technical standards** for handling new fuels in ports. This gives port authorities confidence to proceed without fearing liability or conflicting rules.

- **Investment and incentives:** governments need to put money into enabling infrastructure. For example, dedicate a portion of national recovery funds specifically for **port electrification and alternative fuel infrastructure**. Transport

budgets could be redirected (or increased) to fund maritime projects, and provide **grants or tax credits for shipyard innovations**. Public procurement is a powerful tool: when governments or state-owned companies procure new vessels (navy, coast guard, research vessels, public ferries), they should **mandate zero-emission or low-emission technologies**. This creates a guaranteed initial market for green shipbuilders and equipment suppliers, helping to bring down costs through learning. This approach has been used for electric buses and such, and can be mirrored in the maritime sphere.

- **Skilling and re-skilling programs:** national education ministries and labor agencies should collaborate with industry to update and expand **maritime education and training** programs to include the new skill sets required. Launch **reskilling programs** for workers from declining or transforming sectors like oil & gas offshore workers can be retrained for offshore wind installation and maintenance. Fund **apprenticeships and vocational courses** in specialties like high-voltage electrical systems, cryogenic handling, composite materials, etc. Provide certification pathways for new roles. These national initiatives will ensure the workforce is ready, which also supports just transition aims by moving traditional maritime workers into green maritime jobs.
- **Align energy and maritime policies:** ensure that national energy policy accounts for the needs of maritime decarbonisation and vice versa and encourage **renewable energy development near ports**, e.g. incentivize putting solar panels on warehouses or wind turbines near port zones, possibly through feed-in premiums or by letting ports invest in renewables and use the power directly. Also, maritime spatial plans should identify **priority areas for offshore renewables** and streamline other regulations (like defense or aviation height restrictions) in those zones. This might need national-level negotiation between ministries but it's crucial to avoid unnecessary barriers.

Regional-level policies (Value Chain 2):

- **Regional decarbonisation plans for ports and vessels:** regions, especially those with significant port infrastructure or coastal shipping, should create localized plans to contribute to national/EU decarbonisation targets. For example, a region could aim that by 2030 all intra-regional ferry routes are served by electric or hydrogen-powered vessels, and then outline how to get there (invest in charging/fueling at small ports, provide grants to ferry operators to buy new vessels, etc.). Coastal regions could also designate one port as a **pilot hydrogen port** and concentrate initial efforts there before scaling to others. These regional targets can be more ambitious than national ones and serve as testing grounds.
- **Facilitating local projects and pilots:** regional authorities can proactively initiate pilot projects by bringing together local stakeholders. For instance, a region could coordinate a pilot of **electric buses for port area transit** (reducing port-

city pollution) or a demonstration of a small wave energy device off its coast in partnership with a local university. Regions can simplify local permits within their competence for such pilots and even co-fund them through regional budgets. Often, having a **regional champion** makes pilots happen faster than waiting for national action.

- **Support for local SMEs and innovation:** regions should nurture their local companies to become part of the green shipping and marine energy supply chain. This can be done by **small business grants** or vouchers for, say, a shipyard to purchase tools for working with new materials (e.g. equipment to handle composite materials for building lighter vessels), or for a tech startup to test its port emissions monitoring system in a local port (covering the cost of sensors and installation). Regional innovation competitions could be held, similar to the project's open innovation challenges, where the region poses a specific decarbonisation problem and local SMEs can propose solutions; winners get a contract or grant to implement their solution at a pilot scale. Regions often have development agencies or cluster organizations that can administer such challenges and follow up with support to implement the ideas.
- **Public-private partnerships at regional level:** regions can often act more nimbly than nations in forging **public-private partnerships (PPPs)**. A region could gather a consortium with a local port, an energy utility, and a tech provider to deploy something like a **hydrogen pilot project**. The region might use some of its EU regional funds as seed money, the utility provides technical expertise and maybe equipment, and the tech provider gets a real-world showcase.
- **Community and stakeholder engagement:** decarbonisation projects like offshore wind farms or new fuels in port can face local opposition if not managed well. Regions are on the front line of this and should lead in **community engagement and benefit-sharing**. Some offshore projects in Europe give a small share to local cooperatives, which is a model to consider. Regions can facilitate the creation of these cooperatives or community funds and engage local environmental groups early when designing projects to address ecological concerns from the start.

By implementing these tailored policy measures at all governance levels for Value Chain 2, the conditions will be created in which the innovative projects and investments identified can flourish. These policies aim to **remove barriers and actively drive the transition** to a sustainable blue economy in both value chains. It is the combination of regulatory push, incentives, and collaboration frameworks that will make the difference.

II. Conclusion

The **I3-4-BLUE-GROWTH** project has created a reliable framework by mapping ecosystems, engaging stakeholders, and identifying what is needed to unlock the potential of two critical blue economy value chains. This Sustainability Plan synthesizes those insights into a comprehensive strategy for the next stage: implementation and long-term impact. We have presented a multi-faceted approach spanning policy reforms, investment priorities, and collaborative frameworks that together will drive the sustainable growth of **sustainable seafood, aquaculture, and valorisation of blue bio-resources**, and **marine renewable energy and maritime decarbonisation** in the partner regions and beyond.

By executing this plan, European coastal regions will tackle key societal challenges: providing **nutritious food sustainably from the ocean**, transitioning to **clean energy and green transportation** to mitigate climate change, and creating **new jobs and industries** in the process. Importantly, the plan's measures ensure that less-developed regions are not left behind but rather are empowered to catch up and even lead in niche areas, leveraging support from more developed peers, a true realization of cohesion and smart specialisation principles. The interregional cooperation mechanisms envisaged (like the S3 platform partnerships and the I3 hub) are designed to keep knowledge flowing and partnerships alive, so that innovation continues in a collaborative way.

The **policy recommendations** outlined will create an enabling environment for innovation. Meanwhile, the **proposed investments** in infrastructure, technology, skills, and networks will turn ideas into reality. Together, the policy and investment actions reinforce each other: policies remove barriers and incentivize, investments demonstrate and build capacity. The emphasis on continued collaboration (through S3 partnerships and international cluster roadmaps) will sustain momentum well beyond the lifespan of this initial project.

This plan ensure **multilevel engagement and interregional solidarity** advanced regions will continue sharing expertise via structured exchanges, and less-developed ones will reciprocate with local knowledge and pilot environments each learning from the other. The plan also addresses **financial sustainability and post-project continuity**: by proposing regional innovation funds, public-private partnerships, and the institutionalization of the consortium (possibly evolving into a legal entity or permanent network), it charts a course for mobilizing internal resources and attracting external funding. The suggestion to consider a European Economic Interest Grouping or similar for the consortium is one idea to give it permanence and ability to sign contracts, apply for grants, and involve new partners. Integrating outcomes into mainstream policy (like including recommendations in national/regional policy updates) means the work influences budgets and decisions going forward

III. References

- **I3-4-BLUE-GROWTH Deliverable 2.1** Handbook on innovative best practices in sustainable blue economy (Value Chain 1 & 2 case studies).
- **I3-4-BLUE-GROWTH Deliverable 2.2** Trend Analysis and Ecosystem Mapping (overview of blue economy trends, RIS3 priorities, quadruple helix stakeholders).
- **I3-4-BLUE-GROWTH Deliverable 2.3** Meetings of the Quadruple Helix Working Groups (summary of stakeholder-identified challenges, needs, and innovation priorities for each value chain).
- **I3-4-BLUE-GROWTH Deliverable 2.4** Summary Report on Targeted Value Chains and I3 Opportunities (consolidated needs, challenges, cross-cutting vs specific priorities per value chain).
- **I3-4-BLUE-GROWTH Deliverable 2.5** Action Plan for Improving the Regional Innovation Ecosystem (strategic goals, **policy recommendations** at EU/national/regional levels for both value chains, and a list of potential innovation projects).
- **I3-4-BLUE-GROWTH Deliverable 3.3** Open Innovation & Challenge Programme (results of open calls, SME challenges, and matchmaking events identifying pipeline projects and business cases for value chains).
- **I3-4-BLUE-GROWTH Deliverable 3.4** Capacity-building workshops (consolidated programme and tools on technology, business and investment readiness to support upskilling and investment strategies).
- **I3-4-BLUE-GROWTH Deliverable 3.5** B2B Matchmaking Events (results of matchmaking activities identifying regional cross collaborations).**I3-4-BLUE-GROWTH Deliverable 4.3** Joint Interregional Roadmap and Baseline for Blue Regional Mission (2–5 year roadmap linking advanced and less-developed regions' offers and needs, Azores mission model).
- **I3-4-BLUE-GROWTH Deliverable 4.4** Action Plan to Create Synergies with S3 Platforms (proposals for new thematic partnerships bridging blue economy and energy on the S3 Platform, plan for at least four new interregional initiatives).
- **I3-4-BLUE-GROWTH Deliverable 5.2** Regional Policy Dialogue Roundtables (web-based discussions on regulatory harmonization, funding mechanisms, and policy needs; key topics and stakeholder input on policy improvements).
- **I3-4-BLUE-GROWTH Deliverable 5.4** Action Plan for Internationalization (cluster internationalization roadmaps for Azores, Croatia, Andalusia, etc., with phases for global outreach and investor attraction).

- **Project website** *I3-4-BLUE-GROWTH: Unlocking the potential of Sustainable Blue Economy*, https://www.bluebioalliance.pt/i3-4-blue-growth/