BlueRev

Bio-based revitalisation
of local communities

Business models analysis

Deliverable 3.6

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Table of Abbreviations and Acronyms

Abbreviation	Meaning
APRE	Agenzia per la Promozione della Ricerca Europea
DFBG	Distretto della Pesca e Crescita Blu
DMP	Data Management Plan
EMU	Estonian University of Life Sciences
ESG	Environmental, Social, Governance
FAIR	Findable Accessible Interoperable Accessible
LCA	Life Cycle Assessment
LNG	Liquefied natural gas
FBCD	Food Bio Cluster Denmark
LOBA	GLOBAZ, S.A.
NIBIO	Norsk Institutt for Biookonomi
R&D	Research and Development
RISE	Research Institutes of Sweden AB
STEM	science, technology, engineering, and mathematics
UiA	Universitetet I Agder
WP	Work Package

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1 Executive Summary

This deliverable provides a detailed analysis of the current business models within the pilot regions, with a particular focus on the core operations and byproducts of the blue bio-based sector.

Insights were gathered through structured interviews, workshops, and focus groups, building on the protocols and results outlined in D3.1 and D3.2.

The analysis is structured in two key steps:

1. **Baseline Model Analysis**: A comprehensive review of data from D3.1 and D3.2 to define the baseline model.
2. **Current Business Model Assessment Using the Business Model Canvas Framework**: Categorization of findings within the Business Model Canvas framework, offering a detailed explanation of its indicators and opportunities and challenges for sustainable business development.

This process highlights areas for improvement and serves as a foundation for assessing and developing new sustainable business models within the blue bio-based sector across the three pilot regions of the BlueRev project.

These findings form a critical input for D4.2, helping to bridge the gap between current practices and future opportunities for sustainable innovation within the blue bio-based sector. The deliverable also lays the groundwork for future activities in WP4, including workshops and interviews.

Initial findings from D3.2 emphasize the need for more granular data to explore untapped potential in the blue bio-based sector. This need will be addressed through participatory sessions planned under WP4, ensuring an inclusive approach to identifying, refining, and scaling sustainable business innovations.

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2 Introduction

The objective of Deliverable D3.6 is twofold:

1. To map current business models using the business model canvas framework.
2. To identify business opportunities in the pilot regions based on the initial mapping.

This deliverable builds upon the findings from D3.2, which provided a contextual overview of each pilot region—Denmark, Greenland, Italy, and Estonia—and offered qualitative insights into the blue bio-based sector within these regions. Analysing data collected in alignment with the D3.1 protocol and summarized in D3.2, this deliverable evaluates existing business models and maps them according to the business model Canvas framework. The analysis also identifies localized business opportunities and challenges in uncovering data gaps that require attention for a more comprehensive understanding of the pilot regions business dynamics.

The identified business opportunities are tailored to the specific contexts of the pilot regions, focusing on the blue bio-economy. Addressing the knowledge gaps revealed during this process is crucial for refining our understanding of regional dynamics, engaging key stakeholders, with a particular focus on industry and business participants to guide the development of sustainable new business models. This foundational work will inform data collection activities in the upcoming WP4 co-creation workshops and further support the application of the business model canvas in Deliverable D4.2.

This report begins by defining the business model canvas and its application. It then explores the range of business models identified in each pilot region, building on the foundation established in D3.2. The aim is to synthesize findings, highlight opportunities, and prepare for subsequent stages of the BlueRev project in WP4.

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3 The business model canvas

3.1 Defining the model

The commercial opportunities from each pilot region, are highlighted using the business canvas framework. This framework facilitates a thorough examination of business ideas, evaluating their viability and feasibility for the development of sustainable business models. It achieves this by systematically identifying opportunities and gaps across various critical aspects including customer segments, value propositions, distribution channels, available resources, cost structures, revenue streams, key partnerships, customer relations, key activities.

i. Customer segment

Customer segment is concerned with identifying “whom” we are creating value for, and who their most important customers are.

ii. Value proposition

Value proposition is the value which the idea delivers to the customers, and what problem it helps solve for the customers.

iii. Channels

Business models must state through which channels the customer segment wants to be reached, identify those that work best, most cost-efficient, and how they are integrating them with customer routines.

iv. Key resources

Key resources answer which resources that are required for the realisation of value proposition, distribution channels, customer relationships, and revenue streams.

v. Cost structure

Cost structure includes analysing what the most important costs inherent in the business model are, as by identifying which key resources or activities are most expensive.

vi. Revenue streams

Revenue streams concern looking at what customers are really willing to pay, what they currently pay, what they would prefer to pay, and how much each revenue stream contributes to overall revenue.

vii. Key partners

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Key partners identify partners, suppliers, to which key resources that are acquired from, and the key activities performed by partners.

viii. Customer relationships

This section highlights what type and cost of relationship with each of the customer segments expect to be established, and how these are maintained. It also involves looking at existing relationships, and how these are integrated with the rest of the business model.

ix. Key activities

Key activities include stating which key activities that are required for the realisation of value proposition, distribution channels, customer relationships, and revenue streams.

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3.2 Assessing current business models

Based on the rigours analysis of the data collected based on conceptual framework outlined in D3.1 including interviews, workshops, and focus groups and results presented in D3.2, this section synthesis the current business models in the blue bio-based sector across the three model regions of the BlueRev project: Denmark, Italy, and Estonia. The analysis contributed to identifying distinct perspectives, enabling to frame key aspects of social innovation, governance, and business model evaluation, ensuring a robust and consistent foundation for understanding drivers within the blue bioeconomy for the purpose of this deliverable. These included document analysis from publicly available resources covering a wide range of types, and semi structured interviews with key stakeholders offering insights into the business context in the region. This step aimed to establish a foundational understanding of current business processes and factors affecting their sustainability

3.2.1 Denmark and Greenland

The Nordic pilot region encompasses Greenland and Denmark, with fishing standing as the cornerstone of Greenland's economy, providing livelihoods for many and contributing significantly to the national economy. In Denmark, a notable net exporter of fish and fish products, the processing industry generates a diverse array of products from various species. Both regions, however, harbour untapped potential linked to the strategic utilization of available resources, particularly side streams, offering a foundation for innovative business models and opportunities.

In Greenland, there are lucrative business prospects associated with optimizing side stream utilization, implementing advanced freezing methods, deploying filleting machines, and enhancing overall product quality. Presently, a substantial 30,000 metric tons of valuable side streams from cod, shrimps, and crabs are discarded into the ocean. These side streams hold immense potential for diverse applications, and if transported to suitable processing facilities, they can be transformed into high-value products primed for export to various markets. Expanding beyond side streams, opportunities also emerge in the development of more efficient freezing methods, which could both reduce costs and facilitate the transportation of side streams from Greenland to other locations at a competitive price.

Furthermore, a transformative shift in fish handling practices in Greenland offers a promising avenue for elevating fish quality. Proposed changes include immediate throat cutting for effective blood drainage and a transition to longlines as an alternative to bottom gillnets. These adjustments not only contribute to environmental sustainability but also have the potential to significantly enhance the overall quality of the fish products, aligning with the evolving demands of the global market.

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3.2.1.1 Current business models Denmark

The business model A: Production and processing

Key Partners

- **Suppliers:** Cod suppliers, primarily using ocean transport for frozen cod shipped to Europe.
- **Buyers**: Danish supermarkets (fish cakes), Norwegian collagen producers (fish skin), and feed manufacturers (carcasses and meat scraps).
- **Industry Federations**: The Federation of Danish Industry, for insights and support in addressing labor shortages.

Key Activities

- **Production and Processing**: Processing sea-frozen cod to create primary products (e.g., fish cakes) and by-products.
- **By-product Recovery**: Extracting nutrients like protein and phosphorus from liquid by-products during thawing and processing.
- **Wastewater Recycling**: Treating and recycling process wastewater to recover proteins and polyphosphates, reducing discharge costs and fresh water requirements.
- **Product Development**: Researching higher-value uses for by-products to move up the value chain.
- **Labor Optimization**: Investing in technology to reduce labor requirements, yet managing seasonal hiring and skilled labor shortages.

Key Resources

- **Human Resources**: Core team and seasonal skilled labor; however, high demand in Denmark and the slow work permit process create hiring challenges, particularly for electricians and maintenance workers.
- **Technology**: New equipment investments that reduce labor needs and support wastewater treatment and nutrient recovery.
- **Logistics**: Transportation via refrigerated trucks within Europe and ocean transport for raw material import, though rising energy costs and CO_2-based truck tolls are increasing logistics expenses.

Value Propositions

- **Sustainable Resource Utilization**: The company is focused on maximizing the value of all parts of the cod, including nutrient recovery from wastewater and by-products.
- **Eco-Friendly Practices**: Recycling process water to minimize water usage and utilizing by-products for sustainable applications.
- **High-Quality Products**: Producing fish cakes sold in Danish supermarkets and raw materials for collagen and animal feed production.

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- **Commitment to Innovation**: Seeking higher-value uses for by-products to increase profitability and reduce environmental impact.

Customer Relationships

- **B2B Relationships**: Building stable, long-term relationships with buyers of by-products for feed and collagen production.
- **Retail Relationships**: Selling fish cakes directly to Danish supermarkets, maintaining a focus on product quality to ensure customer loyalty.

Channels

- **Supermarket Distribution**: Fish cakes sold through Danish supermarkets.
- **International B2B Sales**: By-products like fish skin and carcasses are exported, especially to Norway for collagen and feed production.

Customer Segments

- **Retail Consumers**: Danish consumers purchasing fish cakes through local supermarkets.
- **B2B Buyers**: Collagen producers (for skin), feed manufacturers (for carcasses and meat scraps).

Cost Structure

- **Labor Costs**: Seasonal hiring and recruitment challenges, particularly for skilled labor.
- **Wastewater Discharge**: High costs associated with wastewater disposal, driving the need for recycling and treatment.
- **Logistics**: Rising energy costs and CO_2-based tolls on trucks from 2025 impacting transportation expenses.
- **Technology Investment**: Capital spent on labor-saving technologies and wastewater treatment facilities.

Revenue Streams

- **Product Sales**: Revenue from fish cake sales in Danish supermarkets.
- **By-product Sales**: Sale of fish skin to Norway for collagen production and carcasses to feed producers at an average price of DKK 1.30/kg.
- **Potential High-Value Products**: Exploring options to develop higher-value uses for by-products to increase overall profitability.

This model approach highlights both current business operations and the company's commitment to innovation and sustainable practices, while identifying the challenges and opportunities in labor, logistics, and high-value product development.

The business model B: Production and processing

Key Partners

- **Cod Suppliers**: Sourced as sea-frozen raw material, transported by ocean to Europe.

- **Industry and Export Partners**: Danish supermarkets for fish cakes, Norwegian companies for collagen (via fish skin), and feed manufacturers for by-products like carcasses and meat scraps.
- **Danish Industry Federation**: Provides support and insights to help address labor shortages and industry needs.

Key Activities

- **Primary Production and Processing**: Producing fish cakes for sale in Danish supermarkets and processing cod to create both liquid and solid by-products.
- **Nutrient Recovery**: Recovering valuable proteins and phosphorus from liquid by-products for reuse in other production processes.
- **Wastewater Management**: Treating and recycling wastewater to minimize discharge costs and to recover proteins and polyphosphates for internal use, thus reducing the need for fresh water.
- **Labor Management and Technology Investment**: Reducing labor from 10 to 4 employees through automation while meeting seasonal demands for skilled labor, particularly electricians and maintenance workers.

Key Resources

- **Skilled and Seasonal Labor**: Core team and additional seasonal workers (25 during peak periods), though recruitment is challenging due to labor shortages in Denmark, complicated by delayed work permit processing.
- **Advanced Processing Technology**: New equipment investments reduce labor needs and enable wastewater treatment and nutrient recovery.
- **Logistics Infrastructure**: Ocean transport for cod and refrigerated trucks for distributing finished products, though rising energy costs and upcoming CO_2-based truck tolls in 2025 are increasing transportation expenses.

Value Propositions

- **Sustainable Use of Resources**: Maximizing use of cod by recovering nutrients from wastewater and creating valuable by-products from all parts of the fish.
- **High-Quality Products**: Offering premium fish cakes in Danish supermarkets, with by-products like fish skin and carcasses repurposed for collagen and animal feed production.
- **Commitment to Environmental Responsibility**: Recycling process water to reduce fresh water usage and isolating valuable proteins and polyphosphates for internal use, reducing waste.

Customer Relationships

- **Direct Retail**: Supplying Danish supermarkets with quality fish cakes.
- **B2B Relationships**: Established contracts with Norwegian collagen manufacturers and feed producers, ensuring consistent demand for by-products.

Channels

- **Retail**: Fish cakes are distributed through Danish supermarket chains.
- **Export Channels**: By-products such as fish skin and carcasses are exported, primarily to Norway for collagen and feed manufacturing.

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Customer Segments

- **Retail Consumers**: Danish supermarket customers purchasing fish cakes.
- **Business Clients**: B2B customers, including Norwegian collagen manufacturers and feed companies.

Cost Structure

- **Labor Costs**: High costs associated with seasonal and skilled labor needs, particularly challenging given Denmark's labor shortages and slow work permit issuance.
- **Wastewater Discharge Costs**: Expenses related to wastewater disposal, which the company seeks to minimize by treating and recycling process water.
- **Logistics and Transportation**: Rising energy costs and future CO_2-based tolls on trucks add to transportation costs.
- **Technology Investments**: Costs associated with purchasing new equipment to optimize labor and support wastewater recycling.

Revenue Streams

- **Fish Cake Sales**: Revenue from fish cakes sold in Danish supermarkets.
- **By-product Sales**: Income from by-products, including fish skin sold to Norwegian collagen producers and carcasses sold to feed manufacturers at an average price of DKK 1.30/kg.
- **Future High-Value Product Development**: Exploring the potential to develop higher-value applications for by-products, which could significantly increase revenue.

This model highlights the company's focus on sustainable practices, labor optimization, and higher-value product opportunities, alongside current challenges in labor and logistics.

3.2.1.2 Current Business Model Greenland

The Business Model A: Fishing and processing operation

Key Partners

- **Fishing Suppliers**: Internal fleet and local fishermen who supply additional raw materials, supporting diverse fishery operations.
- **Local Authorities**: Provide permits for byproduct disposal, as current operations involve ocean dumping.
- **Regulatory Bodies**: Influences byproduct utilization, as regulations currently restrict fishmeal production for animal feed in Greenland.

Key Activities

- **Fishing and Processing Operations**: The company operates its own vessels and processing facilities along Greenland's coast, processing cod, shrimp, and crab.

- **Byproduct Management**: Around 30,000 metric tons of byproduct side streams are currently discarded into the ocean, requiring permits and incurring disposal costs.
- **Exploration of Byproduct Repurposing**: Investigating the potential to convert byproducts into high-value products such as flavor enhancers or food industry ingredients.

Key Resources

- **Labor Force**: Approximately 2,286 employees globally, with 1,390 based in Greenland and 152 in Denmark, though labor shortages exist in Greenland.
- **Fishing Fleet and Coastal Facilities**: Own fishing vessels and multiple production sites across Greenland's coastline.
- **Local Infrastructure**: Limited due to geographic constraints, with restricted access to towns and settlements only by boat or plane, impacting workforce mobility.

Value Propositions

- **Sustainable Resource Use**: Potential to repurpose fishery byproducts, reducing waste and contributing to sustainability.
- **Product Innovation**: Exploring new high-value products, such as flavor enhancers, that could leverage discarded byproducts and reduce ocean dumping.
- **Local Economic Support**: Potential to create jobs in Greenland, though workforce availability remains a significant challenge.

Customer Relationships

- **Long-term Relationships with Local Suppliers**: Built through ongoing partnerships with local fishermen.
- **B2B Partnerships**: Potential to develop relationships with companies interested in high-value ingredients derived from byproducts.

Channels

- **Global Market Reach**: Current production and fishing operations serve international markets.
- **Potential New Channels**: Exploring opportunities to sell new high-value byproduct-based ingredients in food and other industries.

Customer Segments

- **Global B2B Customers**: Potential customers for high-value byproducts could include companies in the food, flavor, and cosmetics industries.

Cost Structure

- **Labor Costs**: Significant costs due to a large global workforce and challenges hiring in remote areas like Greenland.
- **Disposal Costs**: Expenses associated with byproduct ocean dumping, which requires permits from local authorities.

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- **Infrastructure and Logistics**: Costs related to remote accessibility in Greenland, as transportation is limited to boats and airplanes.

Revenue Streams

- **Fish and Seafood Product Sales**: Main revenue from primary products derived from cod, shrimp, and crab.
- **Future High-Value Byproducts**: Potential revenue from repurposing byproducts for high-value applications, which could mitigate disposal costs and contribute to sustainability efforts.

This model approach highlights the company's focus on fishing and processing, current byproduct disposal practices, and opportunities to generate new revenue through high-value byproduct utilization. It also identifies challenges related to labor, infrastructure, and regulatory restrictions that impact potential expansion.

Overall challenges in the Danish and Greenlandic fish and seafood industry

- **Labour:** The industry in Denmark needs skilled labour and they need both skilled and unskilled labour in Greenland.
- **Supply of raw materials:** The supply of raw materials in Denmark has become very competitive. It is difficult to make a profitable business if the profit comes only from the fillets of a fish. For most companies, it is necessary to also have an output from the side streams.
- **Regulations (Danish Veterinary and Food Administration, DVFA):** DVFA responsible for inspecting and imposing guidelines and legislations stresses that the entire fish must be treated as food, including side streams, which must remain uncontaminated with an unbroken cold chain finds it challenging in managing and advising on side stream regulations. Approval of new technological solutions can be a long process. Greenland is not a part of the EU, but a part of the Danish Kingdom, therefore it can take a longer time to have an application processed e.g., the use of purified seawater in the processing. The Danish industry is challenged by different implementations of regulations in different EU countries.
- **Fresh water supply:** Fresh water supply is a limited resource in Greenland and therefore it is firstly used for private households and secondly for e.g., process water in the industry.
- **Assessment of market potential:** Assessment of markets for new products coming out of the side streams can be difficult.
- **IP rights, patents:** Many companies do not want to focus on IPR, as it is too demanding for even quite big companies to defend their rights.
- **Business models:** The industry could consider new business models.
- **Support for SMEs and Start-ups:** Small companies often find DVFA requirements challenging. DVFA offers a "one-stop-shop" service for comprehensive guidance on topics like ingredient development and new production methods. The DVFA aims to facilitate better industry interaction and provide hands-on guidance to ensure regulatory compliance and support innovation in food production.

- **Product development:** Acceptance of failure in product development is low and therefore there is less willingness to take risks and invest in product development. Seems to be changing now.
- **Trade barriers in the world market:** More and more 3rd world countries are now having special requirements. Globalization is being rolled back – protectionism increases.
- **International support at the Danish representations:** The resources for the Danish embassies and the Export Council have been reduced so that there will be fewer people to service the companies i.e. the companies need hands-on support when for instance containers are stuck in the international harbours. Long term this will reduce the willingness to focus on developing the international business.
- **Funding opportunities:** It is difficulty for fish and seafood companies to participate in development projects (funding) because of rules which implies less funding is available for the fish industry then for the food industry in general.
- **Novel Food:** Many companies struggle to determine if their products fall under the "novel food" category, especially when using by-products from traditional production, regardless of their size. Novel food derives from new production processes or selective extracts, which is relevant when the industry start using the side stream from their traditional business. The agency stresses that side streams from fish processing must be handled as food throughout to avoid contamination and maintain quality.

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3.2.2 Estonia 

The Estonian pilot region, situated on the island of Saaremaa in the Baltic Sea, boasts considerable potential within the blue economy, rooted in its extensive history of maritime industries and abundant coastal resources, including fishing, maritime technology, coastal tourism, and aquaculture. The primary focus in this project is valorization of red algae, with applications spanning the realms of food, nutraceuticals, agriculture, and the cosmetic industry.

Since the 1960s, red algae (*Furcellaria lumbricalis)*, sourced from the shallows near Saaremaa have been used to produce furcellaran that is used as a gelling agent in the food industry. Harvesting involves both trawling from the sea and collection from beaches, with current environmental permits allowing the trawling of up to 2000 tons of red algae annually. However, the actual trawling volume has yet to reach this maximum limit. Red seaweed is also a source of cellulose, thus there is potential for further exploring the extraction and use of microcellulose from the processing biowaste.

Untapped business opportunities associated with red algae abound, including leveraging by-products for applications in new industries such as food and agriculture, with specific potential in bioplastics and cosmetics.

Further potential lies in increasing the volume of red seaweed, a goal that could be realized through growing red seaweed and other macroalgae, including the exploration on if the foundations of windmills could be utilized for macroalgae farming. This innovative approach not only has the potential to overcome trawling restrictions but also presents a valuable avenue for expanding the scope and impact of red seaweed applications in various industries.

3.2.2.1 Current business models Estonia

The business model A: Furcellaran Production

Key Partners

- **Local Fishermen and Algae Collectors:** Sources red algae from a trawler company and 30 local families who collect storm-cast algae from the shore.
- **Environmental Board**: Provides licensing for algae collection in protected areas.
- **Estonian Universities**: Collaborates with the Estonian University of Life Sciences, Tallinn University of Technology, and University of Tartu's Marine Institute for product development, research, and innovation.
- **SA Algaia (French Partner):** Assists in building a pilot plant for powdered furcellaran and testing red pigment technology.
- **Local Horticultural Producer**: Collaborates on creating biodegradable planting pots from production residues.

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Key Activities

- **Furcellaran Production:** Processes red algae into flaky and powdered furcellaran, primarily used as a gelling agent in the food industry.
- **Residue Utilization**: Converts production residue into fertilizers and is exploring other uses such as planting pots and biodegradable dishes.
- **Research and Development:** Invests in developing organic fertilizer pellets, red pigment production, and other sustainable uses for by-products.
- **Export and Market Expansion:** Exports 70-80% of products, reaching markets in Europe, Ukraine, Russia, USA, India, and Japan.

Key Resources

- **Local Workforce**: Employs 26 local workers with longstanding tenure, supporting regional employment.
- **Natural Algae Resource:** Renewable red seaweed (Furcellaria lumbricalis) harvested sustainably under Estonia's yearly trawling quota of 2,000 tons.
- **Pilot Production Facility:** Under development for powdered furcellaran and red pigment testing in collaboration with SA Algaia.
- **Regional Research Infrastructure:** Supports marine resource valorization lab at Kuressaare College for enhanced regional research capacity.

Value Propositions

- **Natural, Chemical-Free Product:** Unique, natural alternative to standard gelling agents like gelatin, pectin, and agar-agar, as the furcellaran is extracted using pure water without chemicals.
- **Sustainable, Locally Sourced Ingredients**: Emphasis on local, renewable algae and sustainable practices, with a focus on reducing waste by repurposing production residues.
- **Innovative By-Product Applications:** Development of additional products, such as fertilizers and biodegradable planting pots, enhancing sustainability and value from production residues.

Customer Relationships

- **Long-term Contracts and Partnerships:** Works closely with regional and international clients who value premium, natural products.
- **Industry and Community Engagement**: Actively engages through associations like the Saaremaa Enterprises Association and Estonian Chamber of Commerce to support local industry growth.
- **Collaboration on Product Development:** Works with universities and other partners for research-driven innovations in product development.

Channels

- **Direct Export:** Primary distribution through direct export to global markets including Europe, India, the USA, and Japan.
- **Regional Partnerships and Networks**: Utilizes business associations and university networks to strengthen regional influence and partnerships.

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Customer Segments

- **Food Industry:** Main customers are food producers using furcellaran as a gelling agent in products like marmalade and desserts.
- **Agricultural and Horticultural Sector**: Local farmers currently use furcellaran residue as fertilizer, and horticulture companies collaborate on bioproduct development.
- **Cosmetics and Specialty Ingredient Markets**: Exploring new applications, such as natural pigments, for use in cosmetics and other specialized industries.

Cost Structure

- **Labor Costs:** Workforce expenses, though controlled through recent technological improvements and efficiency gains.
- **Sustainable Sourcing and Processing:** Costs related to sustainable harvesting practices and natural extraction methods (avoiding chemicals).
- **Regulatory Compliance:** Licensing costs for environmental compliance in protected areas, and costs associated with sustainable algae collection.
- **Research and Development**: Investment in R&D for by-product utilization, red pigment technology, and collaboration with academic partners.

Revenue Streams

- **Product Sales**: Primary revenue from furcellaran sales as a food ingredient, with 70-80% of production exported to international markets.
- **By-Product Sales and Collaborations**: Potential future revenue from high-value by-products like organic fertilizers, bioplastics, and red pigments for various industries.
- **Funding for Innovation:** Secures funding and applies for grants to support R&D efforts, particularly in by-product innovation and infrastructure improvements.

This model provides an overview of the company's operations, highlighting its unique product, sustainable practices, local partnerships, and exploration of new market opportunities through by-product innovation. The model also captures the company's reliance on partnerships for raw material sourcing, its customer-focused export strategy, and its efforts to maximize the value of production residues for additional revenue and environmental sustainability.

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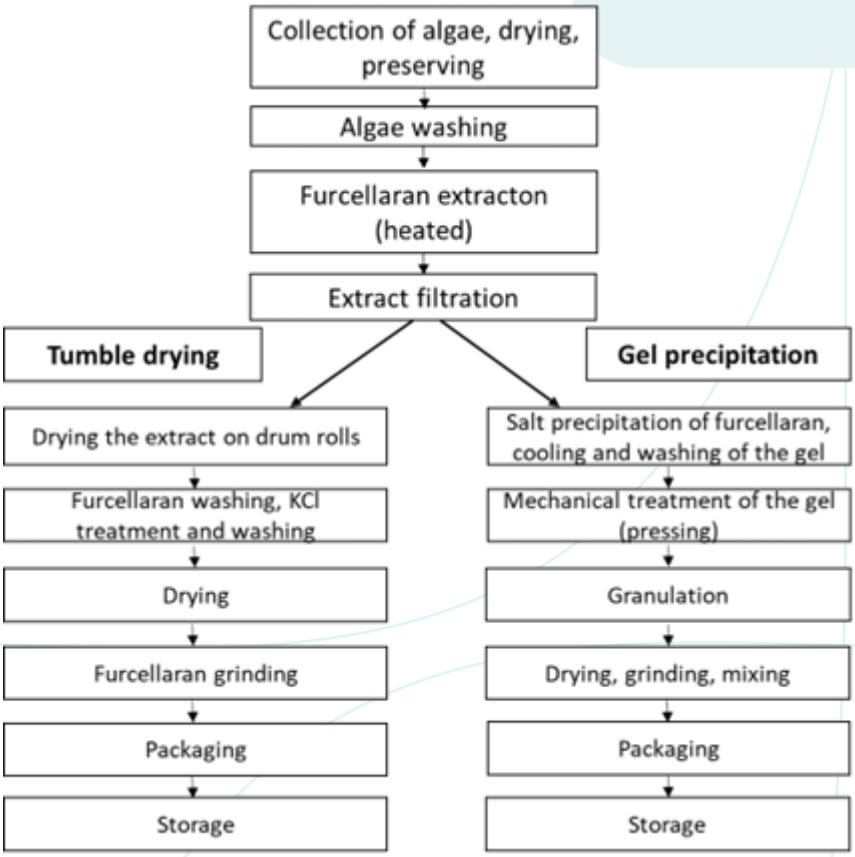

Source: https://estagar.ee/manufacturing/

Figure 1: Stages in the production of flaky (left) and powdered (right) furcellaran

Overall resource challenges are:

- Financial resources and wage pressure
- Company's own laboratory has insufficient capability for the product development
- Lack of expert knowledge and help from researchers, including on the possibilities for algae cultivation and for for development of the natural fertilizers/soil improvers, the planting pots/plant containers and other innovative products, particularly as there are only a few experts in Estonia and it has been hard to find foreign experts.
- Lack of pilot production units or complexes in Estonia where it would be possible to test the production of trial batches
- The red algae quota may be insufficient
- Waste water use- enterprise uses clean well water for production and at this point the use of wastewater after the treatment is not economically justified, but likely must be addressed in the future.

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3.2.3 Italy

The Italian pilot region, situated in the southern part of Italy, specifically in Sicily, offers a plethora of commercial opportunities. These opportunities are rooted in strategic avenues such as product diversification, waste valorization, and the creation of higher-value goods. By intensifying efforts in product diversification and elevating specific fish varieties into premium products, such as smoked fish, one can achieve price stabilization and augment market demand, particularly during peak seasons. The region also presents prospects for innovative transformations of low-value fish into high-value commodities.

Currently, the valorization of less esteemed fish, like menola, involves salting, drying, and selling it in powder form. Exploring further avenues for diversifying processed fish products beyond the powder format is a viable strategy. Additionally, there's an opportunity to harness the untapped potential of fish waste by developing marketable products like couscous broth and pharmaceutical-grade extracts. Notably, the pharmaceutical industry has expressed interest in collecting the gills, liver, intestines, and spleen of the fish, indicating a promising avenue for collaboration and development.

The context of the Italian region presented an intertwined multi layers of stakeholders represent below.

Cooperatives: These provide administrative support, licensing, and equipment procurement at reduced costs for enterprises. AGCI Pesca is a major cooperative association encompassing 44 cooperatives across fishing, aquaculture, and agriculture, with an annual production value of approximately €1.55 billion. This sectoral association also negotiates national labor agreements for members.

Producer Organizations (POs): These are groups of fishers and fish farmers who organize to improve market conditions for fish products, stabilize the market, and align production with demand. POs, supported by EU policies, can adjust market conditions and withdraw products during market downturns to maintain income levels for fishers, offering compensation to members under certain quality and surplus conditions.

Collective Management Bodies (COGEPA): Italy applies Territorial Use Rights in Fisheries (TURFs) for managing mobile species, particularly in coastal areas. This includes creating a management plan with at least 70% of local enterprises, guided by the European Fishery Fund. This involves public-private partnerships with research institutions for sustainable management and resource rebuilding, requiring cooperation among fishers, local authorities, and research institutes.

Trade Associations: These organizations protect specific sector interests, assisting members in negotiations, administration, financial management, and compliance. They offer consulting services, event organization, and representation in regulatory matters.

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District of Fishing and Blue Growth (COSVAP): This district, recognized by the Sicilian Region, focuses on enhancing the fishing supply chain locally and internationally. Through partnerships with institutions, it supports the industry's economic and social growth under the Blue Economy principles.

3.2.3.1 Current business models Italy

The business model A: High-Value Fish Product Transformation

Key Partners

- Local fish suppliers (to source low-value fish)
- Salt and drying machine suppliers
- Regional distributors for expanded market access
- Government and regulatory bodies (for compliance support)
- Restaurants and gourmet shops as primary sales outlets

Key Activities

- Procurement and selection of low-value fish for processing
- Traditional processing (salting, drying) of fish to create high-value products
- Market development and outreach to increase product adoption
- Navigating and adapting to EU regulatory changes
- Product innovation with limited investment due to high regulatory risk

Key Resources

- Drying machines and other processing equipment
- Knowledge of traditional Roman fish processing methods
- Physical space for processing and drying fish
- Financial resources for regulatory adaptation and market expansion

Value Propositions

- Unique, high-quality dried fish powder for pasta, acting as a Parmesan substitute
- Sustainable approach, using all parts of the fish
- Local, artisanal production with a high value-add transformation
- Competitive pricing with fresh fish priced at €5/kg and dried product sold at €200/kg

Customer Relationships

- Close collaboration with restaurants for product integration and feedback
- Emphasis on product quality, tradition, and sustainability
- Customer education through tastings or demonstrations at gourmet shops

Channels

- Direct sales to local restaurants and gourmet shops
- Regional distribution networks for expansion beyond local markets
- Participation in local food markets and festivals for brand awareness
- Potential online sales channel for broader reach

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Customer Segments

- Local and regional restaurants, particularly those offering innovative or artisanal dishes
- Specialty gourmet shops and high-end food retailers
- Health-conscious and environmentally aware consumers
- Culinary enthusiasts seeking unique ingredients

Cost Structure

- Raw fish procurement costs (approx. €5/kg for low-value fish)
- Operating costs for drying machines and traditional processing (salt, labor)
- Packaging and distribution costs for 50g jars (€10 retail price)
- Compliance costs due to EU regulatory changes
- Marketing and sales expenses to develop and maintain customer relationships

Revenue Streams

- Sale of high-value dried fish powder (retailing at €10 per 50g jar)
- Seasonal fresh fish sales, subject to EU regulation constraints
- Future potential for product diversification with additional fish-based products
- Potential premium pricing due to sustainable, artisanal production methods

This model highlights both the unique value of traditional processing and the regulatory challenges, positioning the business as a sustainable, high-value producer with local and regional growth potential.

The business model B: Tuna Processing & Premium Canned Products

Key Partners

- Tuna suppliers in Southeast Asia and Ecuador (for frozen tuna and eggs)
- Packaging companies (mainly multinational) for canning and labelling according to specifications
- Olive oil suppliers (Spanish and Italian companies) for non-extra virgin oil used in products
- Supermarkets as primary retail channels
- Scientific and research organizations (potential for Omega-3 product development and sustainability initiatives)
- Feed companies (to whom waste is sold, though currently low revenue)

Key Activities

- Processing and canning imported tuna for supermarket and premium product lines
- Branding and marketing, particularly for the company's premium label
- Waste management through sale to animal feed producers (seeking more profitable disposal alternatives)
- Import management to mitigate tax impacts and maintain steady supply
- Exploring sustainable packaging alternatives and reducing environmental impact (e.g., reducing oil content)

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Key Resources

- Imported tuna and eggs (sourced from Southeast Asia and Ecuador)
- Packaging and canning facilities
- 235 employees, including a mix of operational and managerial staff (4 men and 10 women in management)
- Supply chain partnerships with packaging and oil suppliers
- Strong brand presence in supermarkets and a premium brand for the canned tuna market

Value Propositions

- High-quality, canned tuna products for supermarkets and a premium line for health-conscious consumers
- Locally processed and branded tuna with traceability and consistent quality
- Sustainable packaging initiatives and reduction of oil content for environmental responsibility
- Omega-3 product potential for a health-conscious consumer base
- Differentiation through premium branding compared to generic supermarket brands

Customer Relationships

- Strong B2B relationships with supermarkets, maintaining a dual focus on generic and premium offerings
- Direct customer engagement through premium brand marketing (educating on quality and health benefits)
- Transparent sustainability efforts to appeal to eco-conscious consumers
- Limited open innovation with value chain partners (potential area for growth)

Channels

- Supermarkets for distribution of both generic and premium canned tuna products
- Partnerships with retail chains and wholesalers in potential international markets
- Potential for online retail or health stores for Omega-3 or specialized premium products

Customer Segments

- Supermarkets and grocery chains (for both generic and premium canned tuna products)
- Health-conscious consumers seeking high-quality, sustainable canned fish
- International markets with potential for expansion (B2B channels initially)
- Pet food companies (although current sales are low margin)

Cost Structure

- Tuna and egg import costs (plus import taxes due to market demand)
- Processing and canning costs, including labor and overhead for 235 employees
- Packaging costs with multinational partners (working towards sustainable solutions)
- Marketing and brand development expenses, particularly for premium line

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- Environmental and waste management costs (selling by-products to animal feed companies)

Revenue Streams

- Revenue splits equally between generic supermarket canned tuna and premium branded products
- Primary revenue from the sale of canned tuna products to supermarkets
- Low-margin revenue from by-product sales (tuna waste) to animal feed producers
- Potential revenue from new Omega-3 products, pending scientific input and development
- Future potential for international market sales expansion

This model captures the company's current focus on value-added tuna processing for both generic and premium markets, while also addressing challenges in waste disposal and regulatory costs, as well as potential growth areas through product diversification and international market expansion.

The business model C: Fish Processer

Key Partners

- Local Restaurants (31 partners): Local restaurants involved in pilot program to utilize low-value fish in their menus.
- Private Financiers: Needed for financing due to lack of EU support for initiatives.
- Potential International Partners: Exploring international partnerships for know-how in transforming low-value fish (e.g., smoking techniques for Capone).
- Feeding Companies: Potential partners to utilize byproducts for fish farming, though currently not engaged in purchasing these byproducts.
- Other Fishing Associations: Exploring merger opportunities with similar associations to increase bargaining power, stabilize pricing, and reduce competition.

Key Activities

- Local Production and Processing: Focus on local market, supplying to restaurants and private clients with small-scale, low-catch operations.
- Pilot Program for Low-Value Fish: Distribution of low-catch fish to restaurants for experimentation and menu inclusion.
- Product Development: Considering options for transforming low-value fish, including smoking techniques and creating dishes like Spanish Paella.
- Industry Training: Providing training to the hospitality sector on handling and utilizing low-value fish in culinary applications.
- Networking and Market Expansion: Expanding reach to new markets, particularly Northern Italy, to increase demand for low-value fish products.

Key Resources

- Fishing Vessels: Small boats for local, low-catch fishing; large boats for higher-volume catches of shrimp and cod.

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- Local Fishermen and Workforce: Small-scale fishermen engaged in catching and processing; a new association leader focused on driving growth and developing market potential.
- Pilot Network of Restaurants: Local restaurants using low-value fish in pilot menus, essential for proof of concept.
- Private Financing: Access to private funding sources necessary to support product development and market expansion.

Value Propositions

- Utilization of Low-Value Fish: Providing an option for restaurants to experiment with underused fish types like Capone, transforming low-catch fish into culinary offerings.
- Support for Local Market Resilience: Training hospitality sector staff and promoting innovative uses of low-value fish, thereby enhancing the value of local catches.
- Exclusive Local Product Offerings: Low-catch, small-scale fishing practices that meet local demand with fresh, sustainably sourced products.
- Potential for New Culinary Products: Exploration of dishes and ingredients using low-value fish, offering unique items for consumers and restaurants.

Customer Relationships

- Collaborative Relationship with Restaurants: Direct collaboration with restaurants, who receive low-value fish to trial and incorporate into their offerings.
- Educational Support for Hospitality Sector: Providing knowledge and training on how to prepare and serve low-value fish to enhance culinary appeal.
- Community Engagement through Associations: Engaging with other associations to stabilize the market, improve product value, and build resilience within the sector.

Channels

- Direct Supply to Local Restaurants: Primary distribution channel, with fresh fish and low-value fish supplied directly to restaurants.
- Association Network: Collaboration with other fishing associations for broader reach, including networking and joint marketing efforts.
- Future Market Expansion: Plans to expand sales channels into Northern Italy to increase revenue streams from low-value fish products.

Customer Segments

- Local Restaurants and Hotels: Main customers, focused on incorporating low-value fish into their menus and expanding culinary options.
- Private Consumers: Small-boat catches sold to individual customers for personal consumption.
- Potential New Markets: Expanding to restaurants and food sectors in Northern Italy to increase demand and use of low-value fish.

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Cost Structure

- High Production Costs: Costs of transformation and production often exceed revenue potential, impacting profitability.
- Private Financing Costs: Lack of access to EU support means reliance on private financing, which can be costly.
- Regulatory Costs: Compliance with EU fishing regulations, which frequently change, adding expense and equipment restrictions.
- Labor and Training Costs: Costs associated with training staff and supporting the local workforce in handling and processing low-value fish.

Revenue Streams

- Restaurant Partnerships: Potential revenue from restaurant collaborations and exclusive low-value fish products.
- Expanded Market Opportunities: Future revenue from sales to new markets, such as Northern Italy, as demand for unique fish offerings grows.
- Membership and Network Fees: Potential revenue from joint ventures with other associations, enhancing sector profitability through collaboration.

This model captures the strategic approach of processes and packages fish for supermarkets, with a national-level premium brand for fresh and frozen fish in Sicily leveraging local partnerships, piloting product innovation with low-value fish, and exploring new market opportunities despite high production costs and regulatory challenges.

The business model D: Tuna Production Association and Fishing Company Owner

Key Partners

- Universities and Research Institutions: Collaborate with universities to test water quality, artificial aspects, and other research relevant to the sustainability and quality of tuna fishing.
- **Association (Cooperative)**: Works as a collective force to advocate for favorable policies, support cost coverage, and help with strategic industry direction.
- **Potential Buyers (North Italy)**: Future clients interested in innovative byproducts like fish ear extracts for pharmaceutical and cosmetic applications.
- **Other Fishing Companies**: Potential partners to address labor shortages and collaborate in policy influence.

Key Activities

- **Tuna and Byproduct Fishing**: Specialized in tuna and related species using hooks rather than nets, which differentiates the company and the association.
- **Product Testing and Quality Control**: Testing fish quality and water standards to ensure high-quality, sustainable tuna and byproducts.
- **Product Development**: Exploring the commercial use of fish byproducts, such as tuna ear extracts, for pharmaceuticals and cosmetics.
- **Industry Advocacy**: Working through the association to influence policy changes that support industry needs and protect members' interests.

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Key Resources

- **Fishing Fleet**: 15 boats with specialized equipment for tuna fishing with hooks, differentiating their catch methods.
- **Expertise in Byproduct Processing**: Developing expertise in identifying and processing byproducts with potential commercial applications.
- **Association Power and Advocacy**: As a leader of the association, leverage collective power to influence industry regulations and policies.
- **Labor Force**: Experienced, though limited, workforce; labor shortages remain a major challenge due to low industry attractiveness.

Value Propositions

- **Specialized Hook Fishing for High-Quality Tuna**: Differentiated, sustainable tuna catch method offering premium fish for market.
- **Potential Byproduct Innovation**: Exploring valuable byproducts, like fish ear extracts, that could open new revenue streams in pharmaceuticals and cosmetics.
- **Industry Influence through Association**: Represents member interests in policy advocacy, ensuring the industry remains viable despite challenges.

Customer Relationships

- **Client-Centric and Collaborative**: Works closely with current and potential clients, focusing on niche needs like byproducts for pharmaceuticals.
- **Association Member Support**: Provides industry support and collective strength for association members.
- **Long-Term Developmental Focus**: Collaborating with universities and other institutions to ensure quality and sustainability, supporting a potential long-term transformation of the industry.

Channels

- **Direct Sales to Buyers (North Italy)**: Direct connections with potential buyers interested in niche byproducts.
- **Industry Networks and Trade Shows**: Engaging with potential partners and clients at industry events to explore opportunities for byproduct commercialization.
- **Association Communications**: Using the association platform to communicate and collaborate with members on industry challenges and solutions.

Customer Segments

- **Tuna Buyers and Retailers**: Primary customers interested in fresh, sustainably caught tuna.
- **Pharmaceutical and Cosmetic Industry**: Potential customers for innovative byproducts like fish ear extracts.
- **Association Members**: Member businesses who benefit from collective advocacy and industry support.

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Cost Structure

- **Operational Costs of Fleet and Labor**: Maintaining and staffing the 15-boat fleet; labor shortages increase costs and limit production.
- **Association Costs**: Costs associated with running the association, including advocacy and policy engagement efforts.
- **Research and Development Costs**: Costs for product testing and collaboration with universities on sustainability and byproduct quality.

Revenue Streams

- **Monthly Tuna Sales**: Main revenue from tuna sales, received every 30 days to cover costs.
- **Future Byproduct Sales**: Potential revenue from commercialized byproducts, such as fish ear extracts, targeted at pharmaceutical and cosmetic industries.
- **Policy-Driven Revenue Optimization**: The association's advocacy aims to secure policy changes that could stabilize revenue and sustain the industry.

This model highlights the focus on specialized tuna fishing, innovative byproduct exploration, and the association's strategic influence to address industry challenges, especially around labor and policy.

The business model E: Preparation and transformation (cooking)

Key Partners

- **Fishermen and Independent Boats**: In addition to owning one boat, the company partners with other local boats to secure a steady supply of fish, including low-value varieties.
- **Supermarkets and Grand Distribution Organisations (GDO)**: Key buyers and distribution channels for both fresh and frozen fish products at a national level.
- **Machinery Suppliers**: Suppliers of new machinery that enables efficient waste processing and sustainable use of fish byproducts.

Key Activities

- **Fish Preparation and Transformation**: Processes fresh and frozen fish for supermarket and GDO distribution, including national-level brand representation.
- **Production of Fish Byproducts**: Using new machinery, the company extracts edible parts from fish waste to create pastes for products like fish cakes, enhancing sustainability and maximizing fish utilization.
- **Quality Management**: Ensures all products meet high-quality standards, from fresh to frozen offerings, as well as new paste products.

Key Resources

- **Fleet of Boats**: One owned boat and five partner boats ensure a diverse supply of fish varieties, including low-value catches.

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- **New Machinery**: Enables efficient processing of fish waste, separating edible parts and enhancing product sustainability.
- **Staff Expertise**: 120 employees, including roles in quality management, production, and brand representation, ensuring high standards and innovation in product offerings.

Value Propositions

- **Premium Fresh Fish Offerings**: Premium quality fresh fish in Sicily, distinct from the frozen fish available in the rest of Italy.
- **Sustainable Product Range Expansion**: Introduction of fish pastes from byproducts, enabling nearly full use of fish and supporting environmental sustainability.
- **Trusted National Brand**: Strong, recognizable brand at a national level, associated with quality fish products, both fresh and frozen.

Customer Relationships

- **Long-Term Contracts with Supermarkets/GDO**: Secure, established relationships with large retailers for consistent distribution of fresh and frozen fish.
- **Brand Loyalty and Recognition**: Positioning as a premium, sustainable brand that customers trust for high-quality fish products.

Channels

- **National Distribution in Supermarkets and GDO**: Direct distribution to major retailers ensures broad visibility and availability of the brand across Italy.
- **Sicilian Market for Fresh Fish**: Direct sales to supermarkets in Sicily, which offer both fresh and frozen options.
- **Frozen Fish for Broader Italy**: Frozen product sales outside Sicily expand reach and cater to a wider market.

Customer Segments

- **Supermarkets and GDO Chains**: Primary customers for both fresh and frozen fish offerings.
- **Consumers Seeking Premium, Sustainable Products**: Target customers who value high-quality, sustainable seafood and are willing to pay a premium for fresh options.

Cost Structure

- **Fleet and Fishing Costs**: Operational costs of maintaining the boat fleet and compensating partner fishermen.
- **Labor and Quality Management Costs**: Employee salaries, including 120 staff members focused on production, quality control, and distribution.

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- **Machinery Investment and Maintenance**: Recent investment in waste-processing machinery and ongoing maintenance costs.
- **Processing and Packaging**: Costs for transforming fish into both fresh and frozen products, along with byproduct-based pastes.

Revenue Streams

- **Fresh Fish Sales**: Premium sales of fresh fish, particularly in the Sicilian market, which have grown in recent years.
- **Frozen Fish Sales**: National sales of frozen fish, targeting areas outside Sicily.
- **Byproduct-Based Products**: New revenue stream from pastes and other products made from fish byproducts, supporting sustainability efforts and product diversification.

This model emphasizes the company's focus on maximizing fish utilization, differentiating fresh and frozen products, and maintaining a strong national brand. It also highlights the importance of sustainability and investment in technology to expand product offerings.

Overall opportunities and challenges:

- **EU Regulations Challenge**: Conflicting EU regulations have limited fishing activities, with restrictions affecting traditional fishing areas and quotas, causing excess tuna that can't be locally consumed.
- **Fish Market and Waste Management**: Created a market for fishermen to sell directly; each fisherman manages their own waste, though waste utilization isn't addressed.
- **High Fish Quality, No Branding**: High-quality fish is sold at a premium, but there's no quality branding, missing a potential revenue stream.
- **Diversified Revenue Streams**: Promoting eco-tourism (e.g., fishing tours) and cultural fishing practices; however, safety concerns make fishermen hesitant.
- **Aging Workforce**: Older fishermen with limited skill set face challenges adapting to new business models, with EU regulations viewed as a significant livelihood threat.
- **Enhanced Regulations**: Strengthening fishing regulations,and supporting fishermen during non-fishing periods with small compensation.
- **Wholesale Market**: All catch is sold at a wholesale market, organized by the association and serving restaurants, hotels, and individual buyers.
- **Dry Fish Business**: Plans to create a dried version of excess fish caught from September to December, with minimal investment needed for a drying machine.
- **Eco-Tourism and Low-Value Fish**: Promoting eco-tourism and utilizing low-value fish for local food production, supported by EU funding.

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- **Seasonal Fishing Operations**: Bluefin tuna season (April to August) employs larger boats with six fishermen, while dolphin fish season (September to December) uses smaller boats with fewer crew members.
- **Collaboration with Other Associations**: merge of similar associations to strengthen price negotiation power.
- **Young Organization Constraints**: Limited resources prevent extensive transformation initiatives, focusing mainly on food-related products.
- **Product Innovation with Limited Financing**: Producing regional dishes (e.g., " Paella " broth) requires financial backing.
- **Market Expansion Efforts**: Exploring northern Italy markets for low-value fish demand.
- **High Production Costs**: Transformation costs are prohibitive, limiting revenue potential.

3.3 Bridging the gaps

Moving forward, it is essential to deepen our understanding by gathering additional insights and data related to the protocols and findings outlined in D3.1 and D3.2. The current research requires further enrichment to support the identification and mapping of sustainable innovations or the enhancement of existing business models. Upcoming co-creation workshops should prioritize collecting comprehensive data from industry participants to refine value propositions and assess eco-social costs and benefits. Adopting a multi-stakeholder, collaborative approach will be critical for achieving meaningful outcomes. Engaging a diverse array of stakeholders—ranging from local industry participants to academic experts and policy makers—across different stages of the value chain will ensure a holistic exploration of opportunities. This strategy is specifically designed to identify robust business opportunities tailored to the blue bio-based industry within the pilot regions. Through this framework, we aim to foster the development of sustainable business models and explore novel opportunities for further innovation and implementation.

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4 Conclusion

The current analytical phase employs a systematic approach to identify existing business models highlighted by diverse stakeholders. This phase involves a comprehensive review of datasets gathered during the data collection process, alongside an in-depth analysis of primary results from each pilot region, adhering to protocols and findings outlined in D3.1 and D3.2. The synthesis of baseline data has facilitated the identification of business models aligned with the business model canvas framework within the blue bio-economy of the pilot regions, highlighting their distinct value chains.

Nordic Pilot Region (Greenland and Denmark):

- **Greenland**: Current business models emphasize optimizing side stream utilization, advanced freezing technologies, and improved fish handling practices. These strategies present opportunities to develop value-added activities, enhancing efficiency and sustainability.
- **Denmark**: The cod processing industry offers significant growth potential through innovative wastewater treatments and advanced waste valorization. Opportunities include repurposing cod carcasses and fins to produce high-value products such as collagen or oil. Further growth could be achieved by automating wastewater treatment processes and adopting eco-friendly practices.
- **Constraints**: Both regions face challenges, including labor shortages, logistical bottlenecks, regulatory complexities, and high costs associated with developing premium products.

Estonia: Estonia's business models leverage its maritime heritage and coastal resources, focusing on red algae valorization for versatile applications.

- **Strengths**: Sustainable practices, local partnerships, and an export-oriented customer strategy drive innovation. By maximizing the value of production residues, Estonia unlocks diversification opportunities in sectors such as bioplastics, cosmetics, and food.
- **Challenges**: Reliance on partnerships for raw material sourcing and the need for further diversification and market expansion.

Italy: Italy's current business models emphasize product diversification and value creation through the valorisation of low-value fish into premium products for differentiated markets.

- **Key Drivers**: Collaborative efforts among policymakers, scientific communities, and financial institutions play a critical role.
    - **Constraints**: Challenges of waste disposal issues, stringent EU regulations, product development costs, labor shortages, and policy-related costs.

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