SmartChain
Blue Bioeconomy Solutions

BlueBio SMARTCHAIN Project

Smart solutions for advancing supply systems in blue bioeconomy value chains

Research Scope - Brief

September 2024

SMARTCHAIN research on blue-bioeconomy

Case studies in fisheries and aquaculture value chains in Norway and Iceland

RRM and FLW

Map biomaterial flows in seafood supply chains, with a focus on rest raw material (RRM) to identify the critical points where food loss and waste (FLW) occurs and their causes (WP1)

Data capturing practices and information flows

Identify important data gaps and explore how the recorded data could be used to improve sustainability and decision making (WP1)

The SMARTCHAIN project duration: October 2021- September 2024.

Multidisciplinary and holistic system approach

The SMARTCHAIN project focused on developing approaches and tools for sustainable utilisation, production planning, logistics optimisation, and traceability to enhance transparency, circularity and sustainable use of bio-resources from catch/harvest throughout the value chain of fisheries and aquaculture products. Industry actors were involved in developing and implementing the SMARTCHAIN solutions and models through case studies.

Supply chain mapping of RRM

The resource utilization in supply chains of demersal fisheries and salmon aquaculture in Iceland and Norway was examined and the hotspots identified where food loss and waste (FLW) occur. The objective was also to explore the status of data capturing practices, identify gaps and promote innovative solutions for utilization of rest raw materials (RRM) to increase the degree of circularity and reduce waste.

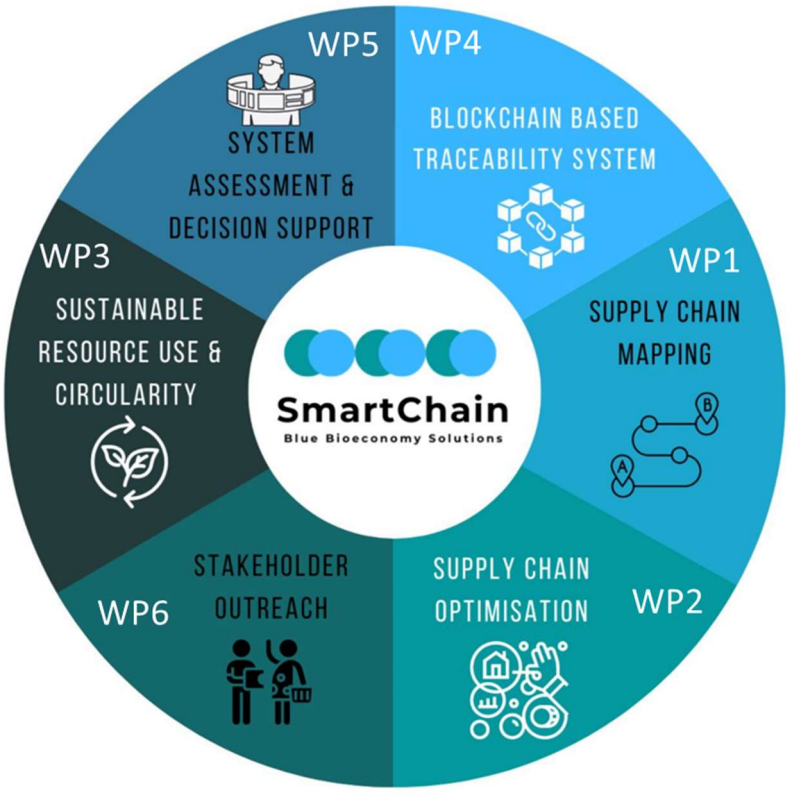

Figure 1 The main activities representing the work packages (WPs)of the SMARTCHAIN project

Quality sorting

Develop innovative pre-processing option by sorting of raw material according to quality using robots and AI-models based on visual data, and control (WP2)

Value added products

Develop and upscale high quality marine ingredients (collagen) from fish skins through testing of different types of enzymes and various hydrolysis conditions (WP2)

Production planning

Develop production planning models for optimal utilisation of raw materials (WP2)

System assessment and decision support

Develop simulation framework for supply chain scenarios aimed at enhancing sustainability performance (WP5)

Traceability

Define a set of high-level requirements for a blockchain-based traceability system for seafood supply chains (WP4)

Sorting of raw material by robots and value-added marine ingredients

Development of automated sorting and quality characterization along with optimized production planning is aimed at reducing waste from processing. The SMARTCHAIN project also explores upscaling the production of high value marine ingredients from RRM such as fish skins and heads in collaboration with the industry partner Seagarden.

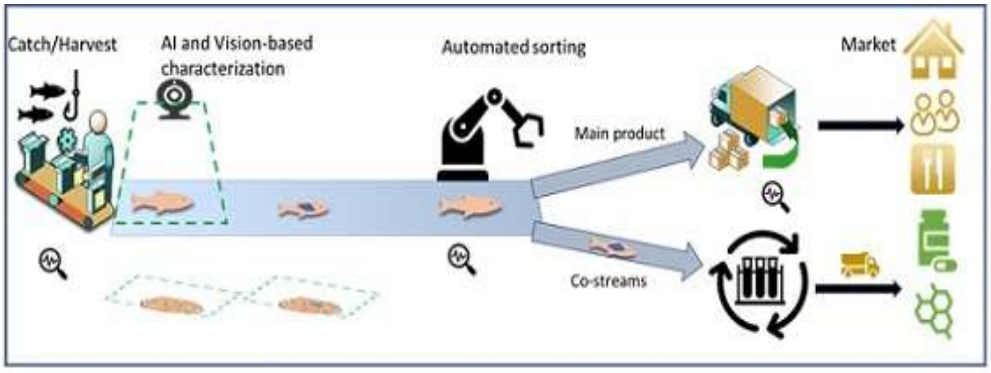

Figure 2 SMARTCHAIN: Process flow for automated quality characterization and sorting (SINTEF)

Supply chain optimization and simulation

Production planning optimization and simulation models are aimed at performing what-if-analyses for specific scenarios of the demand or supply, like seasonality or environmental improvements, with the objective to optimize the in- and outbound logistics flows of a specific company's production facilities, considering quality, environmental and economic aspects.

The work has been carried out in collaboration with the industry partner BRIM and students from DTU. The mathematical models developed aim to optimize the routing and scheduling of fishing activities undertaken by the company's vessels. The primary objective is to ensure a consistent and efficient supply of fish to the production company, which processes the fish into fillets, fishmeal, and fish oil. The study has underscored the critical importance of optimizing the utilization of raw materials and energy usage in the pelagic fishing industry.

A system dynamics simulation framework was also developed to assess scenarios aimed at enhancing sustainability performance from primary production until end consumer. Improvement scenarios include e.g. reducing energy consumption and CO_2 emissions in the supply systems, while maintaining or improving the quality of the biomasses. The SMARTCHAIN simulation framework enables assessment of the end-to-end effects and enlightens policy makers, businesses, investors, entrepreneurs, institutions, stakeholders, and citizens about potential trade-offs

Traceability system

Improved traceability and the use of blockchain based technologies can increase the transparency in the supply chain. In the SMARTCHAIN project, the work focused on the architecture of a smart traceability system to enable better transmission of information through the value chain. The goal is to guarantee an unbroken cold chain and improve the transparency, circularity and sustainability of the system. Functional and non-functional system specifications have been defined based on requirement analysis. Then a high-level architecture structured into business, traceability data, blockchain and application layers is proposed with descriptions of the expected functionality of the core components. To ensure end-to-end traceability, changes are

needed in current supply chain practices and collection and sharing of all (as much as possible) traceability information is key for true end-to-end traceability.

Sustainable resource use and circularity

Analyze drivers and barriers to sustainable circular business models in seafood value chains (WP3)

Sustainable resource use and circularity in seafood supply chains

Sustainability indicators and circularity criteria were reviewed for fisheries and aquaculture supply chains and suitable framework selected along with a dashboard of indicators for assessing the performance of the system solutions. The main goal is to elucidate the opportunities and challenges for further advancement of circular blue bioeconomy activities and strategies. The perceptions of companies, experts and policy makers in Iceland and Norway were explored through in-depth interviews and focus groups to gauge the ways in which they contribute to the circular bioeconomy. Furthermore, drivers and barriers to enhancing circularity and sustainability in seafood value chains were analysed.

Stakeholder outreach

Multi-stakeholder workshops, dissemination and communication activities (WP6)

SMARTCHAIN dissemination and communication activities

SMARTCHAIN contributes to capacity building by creating awareness, opening opportunities for academic researchers and reach out to a broad spectrum of various stakeholders across countries.

The objective is to create a "targeted awareness" regarding SMARTCHAIN results with key players and potential users and inform the target market about the benefits of SMARTCHAIN results. A diverse set of dissemination tools have been applied through Social Media presence, stakeholder workshops and webinars as well as production of videos that facilitate the outreach communications about the project.

Focus of the project is on development of replicable technologies and tools that can be applied to other food supply chains. The results are presented in the project´s deliverables and further dissemination in scientific journals, presentations at international and national conferences and workshops/seminars organised by the partners. The deliverable D5.4 compiles a summary of the key messages of the SMARTCHAIN project.

Key sources for further information

This *Research Sope Brief* is an overview of the SMARTCHAIN project´s research topics.

Further information on the research methods and the findings are summarised in separate *Research Finding Briefs and Policy Briefs* based on the project´s deliverables, conference presentations, webinars and published scientific papers.

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SMARTCHAIN Deliverables

Mehta, S., Myhre, M., Olafsdottir, G., Iordan, C.M., Thakur, M. (2022). Resource utilization in seafood supply chains: Food loss, food waste and rest raw materials. The SMARTCHAIN project co-funded by ERA-NET, EU Horizon 2020 G.A. No 817992, and Norges forskningsråd (RCN), Innovation Fund Denmark (IDF), The Icelandic Centre for Research (RANNIS) / Technical Development Fund (TDF). *Deliverable: D1.1 &D1.2*, SINTEF Ocean, Trondheim, 48 pages

Strand A. V., Olafsdóttir, G., Saviolidis, N. M., Thakur, M. (2023) Data capture and information flows in seafood supply chains in Norway and Iceland. The SMARTCHAIN project co-funded by ERA-NET, EU Horizon 2020 G.A. No 817992, and the Norwegian Research Council (RCN), Innovation Fund Denmark (IDF), and The Icelandic Centre for Research (RANNIS) / Technical Development Fund (TDF). *Deliverable: D1.3*, SINTEF Ocean, Trondheim, 62 pages

Strand A. V., Mehta, S., Myhre, M., Olafsdóttir, G., Saviolidis (2024) Can higher resource utilization be achieved in fisheries supply chains? Status and challenges from Iceland and Norway. D1.4 Manuscript submitted for publication

Misimi, E. (2024). *Report on D2.1 and D2.2*. Approach and Results. The SMARTCHAIN project co-funded by ERA-NET, EU Horizon 2020 G.A. No 817992, and Norges forskningsråd (RCN), Innovation Fund Denmark (IDF), and The Icelandic Centre for Research (RANNIS) / TechnicalDevelopment Fund (TDF). Deliverable: D5.1, SINTEF Ocean, 13 pages.

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https://bluebioeconomy.eu/smart-solutions-for-advancing-supply-systems-in-blue-bioeconomy-value-chains/
https://www.sintef.no/en/projects/2021/smartchain/

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