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SEAMARK DELIVERABLE 8.2: PRELIMINARY TECHNO-ECONOMIC ASSESSMENT

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Public summary of confidential report

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WP 8 / T8.3 Conduct techno-economic assessment of production processes

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Summary:
This report presents a preliminary techno-economic assessment (TEA) for SeaMark flagship products to identify key bottlenecks and possibilities along the respective value chains.

The techno-economic assessment involves the identification of potential optimisation and cost-reduction strategies, and their assessment in a simple static cost-benefit framework. The assessment focuses on improving the production processes of the three SeaMark flagship products: P1: Beta-glucan, produced by Oceanium in Scotland; P5: Fermented pig feed supplement, produced by Fermentation experts in Denmark; and P7: Green alginates, produced by Algaia in France. The assessment also considers processes for production of sugar kelp (*Saccharina latissima*) in the Faroe Islands, as this is the raw material for P1 and P5.

TEA of P1 (beta-glucan) considers the effects of changes in the biochemical composition of the raw material, *S. latissima*, and optimisation of pre-processing, extraction and drying of the beta-glucan fraction. The analysis concludes that the main challenge to profitable beta-glucan production is the low beta-glucan content in cultivated *S. latissima*.

However, the production cost of other co-extracted products can potentially be reduced. Improvement of extraction, filtration and drying processes can enable increased yield of targeted components. Drying technology can be optimized. When it comes to post-harvest treatments, minimising stabilisation and transport costs of macroalgae is a key issue for a small-scale biorefinery, and for this, co-location of cultivation and processing is a preferrable model.

Reducing the cost of *S. latissima* production is important for both P1 and P5 value chains, as it reduces the cost of feedstock. Candidate processes for optimising cultivation and harvest, and also post-harvest processing and transport to market for fermented macroalgae are considered in this report. The cost efficiency of two types of horizontal cultivation rig designs and several harvesting set-ups were analysed and compared to current production. A horizontal cultivation rigs offer higher yields per meter of grow line. This has proven to be a significant variable for production costs. Among the

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alternative harvesting set-ups, the largest cost reduction comes from mechanizing the harvesting process and this is crucial for cost-reduction. With current technology, costs relating to cultivation account for nearly 90% of the total cost, highlighting the need for cost-reducing strategies in the cultivation part.

For post-harvest processing related to the flagship product P5, optimisation of the fermentation process was considered, including transport options and cost-reducing fermentation processes. Currently, 10-15% of the fermented S. latissima does not fulfil quality requirements. To improve this, it is critical to control temperature during fermentation and bacteria development. Costs and benefits of using 20ft containers with reusable bags instead of IBCs (Intermediate bulk containers) were investigated. Simplifying the production process for both fermented and dried seaweed value chains has been proposed to reduce costs further.

For flagship product P7 (green alginate), the techno-economic analysis considered the feasibility of using cultivated rather than the wild harvested macroalgae used today, and also enzymatic treatment of the biomass after extraction. The results suggest that enzymatic treatment of the biomass is potentially an interesting candidate process for harvested macroalgae, while cultivated macroalgae cannot compete with it to produce alginate at current production levels and conditions, due to the much higher cost. Cultivated macroalgae could become an interesting alternative for producing alginates if either the cost of cultivation decreases substantially, or the sales price of alginates made from cultivated biomass increases substantially. The analysis also showed that changes in the cost of biomass have more effect on the economic viability of green alginate production than changes in the additional costs of the enzymatic treatment.

The findings from this preliminary techno-economic assessment will be used for future work in WP8 and in other work packages in SeaMark.