BlueRev

Bio-based revitalisation
of local communities

Governance recommendations for the revitalization of local economies in the blue bioeconomy

D4.3

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Table of Abbreviations and Acronyms

Abbreviation	Meaning
AI	Artificial Intelligence
CFP	Common Fisheries Policy
CGS	Credit Guarantee Schemes
DFBG	The District of Fishing and Blue Growth
DVFA	Danish Veterinary and Food Administration
EDIH	European Digital Innovation Hubs
EMFAF	European Maritime, Fisheries, and Aquaculture Fund
ESG	Environmental, social, and governance
GOIS	Governance of Innovation Systems
ISPRA	Italian National Institute for Environmental Protection and Research
MASE	Ministry of Environment and Energy Security
NIBIO	Norwegian Institute of Bioeconomy Research
NZIA	Net-Zero Industry Act
PPP	Public-Private Partnerships
PNRR	Piano Nazionale di Ripresa e Resilienza, Italian National Recovery and Resilience Plan
PRR	Portuguese Recovery and Resilience plan
R&D	Research and Development
R&I	Research and Innovation
SMEs	Small and Medium-sized Enterprises
SNM	Strategic Niche Management
TIS	Technological Innovation Systems
TRL	Technological Readiness Level

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1 Executive Summary

Coastal communities are grappling with challenges from the climate crisis, rural depopulation, and economic pressures. The BlueRev initiative addresses these issues by empowering coastal communities, reimagining policy frameworks and fostering adaptable governance structures. Recently, the *Analysis of governance models in the pilot regions* report was published, looking at current governance structures in the pilot regions. This report has served as a foundation for generating recommendations to foster economic, ecological and social development within the blue bioeconomy of the studied pilot regions in Denmark, Greenland, Italy, and Estonia.

For each pilot region, a set of recommendations for how the governance structures can be improved has been developed, building on the Governance of Innovation Systems (GOIS) model used in the initial mapping of the governance structures. The GOIS model provides a framework for structuring the recommendations under the categories: knowledge development, direction of search, resource management, market formation, legitimacy creation, and entrepreneurial experimentation – giving an indication in which broader areas change is needed for each pilot region.

Building on previous deliverables and through co-creative workshops across the pilot regions, stakeholders have been engaged to prioritize between the recommendations to find solutions with the most relevance to the regional and local contexts. The results show that there are some recommendations that are unique to individual pilot regions, such as the need to map business practices to match consumer demands in Denmark or the development of culinary tourism in Greenland. However, the key outcome of this report is the demonstration that there are significant overlaps in the need for governance reforms across the pilot regions, indicating similar problems to scale the use of side-streams across geographically dispersed areas in Europe which likely means that similar challenges and needs can be found in the blue bioeconomy in other regions.

The report gives three overarching recommendations that hold for all studied pilot regions:

- simplifying regulatory processes and increasing policy awareness
- implementing entrepreneurial support and new financing models for innovation in the blue bioeconomy
- improving collaborative efforts in blue bio-based industries

These directions of improvement point to the potential for study in further regions throughout Europe to expand the body of research on governance of innovations systems, and ultimately local improvement of systems at local level.

2 Introduction

Policy frameworks, regulations, and the overarching governance of a region and industry are all important determinants of how an industry develops, and the level of innovation that is supported. By rethinking how governance structures surrounding the blue bio-based sector can be adjusted and improved, this can spur innovation and contribute to both a sustainable development in regions with strong blue bio-based industries through the increased utilisation of biobased products and benefit local communities through the economic development an expanding industry can bring. The primary focus of BlueRev is to address these aspects within the blue bioeconomy, and garner information and insights from key stakeholders to device recommendations for European coastal areas. The blue bioeconomy relies on renewable, living aquatic resources such as algae, sponges, jellyfish or microorganisms to deliver a wide variety of products, processes and services.

In the BlueRev report on governance structures, *Analysis of governance models in the pilot regions*[1], published in March 2024, a 'snapshot' of the current situation in the pilot regions was mapped to improve the general understanding of how existing governance structures either enable or hamper economic, social, and ecological development of blue bioeconomy value chains. This was based on the Governance of Innovation Systems (GOIS) approach, which is an adaption of the Technological Innovation Systems (TIS) framework[2,3]. It features six key areas: *Knowledge development and dissemination, resource mobilisation, direction of search, market formation, legitimacy creation, and entrepreneurial experimentation.* The results were based on desk research, interviews and workshops.

The purpose of this deliverable is to develop and give recommendations for how new governance structures can support the development of the blue bioeconomy in the studied pilot regions, and in extension revitalise the local economies that are home to blue bioeconomy industries. In this report, we are going step further to understand how governance structures can nurture and guide the emergence of new sustainable innovation within niche spaces and provide recommendations for how governance structures can be developed in the pilot regions. For this reason, we deployed Strategic Niche Management[4,5] (SNM) as a guiding theoretical framework for the analysis of our workshop outcomes. By understanding the interplay between governance mechanisms and niche dynamics, SNM helps us conceptually deliberate on how experimentation, collaboration and visioning may support the development and diffusion of, for example, niche products and value chains.

In short, the SNM literature proposes that innovation and experimentation of promising new technologies emerge in peripheral niches. These niches provide 'protected spaces' in which innovations are shielded from policy and market pressure. The development of niches includes deliberate efforts to foster learning, visions and expectations about new

technologies and to encourage their broader applications. SNM seeks to facilitate the growth and adoption of innovations by temporarily shielding them from market pressure and allowing them to mature and adapt.

As such, SNM can be used to understand the interplay between governance mechanisms and niche dynamics by showing how actors, actions and policies, can be aligned to support the emergence of new technologies and markets. It is thus a framework that can guide and coordinate the efforts of diverse stakeholders towards imagined futures.

This report builds on five workshops hosted in the BlueRev pilot case studies: Sicily (where two workshops were run), West Jutland (Vestjylland) in Denmark, Greenland, and Saaremaa in Estonia. The workshops took place during May – November 2024, and gathered key actors from across local blue bioeconomy value chains and governance structures. More details on the workshops can be found under the methodology section 3.1 and under the sections for each pilot region.

The results point to overarching similarities between the pilot regions, despite the geographical distances, with several themes emerging across regions in both the broader set of recommendations as well as in the ones prioritized by stakeholders in the workshops. The recurring themes across the regions involve: Simplified regulatory processes and increased policy awareness; Entrepreneurial support and new financing models; improving collaborative efforts in the industry. For each pilot region, each prioritized recommendation has been described in more detail with respect to the local context, to provide more specific details of how they could be implemented.

3 Methodology

1.

The development of recommendations was based on the analysis of current governance structures, as described in the introduction. Weaknesses in these governance structures were identified along the six GOIS-dimensions used for the analysis: *Knowledge development and dissemination, resource mobilisation, direction of search, market formation, legitimacy creation, and entrepreneurial experimentation.*

3.1 Workshops

In order to prioritise and provide depth to new governance recommendations for the pilot regions, a workshop concept was developed and used in each pilot region to test and further advance the governance recommendations together with local stakeholders. The workshops were carried out together with stakeholders in the regions in order to anchor the results regionally and locally, rather than only developing solutions through desk research. Involving a broader set of stakeholders from the pilot regions helps create buy-in to the results and allows for feedback on the recommendations.

The workshops in Denmark and Greenland were carried out in collaboration with the University of Agder (Denmark and Greenland) and NIBIO (Greenland) to integrate the work on governance recommendations with the business models and social innovations. In these workshops, the work on governance recommendations preceded the one on business models to give participants a broader perspective on the proposed changes in the region, followed by more specific discussion on what business models that would be possible to develop based on the regional and local context. For the workshops in Estonia and Italy the governance section was carried out as its own, standalone workshop.

The purpose of the workshop was to find out how changing governance structures can help support “blue” businesses in the pilot regions to reach their goals. It also aimed to empower government agencies to foster a sustainable and competitive industry and promote the growth of local economies based on blue bio-resources. In short, the work aimed to identify new ways to steer, guide, and coordinate actors within a network – in this case in the blue bioeconomy.

The workshops were structured around populating a canvas with four main sections (Figure 1). The first section involved the presentation of the governance recommendations developed in the BlueRev deliverable analysing governance models in the pilot regions[1]. This was followed by a brief reflection and discussion in smaller groups, before the participants were to rate the recommendations from *most important to implement or improve* in the region to the *least important*. The three highest ranked recommendations were then selected to be addressed in the smaller groups. In the second step, the groups identified barriers and enablers related to their assigned

recommendation, aiming to find drivers for change and address existing lock-ins in the system.

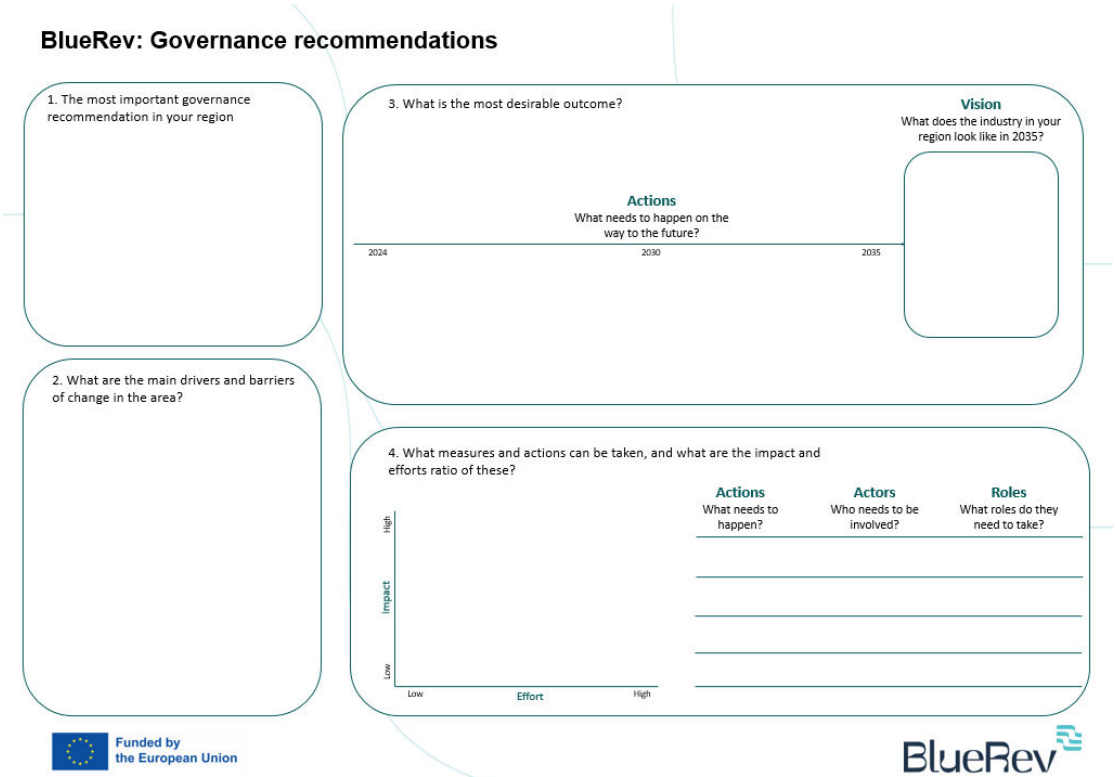

Figure 1. Canvas for development of the governance recommendations used in workshops

In step three, participants were introduced to foresight methods when working on creating a vision for their region in 2035. This future vision was to have a particular focus on the chosen governance recommendation, visualizing what the region might look like if the recommendation was addressed, and the identified barriers were overcome. From the vision, the groups used backcasting to identify actions that could shift the industry in the direction of the vision. Backcasting is a method where participants first imagine that they are in the future, and have achieved their vision, and are subsequently backing towards the present to identify the steps and changes that have taken place along the way to make the vision happen[6]. The fourth and final section of the canvas was developed to deepen the discussion on the type of actions needed, by first mapping them in an impact–effort figure to identify the level and relative impact of these actions. These were subsequently further detailed, including deliberations on which actors need to be involved and their roles in facilitating the activities.

3.2 Desk research

For all pilot regions, the results from the workshops have been used as a starting point for the development of the prioritized governance recommendations. Further desk research has subsequently been carried out in order to give the governance recommendations more depth and clarity, and to provide examples of how similar initiatives have been implemented in other regions. For this purpose, academic articles, grey literature, newspaper articles, blog posts, policy documents, government websites, and other sources have been consulted to provide the additional information needed to supplement the workshop results and ensure that the resulting recommendations are clearly described and with ideas of implementation.

4 Pilot region governance recommendations

A set of governance recommendations, based on the analysis of governance structures in an earlier report of the project, was developed for each pilot region. The recommendations follow the structure of the GOIS-dimensions used in the initial analysis, with at least one recommendation per dimension. The dimensions are:

- knowledge development and dissemination
- resource mobilisation
- direction of search
- market formation
- legitimacy creation
- entrepreneurial experimentation

The recommendations were developed by assessing needs and weaknesses in current governance structures connected to these innovation systems dimensions, based on interviews with regional stakeholders (see the analysis of governance structures for a more in-depth explanation of the GOIS innovation systems dimensions). Our analysis for the mapping of governance structures, found that **knowledge sharing and collaborative learning** are crucial for enhancing the valorisation of side-streams in the blue bioeconomy, as well as for **identifying common visions** and **establishing clear regulatory structures**. This approach would help mobilise resources, unite actors, build trust among partners, and enable entrepreneurial experimentation within the blue bioeconomy. These six key dimensions are general and may be relevant across European coastal areas. As part of the current report, we developed specific recommendations for each geographical pilot case. These were further deliberated on the workshops in the case study areas, emphasising three main recommendations as key to unlocking the potential of blue bioeconomy in their region.

4.1 Italy

For the Italian case, eight initial recommendations across the six governance dimensions were developed based on the analysis of the current governance structure. These recommendations are listed below, along with the rationale behind each one. The recommendations were further discussed and prioritized through the workshop methodology defined under section 3.1, with results from the workshop being described further below. The Italian pilot case, thanks to the involvement of UNIPA in the executive board, is part of the most important Italian (Cluster BIG) and European scientific initiatives supporting blue growth and the dissemination of its principles (European Society for marine biotechnology, European federation of biotechnology), which could provide opportunities for the further development of governance structures to advance the blue bioeconomy.

Knowledge development and dissemination

Knowledge development and dissemination is one area that would benefit from increased attention for the blue bioeconomy to flourish in Sicily. This is particularly evident in relation to the potential that forums for dialogue may hold for exchanging and developing ideas connected to marine by-products, increasing the awareness of opportunities associated to the development of side-streams. Today, marine by-products are predominantly viewed as waste rather than a resource, although they might carry significant economic and environmental potential. This is in part due to the prevailing idea that it is easier and cheaper, in the short term, to pay to dispose of fish waste than to explore its potential, beside some local enterprises have a high level of awareness about the potential of its utilization both from environmental than economic point of view. However, this stifles innovation. The underutilisation of side-streams, coupled with gaps in specialised knowledge necessary for research and development and infrastructural constraints, hinders the development and export of niche marine-based products.

Upskilling programs for a resilient marine sector: Sicily's population is declining. Young people are leaving the island to find employment opportunities elsewhere in Europe. This also means that the workforce is generally getting older and there is a lack of recruitment in all sectors, including in small-scale fisheries. This leads to slowing knowledge development, especially when it comes to the development and commercialisation of marine by-products. Investments in advanced vocational training to upskill workers and an increased focus on R&I in the marine sector could be a solution to Sicily's fishing sector's challenges; both by investing in the resurgence of the sector through new marine by-product applications and strengthening the industry financially.

Therefore, transforming the perception of by-products from waste to resource and increasing the understanding of their economic value is key to enhancing the blue bioeconomy in the region. From there, a multitude of opportunities open. Moreover, investments in upskilling both the existing and the future workforce could be key to improving the outlook of Sicily's marine sector.

Direction of search

Policy awareness to unlock regional governance for market growth: The Italian region of Sicily boasts a strong multilevel governance structure, partly due to its status as an autonomous region within Italy. Sicily has its own regional government and parliament to support and promote its interests towards the national level. In practice, this means that the Sicilian Regional Assembly can pass laws on matters of regional importance, allowing it to address specific Sicilian needs in certain policy areas. Knowledge of how public procurement guarantees and subsidies could support market formation is lacking. Solving this could be key to solidifying market formation and finding a shared direction of development between the industry and authorities.

Industry-academia collaboration for increased innovation and growth: As with the section on knowledge and dissemination, expanding on the importance of dialogue to create common narratives for the sector could be an important measure for the direction of search in Sicily. This could contribute to improve industry collaboration and furthermore, by connecting to their public offices, create strong public-private partnerships (PPPs) to scale and integrate innovation into market structures. In addition to already on-going dialogue initiatives, creating shared visions of the road ahead for Sicily's small-scale fisheries and other actors in the blue bioeconomy are important, for leveraging the sector's relative importance for the region to attain policy attention and shaping strategies for innovation and development. The current gap in strategic planning or preventing uncertainty surrounding the scale-up of the industry over time suggests that a comprehensive approach is necessary.

Despite the general depopulation and lack of new recruitment to the labour force in Sicily, the industry itself does not find the shortage of skills supply an issue for developing marine by-products. This may either mean that the level of expertise is satisfactory, or that there might be a lack of recognition of the potential skills gap – and furthermore, an underestimated potential for further development of the industry and the subsequent skills needed.

Legitimacy creation

Enhancing regulatory knowledge among industry for legitimacy and compliance: Enhancing regulatory knowledge is a key factor in building industry legitimacy and compliance. Improved communication surrounding policy and regulation is essential, as industry responses indicate persistent uncertainty in these areas. This lack of clarity affects risk awareness, safety practices, and understanding of the environmental impacts linked to side-stream utilization.

Bridging these knowledge gaps is vital to ensure that industry stakeholders are well-informed about regulatory compliance, safety standards, and environmental considerations. By strengthening awareness and fostering a proactive approach to best practices, the industry can boost credibility and lay a stronger foundation for sustainable growth in Sicily's blue bioeconomy.

Resource mobilisation

Innovative financing for sustainable growth in the blue economy: Resource mobilisation is crucial for systemic change in the blue economy, requiring financial, physical, and human resources. In the analysis of the governance structure, stakeholders expressed concerns about the sufficiency of financial resources for industry development, highlighting the need for improved financial planning and resource allocation.

Industry stakeholders report significant quantities of marine by-products generated annually, ranging from 8,000 kg to 31,000 kg per organisation in the Trapani region, mainly from April to September. A common challenge is the lack of storage for these by-products, indicating infrastructural limitations in handling and processing them efficiently.

Therefore, improved financial planning, resource allocation and investment strategies, and resources to transfer knowledge from academia to industry, engage in accelerators, and support start-ups are needed.

Market formation

Market expansion for a thriving blue bioeconomy in Sicily: Identifying new applications and potential new target sectors for market expansion in the blue bioeconomy is key to solidifying the industry in Sicily. With a lack of experience in using marine by-product and low levels of knowledge pertaining to market opportunities, the industry is uncertain and pessimistic, considering what market potentials exist and the connected opportunities. Although local academics at the University of Palermo possess great knowledge of the potential valorisation of marine side-streams (including the Technology Readiness Levels, TRLs), there are no clear strategies for market expansion in the industry. Additionally, there is a shortage of research resources to participate in accelerators, facilitate knowledge and technology transfer, and support start-ups in Sicily's blue economy.

Entrepreneurial experimentation

Supporting entrepreneurship in Sicily's marine bioactives: Entrepreneurial experimentation, which involves exploring new commercial applications through innovative practices, is crucial for growth in Sicily's marine bioactive compound industry. However, the absence of end-users for marine by-products (such as in biorefineries or

the cosmetics industry) and the lack of associated knowledge systems and networks are significant barriers to innovation and entrepreneurial efforts in the fisheries sector. Supporting initiatives investigating the commercial use of marine by-products, including identification of risks and challenges would be important to enable entrepreneurial experimentation. As example of successful entrepreneurial experimentation, UniPa group has experimented the realization of a "diffused living lab" involving the research team and the some fish processing enterprises that are included in the network, where new sustainable and innovative marine biobased production are co-created and co-designed (and some yet in the market), to unlock the potential of local marine resources and value-chains.

Government commitment to boost innovation and entrepreneurship: Furthermore, strategies such as smart specialisation, skill and knowledge transfer support, research and technology infrastructure, and sharing best practices among stakeholders are important. These activities can significantly strengthen the sector and foster innovation and entrepreneurial experimentation. Enhancing partnerships between private and public organisations is essential for promoting entrepreneurial experimentation and exploring cross-industry applications. Supporting initiatives that investigate the commercial use of marine by-products, including identifying risks and challenges, can stimulate innovation and entrepreneurial actions.

4.1.1 Stakeholder workshop

Two workshops were held in Sicily, one to provide additional input to the initial analysis on the governance models to aid in the development of the governance recommendations, and a second to prioritize among the recommendations to narrow the range down to the ones with highest relevance to the Sicilian pilot region.

The first workshop was conducted by the University of Palermo, led by Professor Concetta Messina, on the 15th of December 2023 and was attended by seven actors from both the public and private sectors as well as the research industry. Participants discussed the following set of questions:

- What are currently the main barriers to benefiting from innovations related to by-catch in Sicily?
    - Is anything lacking for innovation to take place in the space?
- How do the actors and organizations collaborate and/or exchange knowledge in the region?
    - What is functioning well, and what could work better (or is missing) in the coordination and collaboration among actors in Sicily?
- What is needed to enhance or upscale activity around the by-catch in Sicily?
    - Are there sufficient regional structures (e.g. funding, facilitation, matchmaking, infrastructure etc.) in place to support valorisation of the side streams?

- What should not be changed? (i.e., what is currently working well in Sicily?)

The results from this discussion were summarised by representatives at the University of Palermo and used by RISE to develop the governance recommendations.

A second workshop was held in Sicily on the 26th of September 2024, with the aim to conduct an initial prioritization of the governance recommendations together with stakeholders. The workshop was attended by eight stakeholders and experts from the fishing industry, along with members of the BlueRev project consortium.

Out of the eight governance recommendations outlined above, four were prioritized for more in-depth discussions during the workshop:

- *Enhancing regulatory knowledge among industry for legitimacy and compliance*
- *Policy awareness to unlock regional governance for market growth*
- *Industry-academia collaboration for increased innovation and growth*
- *Innovative financing for sustainable growth in the blue economy*

For the in-depth development of the recommendations below, the recommendations focused on *regulatory knowledge* and *policy awareness* were combined due to being adjacent in terms of content, as well as to reduce the number of recommendations to a more manageable number. A new name was therefore created to encompass the two areas, "*Enhancing policy awareness and regulatory knowledge for industry development*".

4.1.2 Vision for Italy/Sicily

Due to the short timeframe for the workshop conducted in Sicily, there was no time to create a vision for the region. Gathering stakeholders for this purpose, namely to develop a clear and shared image of the desirable future, could be a promising and low-cost step to bring stakeholders together and discuss the path forward for actors in the region.

4.1.3 Development of recommendations

Enhancing policy awareness and regulatory knowledge for industry development

There are specific legislations in place that regulate the Italian fishing industry, such as D.lgs. 152 / 2006 ITA and REG 1069/2009 EU, that manage environmental protection in Italy and the use of animal by-products in foods respectively. The knowledge of how these and related policies affect the development of the fishing industry seems to be missing among actors in the region. Regulations and policies are set on EU- and national levels and further managed by a range of government agencies such as the Ministry of Environment and Energy Security (MASE) and the Italian National Institute for Environmental Protection and Research (ISPRA). As Sicily is an autonomous region with the ability to manage several aspects of its environmental policy within the limits of national regulation, one solution for increasing the regulatory knowledge among actors

is to arrange forums for knowledge sharing between actors in the region. This could include the regional government of Sicily, and more specifically the Regional Department of Territory and Environment that has the main responsibility for environmental policies in the region, and the Fisheries Department of Sicily; ARPA Sicilia, which is the regional environmental protection agency responsible for implementing and monitoring environmental standards; producer- and trade organisations that assist their member in interactions with institutional actors multiple levels, such as The District of Fishing and Blue Growth (DFBG) and Sicindustria. Working on a regional level would further allow for Sicilian stakeholders to discuss and develop policy recommendations that would spur innovation in the region and could be passed on to regulatory institutions.

Establish Industry-academia collaboration for increased innovation and growth

For innovation to occur in the fishing industry, there is also a need for knowledge sharing and collaboration between the industry and academic institutions. While there is a high level of knowledge and technology readiness levels (TRLs) for valorisation of by-products in the academic sector, there is a lack of forums and pathways for scaling and transfer such knowledge. Common issues that must be bridged are the diverging mindsets and ways of working in the academic and business sectors, such as working along different time horizons (long vs. short); whether results should be published or kept inside a business (open-source vs results protection); as well as differing incentives for undertaking the collaborative work (curiosity and academic prestige vs profits)[7]. To successfully implement industry-academia collaborations there is the need for some actor to govern the collaboration and ensure that there is a balance in the contributions and interests of the different partners[8]. One example of how this could be implemented would be through the co-location of SMEs at universities to form incubators, and more readily accelerate innovations and create spin-off businesses that can be brought out into the industry faster[9].

Implement innovative financing for sustainable growth in the blue economy

The fishing industry in Sicily is facing challenges related to the infrastructure in the region and, more specifically, the funds needed to update it and help spur innovation and scale-up of new solutions in the sector. A lack of financing is something that is shared across the pilot regions and will be discussed in more overarching terms at the end of this report. For actors in Sicily, one opportunity is to apply for funding through the European Maritime, Fisheries, and Aquaculture Fund (EMFAF), which is managed by the Ministry of Agriculture, Food and Forestry Policies in Italy. EMFAF funds are distributed to EU member states and are meant to support the EU's maritime policy: promoting innovation in the sector, providing support to coastal communities, and enabling a sustainable development of the blue bioeconomy[10]. Further, emerging financing models for the development of the blue bioeconomy that could be suitable in Sicily include Blue

Accelerator Programs and Incubators, where SMEs in the region can receive support in the form of funding, mentoring, networking, and technical expertise to grow their business. These types of programs can be established and supported through research and development incentives to promote growth in the blue bioeconomy, or by providing funding and grants to accelerator programs. An example in Europe is the BlueTech accelerator in Portugal, supported by the Portugal Blue Digital Hub, a consortium of 17 actors in the Portuguese blue bioeconomy sector led by the Forum Oceano which is the managing entity of the Portuguese Sea Cluster. The BlueTech accelerator, as the name suggests, mainly focuses on supporting the development of new technologies in the areas of Artificial Intelligence (AI), blockchain, and big data to scale sustainable blue solutions[11]. The program is funded by the EU, specifically the European Digital Innovation Hubs (EDIH) program, while also receiving funding from national and regional government bodies in Portugal such as the Portuguese government and the Recovery and Resilience Plan (PRR) in Portugal, which is funded by the European Union's Recovery and Resilience Facility[12].

Italy has its own programme similar to the PRR called the Piano Nazionale di Ripresa e Resilienza (PNRR), the National Recovery and Resilience Plan, meant to fund sustainable initiatives in Italy[13]. With similar governance infrastructure in place, it would be possible for both national and regional governance actors in Sicily to set up accelerators to support businesses in the region.

Further details on new financing mechanisms in the blue bioeconomy can be found under section 5.1.2, where common recommendations across the pilot regions are described.

4.2 Denmark

West Jutland in Denmark is a region where the fishing industry and seafood processing are central to the region's local economies. The region is presented with a number of challenges and opportunities, all connected to the present governance system in one way or another. This includes the intense competition for skilled labour, access to raw materials and the reduced quotas following Brexit. Furthermore, with the high costs connected to protein content in wastewater from fish processing facilities, and the loss of the animal feed market due to the general ban on mink breeding in 2021, valorisation issues have become increasingly relevant in the industry.

The Danish fishery policy is in part governed by the Common Fisheries Policy of the European Union, with much regulation adopted from EU directives and implemented at the national level in Denmark. These regulations include marketing standards and detailed labelling requirements. These regulations ensure product quality and safety but also add layers of complexity for businesses.

The Danish Ministry of Food, Agriculture and Fisheries handles administrative, and research tasks related to farming, fisheries, and food production, and the national government oversees legislation related to fisheries, ensuring compliance with EU standards. At regional and local levels, administrative responsibility is largely delegated to the municipalities. Local governments can support the fishing industry and develop and implement programmes under the European Maritime Fisheries Fund via the national managing authority.

Knowledge development

Initiate knowledge development in the use of side-streams through educational efforts aimed at innovation: In Denmark, there are significant knowledge gaps related to the use and maximisation of value from by-products. Despite these knowledge gaps, there are signs of change. Innovative initiatives, such as the recovery of nutrients like protein and phosphorus from processing water, and the creative use of solid side-streams, indicate a shift towards more sustainable practices. Economic factors and a historically cautious approach to product development present challenges, but there is a growing trend towards embracing innovation and risk. Therefore, initiating knowledge development in the use of side-streams through educational efforts aimed at innovation would be wise.

Increase policy makers' knowledge to handle new products based on side streams categorised as novel foods: Further knowledge development is essential in both the fishing industry and among policymakers, particularly concerning new products based on side streams being categorised as novel foods. This categorisation is a significant hurdle, as it is not always clear what constitutes a 'novel food'. Additionally, novel foods must be cleared for human consumption by the European Commission's Novel Food Regulation, which presents a regulatory barrier for new products entering the market.

Increasing policy makers' knowledge to handle new products based on side streams categorised as novel foods, would be crucial for the industry to progress.

Direction of search

Establish effective collaboration between regulatory bodies and industry players to navigate challenges posed by regulatory requirements: In Denmark's fishing industry, effective collaboration between regulatory bodies and industry players plays a part in developing and scaling by-products. There is a need for actors to collectively navigate regulatory requirements and market demands to foster innovation and sustainability in the sector. However, the industry faces challenges in initiating collaboration around the use of side streams, as businesses are often reluctant to share information due to competitive concerns. Overcoming this lack of a collaborative culture is key to creating shared perspectives and visions for value chain development. Engaging industry actors in collaboration around the use of side-streams would enhance common opportunities within the region and the industry's direction of search. Continuous dialogue and adaptive strategies are needed for the long-term success of by-product utilisation.

Engage industry actors in collaboration around the use of side-streams: Formal arenas for dialogue and collaboration, especially regarding by-products, are influenced by regulatory bodies like the Danish Veterinary and Food Administration (DVFA). The industry notes a gap in inspectors' expertise in managing side streams, leading the DVFA to encourage early engagement with their ingredients team and inspectors during pilot production. This proactive approach can facilitate a smoother approval process and ensure compliance with new products. Establishing such effective collaboration between regulatory bodies and industry players to navigate challenges posed by regulatory requirements in general.

Legitimacy creation

Create a regulatory guide to enable SMEs to meet legal requirements, and to highlight regulatory barriers to new innovations: Denmark, as a member of the EU, must comply with the rules set out in the Common Fisheries Policy (CFP). These regulations ensure product quality and safety but also add complexity for businesses, especially in handling and marketing by-products.

The regulatory frameworks in Denmark, along with EU-level regulations, can act as both drivers and barriers for the market formation of fish processing by-products. Businesses are encouraged to innovate and find new uses for these by-products within the constraints of existing regulations. Smaller SMEs and start-ups, with less specialised and limited staff, often find it demanding and time-consuming to meet the requirements of the DVFA inspectors. They seek a more manageable and supportive approach to inspections. With these regulations, it might be pertinent to create a "regulatory guide" to

enable SMEs to meet legal requirements and to highlight regulatory barriers to new innovations.

Map business practices to understand shifting customer values: Policies and regulations significantly influence the market demand for fish processing by-products in Denmark. For example, businesses in Denmark must pay fees to dispose of wastewater from processing side streams to minimise the environmental impact of the fishing industry. These financial implications can act as a deterrent and an impetus for innovation and novel uses of by-products. Moreover, Danish companies cannot get approval for production for both human and animal consumption at the same location, and key customers are also increasingly interested in how firms in the fishing industry manage their side streams. Here it would be beneficial to start mapping practices to understand the shifting customer values and priorities.

Resource mobilisation

Investments in infrastructure to process side-streams, such as large-scale facilities for processing side-streams to higher value products: In Denmark, increasing costs for energy and for importing fish have prompted more actors to explore the use of side streams to boost their profits. Investments in infrastructure processing side-streams, such as large-scale facilities for processing side-streams to higher value products would be highly effective.

Initiate joint efforts to attract workers to the industry: While interest in using side streams is on the rise, Denmark has encountered challenges related to the infrastructure for processing these side-streams. For example, Denmark lacks large-scale facilities for converting side streams into higher-value products. Another significant challenge affecting Denmark is the shortage of, and competition for, a skilled labour force. This shortage spans the whole fishing industry, including workers on boats and in processing facilities, as well as qualified labour for maintenance roles such as electricians. The growing life-science industry presents a significant challenge in Denmark in particular. There is therefore a need to initiate join efforts to attract workers to the fishing industry across the region and the country.

Market formation

Explore novel markets further afield, such as Asia: There is significant potential for market formation of side streams in Denmark. One barrier to further market development in Denmark is the cost of processing side streams. Although side streams are generally inexpensive, extensive processing steps, such as freezing or labour-intensive processes like scraping meat from carcasses, make it difficult for businesses to achieve profitability. Additionally, assessing markets for new side-stream products is challenging as globalisation recedes and protectionist policies re-emerge, complicating the export of

side streams and products. Denmark lost one of its biggest markets for fishing industry by-products when the mink industry was nearly terminated during the COVID-19 pandemic, due to fears that COVID-19 mutations could be transmitted from minks to humans, and the entire farmed mink population in 2020 was culled. Previously, much of the fish side-streams were used as mink feed, but these by-products are now being exported. Here, exploring new markets further afield, such as Asia, would perhaps make room for new products.

Consumer behaviour also plays a crucial role in the market formation around fish by-products, as acceptance of new items can be challenging due to entrenched consumer habits. New products must compete with existing ones, requiring efforts to nudge consumers into new purchasing behaviours or effectively communicate the benefits of these new products.

Explore cost-sharing, and new forms of business and public sector collaborations, to bring down the expense of valorising side-streams: Products from side streams need to achieve price parity with existing choices, as price is a strong driver of consumer decisions[14]. Part of this comes from the expense of valorising side-streams, which means that exploring cost-sharing and new forms of PPPs and collaboration could help the industry.

Entrepreneurial experimentation

Create spaces for start-ups and smaller businesses to share experiences and experiment: Low level of innovation presents a challenge in the region, and it is due to several factors, including a lack of experience among businesses in developing new solutions and few smaller, innovative companies driving industry development. There is also a lack of knowledge on how to use side streams in new ways and the practical know-how to valorise these streams. While side streams are seen as valuable resources by industry actors, they often lack the knowledge to utilise and valorise them for higher returns. Few are willing to be first movers due to the associated risks, preferring to follow once a competitor has demonstrated success. Creating spaces for start-ups and smaller businesses to share experiences and experiments could be an advantage for the region and the country at large.

Incentivise first mover advantage to get businesses to take risks and lead the development of the value-chain: Regulation is another barrier to entrepreneurial experimentation with side streams in Denmark. Some products based on side streams are classified as novel foods, and EU and Danish regulations surrounding novel foods deter companies from investing in products that may not receive approval for human consumption. Early involvement of the DVFA in production processes for guidance could provide clear answers and spur more innovation.

4.2.1 Stakeholder workshop

A stakeholder workshop was held in Aalborg, Denmark on the 22nd of May 2024. The workshop gathered 11 regional stakeholders, divided into three groups elaborating on one of the three highest-ranked governance recommendations presented above (for the full workshop methodology and process, see section 3.1).

In the first part of the workshop, participants ranked 12 suggested governance recommendations. As this was the first workshop, governance recommendations were, for convenience, re-written into plain English (i.e., simplified). The translation of the governance recommendations into plain English was made by ChatGPT and adjusted by the researcher. Reflecting on this, the governance recommendations' simplifications were perhaps unnecessary. Sometimes, the simplified versions communicated less information about the recommendation than the original or were more specific. For example, the recommendation '*Initiate knowledge development in the use of side-streams through educational efforts aimed at innovation*' was simplified into '*Teach people about using side-streams creatively to find new ideas*', which led participants to ask about who the word 'people' refers to. Although such discussions are good for creating a shared understanding of the task at hand, the time can just as well be spent discussing more complex concepts. Therefore, governance recommendations were not written in plain English in the subsequent workshops.

The three highest prioritized governance recommendations by stakeholders in the workshop were:

- Make sure that government rules and businesses work well together to handle the challenges of following regulations.
- Get businesses to work together on using side-streams in their products.
- Study how businesses change to match what customers want.

Converting this back to the original governance recommendations it indicates that 'establishing effective collaboration between regulatory bodies and industry players to navigate challenges posed by regulatory requirements', 'engage industry actors in collaboration around the use of side-streams' and 'map business practices to understand shifting customer values' are the most important governance recommendations according to the workshop participants. Accordingly, to increase the potential of valorisation of marine by-products in Denmark, there needs to be a focus on supporting innovation functionality related to the 'direction of search' and 'legitimacy creation'.

4.2.2 Vision for Denmark/West Jutland

Each of the three groups (par. 4.2.1) was tasked with creating a brief vision for the region, describing a future by 2035 where the selected governance recommendation is implemented, and identified barriers are overcome.

For the analysis, the researchers combined the results from the three groups to generate an overarching vision for the region:

> *"In 2035 the fishing industry in the region has grown, with more businesses, more jobs, and a greater economic distribution of the value created from the industry. This has been driven by a faster start-up process for new ventures, helping to increase the pace of innovation in the region. The knowledge level has further improved, helping to stimulate new ideas on the valorisation of side streams, where raw materials are now fully utilised for food, and there is a demand for products originating from side streams throughout the value chain."*

4.2.3 Development of recommendations

Establishing effective collaboration between regulatory bodies and industry players to navigate challenges posed by regulatory requirements

One of the prioritized recommendations for the Danish pilot region involves making sure that government rules and businesses work well together to handle the challenges of following regulations. By creating collaborative practices around navigating industry regulations, there is an opportunity to find new pathways where value creation and innovation can help the industry around side-streams grow. Current barriers to this recommendation identified in the workshop include the pace and inflexibility of current regulations. The process of obtaining permits for new ventures takes too much time and makes the operating environment for business more uncertain as it prevents more long-term planning. Guidance from the appropriate government agencies, such as the Danish Food and Veterinary Agency, is also lacking. Furthermore, there is an experienced lack of shared understanding among actors in the region due to few examples of innovation that demonstrate how side-streams can be valorised.

There are, however, positive indicators in the industry to build on, including the shared understanding that change is necessary and a development mindset in both the public and private sectors – meaning that the change lies in establishing new forms of collaboration.

A set of actions for the implementation of this recommendation were discussed during the workshop. The four main points of actions identified were: setting up calls to highlight new businesses' needs for guidance in relation to existing regulations; the formation of expert groups to provide guidance and transparency in regulatory matters; provide an

overview of the regulations for different by-products that is more readable and accessible to industry actors; and finally to shorten approval processes for new ventures to enable greater access to the market and lower barriers for entry.

Engage industry actors in collaboration around the use of side-streams

The second prioritized recommendation involves incentivising businesses to work together on using side-streams in their products. Cooperation needs to be facilitated through both push and pull approaches, where industry actors are both pushed to collaborate through, for example, regulations punishing the waste of side-streams; and pulled through incentives making collaborative efforts pay off financially. Industry collaborations are currently hampered by long distances between actors in the industry, making joint ventures more challenging, as well as businesses generally being sceptical of collaborations due to wanting to keep business secrets.

Drivers for change in the area include the current momentum in the use of side-streams and by-products in the fishing industry; current volumes of side-streams and by-products that could be used for further valorising; and environmental laws and regulation pushing for change in the industry.

Actions needed to invoke change and enact the recommendation involve developing more specific regulations that will further incentivise industry actors to collaborate around shared solutions; the development of new business models, which could also involve aspects of shared value creation across the value chain and working with government agencies to implement policies supporting new forms of value creation; and to work with technology development.

Map business practices to understand shifting customer values

The final prioritised recommendation for the Danish pilot region involves working with businesses, studying their value propositions and practices around side-streams, and matching those with customer demands. This recommendation involves mapping out and creating transparency throughout the value chain, making it easier to communicate business practices to customers. This is currently difficult to implement due to the onus being put on customers and consumers to see through the environmental footprints, which is not an easy task. While there is some shift in customer values in that some supermarkets and purchasers are looking for more sustainable products, the volumes of demand needed for large scale utilisation of side streams are, however, currently lacking.

Currently, ESG is driving change in the area by increasing the transparency in the industry, while further governance actions such as regulations are needed to push purchasers to ask for more products made from side-streams – thus increasing the market demand signal needed for the scale up of production earlier in the value chain.

Actions towards this end include implementing legislation that is fit for purpose along with faster permit processes to promote innovation in the fishing industry, allowing businesses to respond faster to customer demands and create markets for new products. This could also involve creating a producer responsibility for utilising the entire raw material to the best advantage, which would take some pressure off the customer to know what a sustainable product is. Finally, similar to the recommendations above, the recommendation can be helped by increased cooperation between policy actors and responsible authorities to avoid barriers to innovation.

4.3 Greenland

For the case in Greenland, eight different governance recommendations were generated based on the results of the current governance structure. The recommendations are listed below together with the reasoning behind each one.

Knowledge Development

Encourage collaboration before going to market: The analysis of the current governance structure in Greenland found that there is a lack of collaborative efforts in the industry, and that it is difficult to engage actors in projects on shared knowledge and value creation. The main reason for this is that many organizations worry about giving up sensitive information relating to their business that provides a competitive advantage. Seeing as the fishing industry is very competitive there is an overall lack of collaborative culture. For the industry to move forward and make use of side-streams this barrier must be overcome.

The recommendation is to create spaces where businesses in the same industry can work together on new ideas and solutions before selling them. By gathering actors to collaborate in a pre-competitive space it would be possible to overcome the hesitancy to share business critical information and instead work together to find solutions earlier in the R&D process.

Enhance policy makers' knowledge about new products: When finding new ways to utilize side-streams it is possible that the end-product can be categorized as novel food, as similar products might not have been available on the market before. Products that become labelled as novel foods present barriers to producers for two main reasons. First, it is not always clear to either producers or regulators what should be categorized as novel foods. Second, when something is categorized as a novel food product it must be cleared for human consumption by the European Commission's Novel Food regulation. As a result, regulatory processes can be lengthy before a product is cleared and allowed to enter the market. This provides a significant barrier, as it requires organizations to have the financial means to wait for regulatory approval or that there is an established market for the product, making it worth the wait. For smaller enterprises and start-ups, neither of these tend to be the case.

To overcome this barrier, it is recommended that government officials receive guidance on how to handle new products made from side-streams categorized as novel foods. This can be through educational initiatives or simplified regulatory processes for dealing with novel foods, or both.

Direction of Search

Improve communication between regulators and businesses: For the fishing industry to improve its use of side-streams, it is necessary for actors across the business ecosystem, from regulatory bodies to industry players, to have shared ideas and visions for the direction of the industry. To scale the development of products from side-streams, businesses must navigate both regulatory and market demands. Having a collective vision for the industry can allow for better synergies between actors. However, this type of shared vision and knowledge is currently missing in Greenland.

The recommendation suggests making sure that government agencies and businesses in the fishing industry can work together well to deal with challenges from rules and regulations. New initiatives should be started where stakeholders can meet, share perspectives, and start building together the future of the industry.

Legitimacy Creation

Show new ideas in action: The fishing industry in Greenland is currently suffering from low levels of innovation. This is primarily driven by a lack of knowledge on how to valorise side-streams in practice, a lack of experience in developing new products, and a lack of smaller companies and start-ups to challenge current incumbents. The focus for most companies in the region is to increase yields rather than finding new ways of utilizing their resources to create new value streams.

To combat the lack of practical know-how and experience, as well as inspiring potential entrepreneurs, demonstrators and testbeds could be organised to show off new practices and new innovations. Highlighting successful implementations of new solutions gives organizations a clearer view of how things can be done and increases the chances that innovations are applied in more places.

Entrepreneurial Experimentation

Reward being the first to try something new: Being a first mover in an industry is often seen as an advantage, providing competitive edge in a crowded market. However, the opposite can also be true, which is the case in Greenland. Greenlandic companies have a first-mover disadvantage. Few actors are willing to take the first step and be the drivers of change as it means taking higher risks than many actors are willing to do, as it could result in a competitive disadvantage. Instead, many businesses tend to follow the pioneer, resulting in a slower innovation process.

Here, the governance system must encourage businesses to take risks and lead the way in developing new products and ways of doing things. New incentives can be introduced to boost first-movers, for example through specific grants for innovative new production technologies and processes, product development, market formation and so on.

Market formation

Make rules easier for small businesses: Current regulations can act as a barrier for innovation in the valorisation of side-streams, particularly for small businesses that do not have the finances, staff, or regulatory know-how to navigate the regulatory landscape. This can hamper start-ups as it drains their time and resources.

To improve the situation and create an overall more welcoming situation for small enterprises, regulatory processes must become more manageable and agile. One solution is to create a guide to help small businesses follow the law and understand what might stop them from entering new markets. Alternatively, it is an idea to institute guided help from government agencies that can both simplify and speed up regulatory processes for SMEs.

Share costs and work together: The cost of processing side-streams can be prohibitive for innovation to take place in the fishing industry. While side-streams themselves tend to be cheap, the steps to process them (e.g. freezing or scraping meat from bones) add costs that make it difficult for individual businesses to make a profit from them.

It is important to note that few organizations can solve the issues connected to valorising side-streams alone. Instead, there is a need to explore ways for businesses and government groups to work together and share costs, making it cheaper to use side-streams. This includes the development of new business models, new forms of government financing, and supporting the sharing of costs, risks, and investments in the industry.

Resource Mobilisation

Encourage people to join the industry: One of the scarcer resources in the industry in Greenland is the number of employees available for work. There is both a shortage of workers in general, as well as competition between companies and industries for the ones that are available. For the fishing industry there is a lack of people to work both on boats and in processing facilities, and workers with more specialized skillsets such as electricians to work on the maintenance of facilities. The development of side-stream operations in Greenland is hindered by a shortage of workers, making it difficult for businesses to process both filets and side-streams. As companies must prioritize their limited resources, expanding the side-stream sector could end up competing with the primary business.

The recommendation here is for both the public and private sectors to give people reasons to enter and stay in the industry. This could be achieved by providing them with opportunities for upskilling and development over time thorough initiatives such as government supported apprenticeships aimed at young people. Alternatively, through similar sector-based work academies used in the UK to support people gain new skills and enter new industries[15]. A further need is for affordable housing to be constructed, as

a lack of housing is preventing people in the region from moving to areas where there is a need of workers (i.e. Nuuk) and potentially prevents people from joining an industry that will not provide sufficiently high salaries to afford somewhere to live.

4.3.1 Stakeholder workshop

A workshop was held in Nuuk, Greenland on the 18th of June 2024, gathering a total of 19 regional stakeholders. The aim was to verify and further develop a selection of the governance recommendations presented in the section above. Participants were divided into three collaborative discussion groups. The workshop followed the methodology outlined under section 2.1.

In the workshop, three recommendations were prioritized by the participants for further development:

- Show new ideas in action
- Make rules easier for small businesses
- Share costs and work together

The three groups selected one recommendation each to work with on the canvas (Figure 1). The recommendations were drawn from the dimensions knowledge development, legitimacy creation, and market formation, indicating that these areas are important for development to increase the valorisation of sea food by-products in Greenland.

4.3.2 Vision for Greenland

During the development of the recommendations, the groups were tasked with creating a vision for the region. The vision was to reflect the stakeholders' desirable future for Greenland's blue bioeconomy in 2035. Each group discussed and wrote down aspects of their vision for the region in relation to the governance recommendation they were working with. The three visions have been combined here to form an overall vision for the valorisation of side-streams in Greenland.

> *"In 2035 there are small businesses all over Greenland, where there is a good enough economy to support businesses and people in the settlements. Greenland has achieved greater self-sufficiency, is closer to a 100% circular economy, and is enabled by an innovative culture where businesses are not afraid to make the first move."*

4.3.3 Development of recommendations

Show new ideas in action

One of the three recommendations to be prioritized for further development was to show new ideas in action. The core of this recommendation is to set up demonstrators to show how new practices and solutions have been implemented to give actors in the region a realistic view of change.

Participants identified two main barriers as to why this recommendation is currently not in place. First was the education level required to execute ideas, which needs to be increased, and second was a general lack of actors and support for new actors in the industry. Drivers for change in the area included the potential seen in tourism and gastronomy where existing success stories can be highlighted.

The connection to the fishing industry would be twofold. The first is to put a greater value on traditional culture, primarily in the educational sector as a way to incorporate traditional knowledge into schools. This would serve to bring practical knowledge into education, and provide children and adolescents with positive images of how indigenous knowledge can be used in current settings. For this to happen both municipalities and the educational sector need to be involved to develop material and curriculums that are fit for purpose. Others have written in more detail on the educational system in Greenland, and possible improvements, such as conducting more of the education in Greenlandic rather than Danish to improve school attendance for older children[16,17.] The connection to the fishing industry would be twofold. One is to increase the overall educational level in Greenland and thus enhance chances of people moving to higher education and improving the overall knowledge level in the industry that would allow for more new ideas being developed and demonstrated. The other is to improve the knowledge among Greenlandic students of traditional methods for fishing, cooking, and food preservation – enabling them to use and build on this knowledge to contribute towards a sustainable fishing industry.

While being more of a long-term strategy, developing the educational sector in Greenland could have effects on the fishing industry and the revitalization of local economies in the long run.

The second action identified was the collection and sharing of knowledge. One possibility mentioned is to work closely with the tourism and gastronomy industries. Restaurants and chefs can be drivers of change and contribute to changing norms around food. This has been evident in movements such as New Nordic Food or the Italian Slow Food movement that both emphasise the use of traditional ingredients and recipes. At the moment there is momentum surrounding the Greenlandic kitchen that can be used to the advantage in the fishing industry. The Greenlandic chef Innunguaq Hegelund is involved in the New Arctic Kitchen, aiming to promote food from arctic regions cooked with traditional ingredients and methods – a movement that has been featured in international media[18]. Additionally, the Faroese Michelin starred restaurant Koks has temporarily relocated to Greenland while renovating their space in the Faroe Island[19], while the Arctic Young Chef tournament aims to promote young talented chefs in arctic regions using underutilized ingredients[20]. Further development could be envisaged through closer collaboration between chefs, the tourism industry (including Visit

Greenland), and the fishing sector – facilitated by government agencies such as Ministry of Fisheries, Hunting, and Agriculture, the Ministry of Business and Trade, as well as the Greenlandic Fisheries Council to promote the use of side-streams in the Greenlandic kitchen. The key to this action is to not only talk about success stories, but to create platforms to share knowledge and experience from those who have succeeded to replicate results.

Make rules easier for small businesses

The second recommendation stems from the fact that small businesses face difficulties in finding a footing on Greenland due to infrastructure and regulatory challenges. Stakeholders perceive a lack in current legislation to support small businesses, and rather than just being told "no" that a business idea does not work, it would be much more productive to be guided through the regulatory process to gain a better understanding of the legislative landscape and the possibilities that exist within it.

Two lines of actions were identified that would move the recommendation towards implementation. One of these is to provide governmental guidance to small businesses, both through the development of a guidebook contributing to knowledge development but also through the establishment of one-stop-shops, one-door policies, or similar. These types of initiatives are emerging across Europe, where the core function is that businesses needing regulatory guidance related to innovative products or processes will only need one point of contact with government agencies, which then guides them through the regulatory process across different domains. This simplifies the process of understanding the hard and soft regulatory boundaries for innovations, particularly for smaller businesses with less resources, and provides government agencies with input into emerging regulatory issues where policies and legislations might have to be revised. There are examples where this has been implemented to draw inspiration from. First, Greenland's mineral strategy from 2020 to 2024[21] mentions how a one-door approach to licensing for mineral extraction should be maintained. Like the fishing industry, the mineral industry must go through multiple government bodies for mineral license applications. This should mean that there is experience in Greenland on how to set up a similar solution for the fishing industry to simplify regulatory guidance for both incumbents and new market entrants on how to valorise side streams. Further details on the one-stop shop concept, and the adjacent regulatory sandboxes, can be found under the conclusions in section 5.1.

The second action is for local, regional, and national governments to improve access to facilities for start-ups, both industrial spaces such as offices and processing facilities, and housing. With facilities being scarce, particularly in Nuuk, this drives competition for available real estate which drives up the costs for new entrants in the market and effectively inhibits new innovative companies. Addressing the lack of industrial real estate and housing could enable a more diverse business landscape, with smaller actors

challenging current norms in the use of side-streams and enabling new forms of collaborations with incumbents – both of which could spur change in the sector.

Share costs and work together across value chains

The third, and final, recommendation discussed in the workshop involves mitigating the first mover disadvantage in the industry and provide actors with the means to share costs, risks, and value across the supply chain. The first mover disadvantage refers to the challenges that occurs when a company's early market entry leads to higher risks, costs, and the possibility of competitors following and copying innovations from first movers. In the fishing industry, there are significant costs in investing in new infrastructure or product development, leading most big actors to becoming followers, waiting for someone else to take the first step and then join once an innovation has had some success. The issue being that the overall innovation in the industry will suffer and prohibit desirable change from taking place. The problem is further complicated by a lack of collaboration in the sector, and that many issues are too big for single organisations to solve, such as investments in new infrastructure, vocational training schemes, or market demands.

There are two main areas of action that are part of this recommendation. One is to explore and implement new funding schemes and ways to finance innovation where the financial pressure of being the first mover is mitigated. There are several examples of funding schemes being implemented on supranational and national levels to support business development and innovation across industries. Such examples include credit guarantee schemes and investment schemes. Credit guarantee schemes (CGS) are financial mechanisms that help SMEs access loans by reducing lender risk through guarantees that cover a significant portion of the loan if the SME defaults[22]. CGSs can, for example, be accessed through the European Maritime, Fisheries, and Aquaculture fund[23], which Greenland has access to despite not being an EU member state through partnership agreements with the EU. Investment schemes can include venture capital, a type of financing of early-stage businesses deemed to have high risk but high reward. Across Europe there exist a few venture capital initiatives aimed at encouraging investments in SMEs, such as the United Kingdom's Venture Capital Trusts where investors gain tax benefits on investments made in start-ups[24]; or France's FCPI (Innovation Mutual Funds) where there is similarly an income tax deduction and capital gains tax exemption to attract investments in specific sectors[25]. While there is venture capital funding in Greenland, greater policy support for investors could provide more financing that would encourage actors to become first movers. Further financing mechanisms that could be applicable to Greenland are described under section 5.1.2.

The second area is linked to new ways of working and collaborating among actors, both public and private, in the industry. Here, regional authorities can support the formation of collaborative efforts through funding, dedicated spaces, and support on policy and regulatory issues to enable businesses to work together. One approach with the potential

of helping actors in Greenland to mitigate first mover disadvantages is to work with networked business models[26], and establish industry-wide agreements, and to find common interests and possibilities for cost and revenue sharing across actors in the industry. For this to happen, a shared dialogue between actors in Greenland must happen, ideally with a neutral party hosting and facilitating to instil trust in the process. This function could be taken by a research organisation, such as the University of Greenland if funding can be obtained, or representatives from the Fisheries Council that counts industry interests, fishermen and hunters, Government Ministries, Association of Municipalities, Employee's Union, Employer's Association, the Nature Protection Association, etc, among its members. Sharing costs, risks, and revenues for the development of the entirety of the fishing industry in Greenland should be in all members' interests.

4.4 Estonia

In the Estonian pilot region, six governance recommendations were generated based on the results of the initial governance analysis.

Direction of search

Align governance landscape: The governance landscape of the blue bioeconomy is fragmented in Estonia on governmental (national, regional, and local), research, and industry levels. On a governmental level, there is both a gap between agencies, and between the national and local levels. On the national level, the main responsibility to manage aquaculture and fisheries falls under two different ministries, the Estonian Ministry of Regional Affairs and Agriculture and the Estonian Ministry of Climate, with further seven ministries and agencies in their governance area involved in regulating the blue economy and maritime topics to various extent. This results in government silos where each ministry focuses on its own area, without anyone being responsible for the overarching vision. There is a similar fragmentation of blue bioeconomy topics between universities, leading to an absence of coordination and activities across institutions.

Initiating dedicated forums for dialogue could enhance collaboration, align the objectives and spur horizontal collaboration between national, regional and local governments. Connecting researchers and industry actors to create a more holistic governance process is crucial. Clearer long-term strategies for the blue bioeconomy should be developed to align governance objectives/processes and it is necessary to establish shared narratives for the industry. Such strategies could focus on sustainable practices, regulation, market expansion, educational and research funding policies, and planning and infrastructural development.

Legitimacy creation

Simplify regulatory processes: Current legislation regulating the use of marine resources in Estonia has been identified as a bottleneck for industry development. It is argued that it leads to legal and operational uncertainties for many organizations. Planning processes are often slow, placing entrepreneurs in a difficult position where they might have long periods of uncertainty before knowing whether they can continue with their business plans. An additional challenge is that the planning process and requirements do not sufficiently differentiate between different types of projects as similar requirements are applied to small-scale aquaculture pilot projects as to large-scale marine projects.

The solution to this barrier can be two-fold. One step is to streamline regulatory processes, develop a more nuanced approach that differentiates between different types of aquaculture projects, and speed up planning and licensing processes to give businesses greater operational certainty. The second step is to establish one-door

policies or a similar concept (see sections 4.3.3 and 5.1), where businesses can get in touch with government ministries with a question or regulatory problem and be assigned one contact point to guide them through the process. This would further allow for greater collaboration between government ministries, as all relevant policies and regulations would have to be pooled to provide input back to the business organization. Moreover, it gives the government instant input to regulatory hurdles that enterprises are facing.

Communicate benefits of the blue bioeconomy: For the blue bioeconomy to grow in the Saaremaa region, it is important to get community buy-in to an expansion of the industry. There is currently a worry among some industry actors about the growing opposition to offshore windfarms among the general public. Along with the perception of the Baltic Sea as an area for leisure rather than businesses, it could hamper the future development of other maritime projects, such as building facilities for macroalgae cultivation, mussel and fish farming at sea.

To address challenges related to public acceptance, communication of the potential for sustainable economic activities in the blue bioeconomy is necessary. Public and private actors should work together on strategic communication and community engagement to build societal acceptance. They could further initiate citizen assemblies to create a united vision for the industry and region together with the wider local community to create greater ownership of a common vision for the region. Another opportunity that was mentioned was the exploration of investment models and requirements that include additional investment into local communities and/or financing of local social projects, with the aim of ensuring that the community benefits directly from the project.

Resource mobilization

Investments in research and innovation: The Saaremaa region needs mobilization in the regional innovation support structures for improving funding for commercialisation and scaling of innovative solutions. Furthermore, there is a funding gap for research, which stands in the way of developing new technologies for the valorisation of macroalgae, and in particular for industrial scaling. The industry surrounding macroalgae can still be considered as an emerging, capital-intensive industry, which adds to the complexity of the challenges. This makes it difficult to develop infrastructure and attract investments that would allow for costs to come down in the future.

New funding schemes should be introduced. These should be aimed at both the earlier stages of research and development, potentially with a focus on research-industry collaborations, as well as on the implementation and scaling of new solutions. The barriers highlighted above could further be ameliorated by incentivizing innovators that are taking risks through financial incentives or public acknowledgements. Additionally, structures could be developed for public servants to become more engaged in supporting new initiatives in the region. This could include guidance for actors to find the right type

of funding and provide support on legislation and policies. This may in turn lead to the identification of barriers to innovations and find opportunities to lobby for policy interventions to create supportive environments for entrepreneurs.

Development of skills and labour force: Access to a skilled workforce is a challenge for the industry in Saaremaa. Due to the region's low population density, it is difficult to find the right competences to expand the blue bioeconomy. As the enterprises in the industry are micro- or small enterprises, their ability to invest in R&D is very limited. Currently, the region relies on cross-border grants, e.g. Interreg, and participation in international projects, e.g. Horizon Europe, to mobilize sufficient knowledge resources. There is, furthermore, a concentration of expertise in Estonia around the capital/larger cities, with only a few R&D actors capable of providing the expertise needed to support technology and product development.

To tackle the shortage of skilled labour, the government, universities, and industry actors need to highlight opportunities in the region and the industry. PPPs can be formed to establish training, such as apprenticeships in the industry and industrial doctorates, and communicate the need for skilled workers in the region. This would require collaboration between government ministries, such as the Ministry of Education and Research and the Estonian Ministry of Regional Affairs and Agriculture to identify the industry's needs and shape a new educational agenda focused on skilling the future labour force for a vibrant blue bioeconomy in Estonia.

Market formation

Stimulate market growth through investments and policy: The market formation for macroalgae products in Estonia is hampered by two main factors: costs of production and scaling, and regulations. New products made from macroalgae are currently not cost-efficient, while it is also difficult to secure significant investment capital for infrastructure development, large-scale pilot testing, and macroalgae cultivation technologies.

The recommendation is to offer financial incentives or subsidies to companies embracing sustainable practices within the blue economy, or to use other financial mechanisms to drive market expansion and help establish new industry standards.

4.4.1 Stakeholder workshop

The discussion of governance topics was split between the different workshops conducted in Saaremaa. The BlueRev and BlueBioClusters project held workshops on February 3rd, 2023, and July 6th, 2023, where they discussed the vision for the blue bioeconomy in Saaremaa with local stakeholders.

A digital workshop for the governance recommendations was hosted in Estonia on the 4th of November in 2024, with a total of 32 participants in attendance physically and digitally. The workshop was run as a hybrid event to allow for a broader set of stakeholders to attend. The physical part of the workshop took place in Saaremaa in Kuressaare College, with two representatives for the Estonian pilot region hosting the event and facilitating discussions in the room. The researchers and authors of this report led the workshop and preceding presentation of the governance recommendations via Zoom and facilitated a discussion of attendees digitally using a Mural board to display the canvas in Figure 1, and to collect insights from participants.

The key result from the workshop was the prioritization of the governance recommendations, where participants noticed similarities in some recommendations and suggested that some were merged to give the following list of prioritized governance recommendations to support innovation in the blue bioresource based industry in Estonia:

- Align the governance landscape and simplify regulatory processes
- Development of skills and labour force
- Stimulate market growth through investments in research and innovation

A more in-depth explanation, and development of each recommendation is presented below.

4.4.2 Vision for Saaremaa/Estonia

The vision for Saaremaa has been developed as part of the Saaremaa region development strategy for 2022- 2035 and has been condensed for brevity here.

> *"By 2035, the Baltic Sea's environmental condition has improved with reduced phosphorus and nitrogen levels. Saaremaa skilfully extracts excess nutrients from the sea, using marine raw materials to create value chains that support both economic growth and environmental protection. Research and development are centred in Saaremaa with the establishment of a blue biocluster and cooperative networks. A pilot site for algae, shellfish, and fish farming is operational. Public awareness is high, with new marine-based products being well received and introduced in local schools. Special financing supports water-based innovations and offshore projects."*

The two workshops held in 2023 discussed various challenges and activities related to this vision for 2035 and, for clarity, shortened it to an operational statement: "*A sustainable, high-value-added blue bioeconomy benefitting communities.*"

4.4.3 Development of recommendations

Align the governance landscape and simplify regulatory processes

This recommendation is a combination of two perspectives: gather government agencies working with the blue bioeconomy in some respect, and ensure that regulatory processes are made easier for businesses in the industry or those entering the market – e.g. when it comes to applying for permits. Currently, government institutions are limited in that, as they are only responsible for a small section of the blue bioeconomy, and are wary of taking responsibility for making decisions that they perceive are outside their jurisdiction.

Part of the solution could be that one government agency adopts responsibility for handling matters related to the blue bioeconomy. While it might be difficult to revise the structure of responsibilities between government agencies, as some aspects of the blue bioeconomy will naturally fall between different agencies, instead there is the opportunity to follow a similar structure to the one-stop or one-door policies described under section 4.3.3. For this to be implemented, it would be necessary to make a more in-depth mapping of the government agencies, their responsibilities, and subsequently gather them in the same room to have them discuss how responsibilities should be shared and who is accountable for what.

Develop skills and labour force in the blue bio-based industry

With a lack of skilled workers in the industry, there is a need to increase the labour force and upskill those already employed in the industry. Part of the solution to attract more people to the industry lies in communicating the benefits of the blue bioeconomy to the region, giving a more favourable perception of the development of new facilities and, in turn, attracting more people to the sector. In Saaremaa there has been local opposition to the establishment of offshore windfarms due to concerns for the environmental impact. However, building windfarms can be combined with blue bioeconomy projects to provide benefits to the local community in the form of new job opportunities. A study has shown that multi-use windfarms can combine the sustainable production of energy with, for example, sugar kelp aquaculture for human consumption, animal feed, or as input in pharmaceutical products[27].

This must be supported through more long-term funding of the local Kuressaare college, though it is currently resource expensive with only a small number of students. The two very significant steps towards addressing the labour force and skill issue have been the opening of laboratory for the blue bioresource valorisation, and the new bachelor program on sustainable technologies for blue economy 2024 in Kuressaare College in Saaremaa Island. However, building the team and setting up the necessary research laboratory have just started and been difficult, as the equipment is expensive, and the acquisition is often not economically feasible because of the smallness of the sector and its limited capacity to support it. Funding should be allocated to expand the blue bioeconomy curriculum to attract more students, and expand the program, to build the local skills to serve local industry, helped by the communicative effort explained above. Developing the labour force could then be supported by increasing the knowledge of the sector, and the benefits it can provide to the local economy, sustainable efforts, and

future job opportunities. During the workshop, a demonstration of success stories was also mentioned as an important communication measure that would build the community's acceptance and support the investment measures.

Stimulate market growth through investments in research and innovation

Currently, the main focus in macroalgae research is exploring the possibilities of using its biomass in the laboratory, conducting small-scale pilots on its farming technologies, and developing the first prototypes. Although various projects are underway, those are in the pre-commercialization stage, and product prototyping is just starting. The product performance testing, industrial scaling and market development for new macroalgae products and for other blue bioresources such as mussels has yet to start.

Costs of production, scaling, research and innovation, and investments in new facilities and infrastructure are all barriers for the development of the industry in Saaremaa, meaning that there is a need for improved funding for commercialisation and scaling of innovative solutions.

Market growth can be achieved through several mechanisms. One being the implementation of innovative procurement methods and other targeted support measures to support actors in the industry. Having a more predictable demand that procurement could allow for, would help actors plan more long-term and develop new projects and initiatives to expand their operations. This could involve Pre-Commercial Procurement (PCP), where public authorities can create demand by asking companies to create innovative solutions for a public need, and provide a proto-market for early-stage products and processes[28]. Public procurement can also play a role by specifying needs that are not currently met by current products or actors on the market, thus spurring innovation and creating a market for new solutions. Working with procurement as a solution would likely mean a collaboration between the Ministry of Finance and several agencies involved in overseeing the blue bioeconomy to create a framework for procurement that targets the nascent blue biobased industry in Saaremaa.

Additionally, market creation and growth can be achieved through improved collaboration between the universities, Kuressaare college in Saaremaa and businesses in the region. Three out of the six public universities in Estonia conduct the majority of research on the blue bioeconomy. Those are the Estonian Marine Institute at Tartu University, the Estonian University of Life Sciences, and Tallinn University of Technology, including its local college in Kuressaare. The universities, the local college, and local industry have limited overview on what others are working on. Increased cooperation can help to raise awareness of the potential in the blue bioeconomy by spreading knowledge through a wider network of actors. Currently universities work on projects related to blue bioeconomy, however, the level of involvement of industry differs. Often no, or few, entrepreneurs are involved and, as a result, do not develop sufficient knowledge of new production processes in the industry. Involving local actors will allow

for more knowledge to flow between universities and entrepreneurs, and entrepreneurs can provide learnings from practice to further develop more technical aspects of innovation in the blue bioeconomy. Further collaboration between the three universities in Estonia and Kuressaare College should also be encouraged to utilise all skills and knowledge available for the development of the blue biobased sectors. The Estonian research community is small, with only a few researchers specializing in the field and capable of providing know-how and technical support for the enterprises. Local industry and universities are investigating ways to collaborate, including through industrial doctorates and building the applied research capacity at Kuressaare College.

During the workshop in Saaremaa, it was suggested that the universities could create a model for the development and testing of new solutions, basing it in Saaremaa to highlight both the sector's and the region's potential. This could be supported by funding mechanisms that require collaboration as a condition for a project to be accepted and financed, as it has been shown that researchers receiving funding together are also more likely to publish together – a measure of collaborative effort[29,30]. Thus, the Estonian government could stimulate innovation in the region by making collaboration, between both universities and entrepreneurs, a condition for funding.

5 Conclusions

This report has suggested several governance recommendations, partly overlapping, for each of the four pilot regions in BlueRev: Italy, Denmark, Greenland, and Estonia. The recommendations were based on the analysis of governance structures conducted earlier in the project and detailed in the report *Analysis of governance models in the pilot regions*[31]. For each pilot region, between eight to twelve recommendations were put forward on how to improve the governance system towards the goal of developing the blue bio-based sector and revitalizing the local communities.

5.1 Common recommendations across pilot regions

After assessing the developed recommendations from the pilot regions, some shared themes emerged across the cases. The following recommendations hold for all geographical regions studied, suggesting that the similarities seen here could also be shared with the blue bio-based industry in other regions across Europe. Implementing these changes could boost innovation in the blue bioeconomy, and contribute to environmental, economic, and social benefits to coastal communities. While presented here as three separate overarching recommendations, there are overlaps between them and the recommendations should be seen as parts of a puzzle for a sustainable blue bioeconomy and revitalised local economies.

5.1.1 Simplified regulatory processes and increased policy awareness

In all of the pilot regions it was deemed that simplified regulatory processes and policy changes on national levels to fit emerging practices in the industry were important for the blue bioeconomy to scale up. Clear examples of how this could be implemented across regions, and in further parts of the EU are through regulatory sandboxes and so-called government one-stop shops.

A regulatory sandbox can be defined as an environment where entrepreneurs can test new innovations in a safe space under eased regulations and regulatory and guidance. Experiments can provide insights into whether current legislation is fit for purpose in light of innovations, or whether it poses barriers for the implementation of promising products and services, and in the long run whether legislation stifles innovation and is in need of change[32]. While this can take place on a supranational level, such as the EU, individual member states can also initiate regulatory sandboxes in the food system. An example of this being implemented is the regulatory free special zone set up by South Korea in cultivated meat to spur innovation in the food sector[33].

One-stop shops, on the other hand, provide support to businesses in navigating often complex regulations, applications for permissions, and contact with multiple government ministries to only requiring a single point of contact. The aim of these initiatives is to

streamline, for example, permit processes by reducing the administrative burden of actors in the industry through the one-stop process, though also increasing the speed at which permits can be issued by facilitating collaboration between responsible government agencies, allowing them to coordinate and arrive at a verdict faster. A number of one-stop initiatives are emerging across Europe, some directly related to the food and bioeconomy industries whose structures could be implemented in additional European regions.

On national levels, both Sweden and Norway have worked to implement one-stop solutions that incorporates all agencies involved in regulating and overseeing an industry. Already in 2005 Norway implemented their Aquaculture Act to regulate the aquaculture industry. The act specifies a single government agency, Ministry of Fisheries and Coastal Affairs, as being responsible for overseeing the industry with the Directorate of Fisheries within the ministry is responsible for coordinating licensing processes in aquaculture, as well as overseeing surveillance and regulatory compliance[34]. The Swedish "One-stop-ministry-shop" was first tested during 2023 as a means of creating increased cooperation between government agencies, and support innovation in the food industry by helping businesses navigate existing regulatory frameworks through a single point of contact. While recently launched, and with a sole focus on the food industry so far, the Swedish Agency for Economic and Regional growth has published a report outlining the guiding principles for the initiative and share initial learnings of use for other countries of regions interested in launching a similar concept[35].

On a European level, the EU has recommended member states to establish a single national entity responsible for overseeing aquaculture, while also harmonising laws regulating the industry to facilitate transparency of the legal requirements involved and reduce the time and burden of licensing procedures for new entrants. The recommendations from the European Commission further go on to advise member states to set up the aforementioned one-stop shops for licensing procedures in aquaculture, whose responsibilities would involve having a dialogue with applicants for production licenses to ensure that all the right documents are in place, and pre-screen applications and relay necessary information to the relevant authorities to help facilitate faster decision-making[36]. One-stop shops will further be implemented across EU member states through the Net-Zero Industry Act (NZIA), meant to increase competitiveness of EU industries in the net-zero technology sector. As part of the NZIA member states, according to the European Commission, will be required to set up one-stop shops with single point of contact entities to facilitate and coordinate permit granting processes[37].

To implement the one-stop shop concept states and regions need to ensure that all relevant government agencies are involved and engaged in the process. For this to happen the requirement is to have clear guidelines on roles, mandate, and the division of responsibilities[38]. There is also the need to determine at which level licensing procedures should be implemented, nationally, regionally or locally; this will shape how collaboration between different levels of governance should take place and which agencies should be involved[39].

5.1.2 Implement entrepreneurial support and new financing models

To spur innovation around side-stream in the fishing, aquaculture, and algae industries there is a need for entrepreneurial support, and new models for financing that go beyond new business models, that can sustain risk taking and help new competitors enter the market as well as motivate stakeholders to invest in new technologies and practices to scale up emerging practices. There is a growing number of financing models that are being adopted in the blue bioeconomy that could be further implemented in the studied pilot regions, and supported through governance structures. The following is a selection of financing models that are gaining traction within the blue bioeconomy.

Blue bonds

There is a precedent for the implementation of "blue bonds" to finance change in the blue bioeconomy, building on a longer history of green bonds used to finance projects aimed at creating a positive environmental impact. The bonds can help attract investors to sustainable development, and provide capital for projects wanting to achieve a sustainable impact in a specific area. The bonds can be taken out by, for example, governments to fund projects on a national level, but can also be issued by supranational organisations such as the World Bank[40]. In terms of blue bonds, focused on financing sustainable oceans, the Seychelles Blue Bond was the first one to be issued by the Seychelles government in 2018[41]. This has been followed by others in recent years, such as the Nordic-Baltic Blue Bond from the Nordic Investment Bank, The Nature Conservancy Blue Bonds for Conservation, The Fiji Blue Bond, Pacific Blue Shipping Partnership Bond, the World Bank & Credit Suisse Sustainability Bond, and the World Bank & JP Morgan Sustainability Bond. While this presents an opportunity to attract funding to an area that has lacked the necessary finance to achieve a sustainable transition, the impact and effectiveness of blue bonds have been debated. There is a risk of governments, particularly smaller states, becoming indebted due to issuing the bonds and being responsible for repaying the debt with interest to investors[42]. Should governments go down this route it is important they clearly understand the principles of the bond and establish a framework for distributing the funds[43].

Accelerators

Business accelerators have emerged somewhat recently in the entrepreneurial ecosystem. They consist of programs that provide startups with mentorship, resources, and often funding to help them grow rapidly over a short, fixed period. Accelerators typically offer access to industry experts, networking opportunities, and potential investors in exchange for equity or a small fee. While helping to grow businesses and scale up SMEs, they further help foster innovation in smaller communities through their activities[44]. One example from the blue bioeconomy is the EU-backed BlueInvest Accelerator[45], which provides a platform for innovative startups to grow and attract investment. BlueInvest aids SMEs through assistance in getting their product sufficiently ready to attract the necessary investments as well as assistance in actually attracting

the funding, and to investors to build their knowledge and capacities in the blue bioeconomy to enable a better match between the industry and investors.

National, regional, and local governments could provide similar platforms on a local level to match SMEs with funding, making the search for investments easier for up-and-coming actors and reducing the burden of finding sufficient financing to scale-up.

Impact investments

Impact investments focus on generating positive environmental and social impacts along with financial returns. Several funds have emerged to target the blue bioeconomy, supporting innovation in sustainable fisheries, aquaculture, marine biotechnology, and coastal tourism. An example is the Ocean 14 Capital Fund I[46], which is a private equity fund that focuses on investing in small and medium-sized enterprises (SMEs) that have a positive impact on the ocean and its resources.

From a governance perspective, the key is to provide incentives to promote innovation through the various funding alternatives, either by offering funding opportunities and grants or by encouraging investors with a strategy in support to the development in the blue bioeconomy, through tax schemes, blended financing models combining public and private funds, and other approaches to attract investment.

5.1.3 Improve collaborative efforts in the industry

With the knowledge that no single organisation can single handedly change the blue bioeconomy, there is a need for greater collaboration to transform the system[47]. Being a broad area, there are several ways in which collaborative efforts could be increased, and supported through governance measures, some of which are outlined here.

Collaborative councils and regional cooperation networks

To increase collaborations in the blue bioeconomy councils can be created that include representatives from across stakeholder groups — fishers, processors, environmental NGOs, researchers and more. These councils can oversee side-stream initiatives and facilitate dialogue and decision-making. By fostering networks across regions to share best practices, resources, and knowledge, stakeholders can more readily learn from each other's experiences. This type of networked governance can help spur regional innovation through the transfer of knowledge and technology between actors. However, the implementation of this type of collaboration often requires public funds, which are not necessarily easily accessible[48]. Researchers have identified further barriers and facilitators for the implementation and success of university-industry collaborations. Related to governance, barriers include a lack of mechanisms of communication and collaboration, or stringent rules set by universities or government funding schemes that hinder collaborative projects. To instead facilitate cooperation in regional networks, universities or other stakeholder groups, can organise seminars where industry representatives are invited and vice versa. Dedicated university-industry interaction

offices could further be set up to create spaces where interactions take place, and knowledge can be shared[49]. Government incentives can also contribute to the establishment of cooperative networks, including tax exemptions for industry actors participating in collaborative projects or specific funding programs to encourage collaboration[50]. Collaborations can also be incentivised through funding requirements that require actors to collaborate to receive financing[51].

For the general public to get involved and support the development of the blue bio-based sectors, which was seen as an important part in Saaremaa Estonia, stakeholder engagement forums can be established. By organizing forums for public engagement, community members could be allowed to voice their concerns, ideas, and support for initiatives related to the expansion of blue biobased businesses.

Public-private partnerships (PPPs)

A further step is to encourage collaborative initiatives such as PPPs to fund and implement projects focused on side-stream utilization. These partnerships can leverage both public resources and private innovation. PPPs bring together governments, research institutions, and private companies to co-finance large-scale innovation projects in the blue bioeconomy. These partnerships often focus on high-risk, high-reward areas such as offshore aquaculture, marine renewable energy, and blue biotechnology[52]. PPPs in sectors like marine biotechnology, offshore wind, and sustainable seafood are gaining momentum in Europe, with national governments providing seed funding and private firms leading commercialization efforts.

6 Next steps

This report has outlined several governance recommendations for the development of the blue bioeconomy across Europe, ending with three overarching recommendations that hold across the studied pilot regions and likely in other European regions facing similar challenges of increasing innovation in the use of side-streams from blue sectors.

The next step in this process is to find ways to implement one or more of the recommendations in the studied regions to achieve desired change and impact on local economies. Initiating the process of implementation, relevant stakeholders should be invited to a systemic innovation lab where wicked problems related to the recommendations can be addressed by actors involved in, and affected by, the change. The systemic innovation lab concept has been developed to meet the need to engage actors in an ecosystem to find joint solutions to complex problems, and share responsibilities for actions and achieving change. Systemic innovation labs would be fitting in the current context as the approach: *focus on addressing complex problems, take a place-based transition approach, enable coherent action by diverse actors, involve users as co-creators, support a networked governance approach and recognise government as an enabler of change*[53]. While the lab activities can look different depending on the desired outcome of a stakeholder meeting, a suitable approach for implementing new governance structures would involve gathering relevant actors to discuss how a selected recommendation could be implemented; the stakeholders in the room could identify which appropriate actors should take specific responsibilities during and after the implementation of the systemic innovation lab.

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